SECTION 01 10 00.0006
TASK ORDER STATEMENT OF WORK

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1.0 PROJECT OBJECTIVES

The project objective is to design and construct facilities for the military that are consistent with the design and construction practices used for civilian sector projects that perform similar functions to the military projects. For example, a Company Operations Facility has the similar function as an office/warehouse in the civilian sector; therefore the design and construction practices for a company operations facility should be consistent with the design and construction of an office/warehouse building.

Comparison of Military Facilities to Civilian Facilities

Military Facility	Civilian Facility
Barracks/Company Operations Facility (B/COF)	Dormitory / Office Building
Lawn Equipment Building (LEB)	Storage Shed

It is the Army's objective that these buildings will have a 25-year useful design life before a possible re-use/re-purpose or renovation requirement, to include normal sustainment, restoration, modernization activities and a 50-year building replacement life. Therefore, the design and construction should provide an appropriate level of quality to ensure the continued use of the facility over that time period with the application of reasonable preventive maintenance and repairs that would be industry-acceptable to a major civilian sector project OWNER. The site infrastructure will have at least a 50-year life expectancy with industry-accepted maintenance and repair cycles.

The project site should be developed for efficiency and to convey a sense of unity or connectivity with the adjacent buildings and with the Installation as a whole.

Requirements stated in this contract are minimums. Innovative, creative, and life cycle cost effective solutions, which meet or exceed these requirements are encouraged. Further, the OFFEROR is encouraged to seek solutions that will expedite construction (panelization, pre-engineered, etc.) and shorten the schedule. **The intent of the Government is to emphasize the placement of funds into functional/operational requirements. Materials and methods should reflect this by choosing the lowest Type of Construction allowed by code for this occupancy/project allowing the funding to be reflected in the quality of interior/exterior finishes and systems selected.**

1.1. SECTION ORGANIZATION

This Section is organized under 6 major “paragraphs”.

(1) Paragraph 1 is intended to define the project objectives and to provide a comparison between the military facility(ies) and comparable “civilian” type buildings.

(2) Paragraph 2 describes the scope of the project.

(3) Paragraph 3 provides the functional, operational and facility specific design criteria for the specific facility type(s) included in this contract or task order.

(4) Paragraph 4 lists applicable industry and government design criteria, generally applicable to all facility types, unless otherwise indicated in the Section. It is not intended to be all-inclusive. Other industry and government standards may also be used, where necessary to produce professional designs, unless they conflict with those listed.

(5) Paragraph 5 contains Army Standard Design Criteria, generally applicable to all facility types, unless otherwise indicated in the Section.

(6) Paragraph 6 contains installation and project specific criteria supplementing the other 5 paragraphs.

2.0 SCOPE

2.1. BASIC TRAINING AND ONE STATION UNIT TRAINING (BT/OSUT) COMPLEX

2.1.1. BARRACKS/COMPANY OPERATIONS FACILITY

Provide 2 standard B/COFs. This facility type is to house single trainee soldiers and company administrative, training and command operations.

Maximum number of single personnel to be housed is 240 per B/COF. Each B/COF is designed for a surge capacity of 288 single personnel.

The maximum gross area for each B/COF is 64,700 square feet.

The floor plans provided in Attachment A - Drawings indicate functional and operational arrangements that meet user operability requirements. The floor plans provided in Attachment A (located at the end of paragraph 3) are mandatory and indicate functional and operational arrangements that meet user operability requirements. The Design/Build (D/B) Contractor is required to adhere to these mandatory designs. Minor plan alterations are permitted to accommodate building system requirements, however, the Minimum Area Requirements shall not be reduced in order to accommodate building system requirements.

2.1.2. NOT USED

2.1.3. NOT USED

2.1.4. LAWN EQUIPMENT BUILDING

Provide one Lawn Equipment Building (LEB). This facility type is to store lawn maintenance equipment. There is no provision for fuel storage in this building.

The allocated gross area for lawn equipment storage is 400 square feet per B/COF. The maximum gross area for the LEB is 0 square feet.

2.2. SITE:

Provide all site improvements necessary to support the new building facilities. Refer to Paragraph 6.

Include Antiterrorism/Force Protection measures in the facility design in accordance with applicable criteria. The Contractor shall be responsible for all repairs to existing sidewalks, pavements, curb and gutter, utilities, and/or landscaping damaged as a result of his construction activities.

Approximate area available 24.00 acres in the limits of construction, as shown on the site layout plan. Refer to Appendix J - Drawings.

2.3. GOVERNMENT-FURNISHED GOVERNMENT-INSTALLED EQUIPMENT (GFGI)

Coordinate with Government on GFGI item requirements and provide suitable structural support, brackets for projectors/VCRs/TVs, all utility connections and space with required clearances for all GFGI items. Fire extinguishers are GF/GI personal property, while fire extinguisher brackets and cabinets are Contractor furnished and installed CF/CI. Include tables/cabinets/carts/etc. for GFGI equipment that is not freestanding in furniture design. All Computers and related hardware, copiers, faxes, printers, video projectors, VCRs and TVs are GFGI.

The following are also GFGI items: Refrigerators, ice cube machine dispenser and vending machines. See paragraphs 3.2.2.2 and 3.2.3.5 for additional

- Clothes Washers
- Stackable Clothes Dryers
- Vending Machines
- All exercise Equipment
- Dumpsters

2.4. FURNITURE REQUIREMENTS

Provide furniture design for all spaces listed in Chapter 3 and including any existing furniture and equipment to be re-used. Coordinate with the user to define requirements for furniture systems, movable furniture, storage systems, equipment, any existing items to be reused, etc. Early coordination of furniture design is required for a complete and usable facility.

The procurement and installation of furniture is NOT included in this contract. Furniture will be provided and installed under a separate furniture vendor/installer contract. The general contractor shall accommodate that effort with allowance for entry of the furniture vendor/installer onto this project site at the appropriate time to permit completion of the furniture installation for a complete and usable facility to coincide with the Beneficial Occupancy Date (BOD) of this project. The furniture vendor/installer contract will include all electrical pre-wiring and the whips for final connection to the building electrical systems however; the general contractor shall make the final connections to the building electrical systems under this contract. Furthermore, the general contractor shall provide all Information/Technology (IT) wiring (i.e. LAN, phone, etc.) up to and including the face plate of all freestanding and/or systems furniture desk tops as applicable, the services to install the cable and face plates in the furniture, the coordination with the furniture vendor/installer to accomplish the installation at the appropriate time, and all the final IT connections to the building systems under this contract.

The Government reserves the right to change the method for procurement of and installation of furniture to Contractor Furnished/Contractor Installed (CF/CI). CF/CI furniture will require competitive open market procurement by the Contractor using the Furniture, Fixtures and Equipment (FF&E) package.

2.5. NOT USED

3.0 BASIC TRAINING (BT) AND ONE STATION UNIT TRAINING (OSUT) COMPLEX

3.1 GENERAL

BT complexes are required by the Army to encompass living, dining, training, and administrative/command operations. A BT Complex consists of Barracks/Company Operations Facilities (B/COF), Dining Facility (DFAC), Battalion Headquarters (BNHQ), and a Lawn Equipment Building (LEB). In addition, a Central Cooling Plant (CCP) may be part of the complex. These facilities, with outdoor training areas and any additional support structures and amenities, shall be arranged on the site as a unit to allow the Battalion to live, eat, train and work together. This project consists of the facilities listed and described below.

A B/COF is comprised of sleeping bays, restrooms, classrooms, storage, laundry areas, scrub rooms and company operations components.

A LEB is a storage building for lawn maintenance equipment

3.2 FUNCTIONAL AND AREA REQUIREMENTS

Gross building area shall be calculated in accordance with Appendix Q. Net area is measured to the inside face of the room or space walls. Minimum dimension where stated shall be measured to the inside face of the defining enclosure. Net area requirements for programmed spaces are included in this paragraph. If net area requirements are not specified, the space shall be sized to accommodate the required function and to comply with code requirements, overall gross area limitations, and any other requirement of this RFP. Area requirements for corridors, stairs, and mechanical rooms will typically be left to the discretion of the offeror.

3.2.1 ACCESSIBILITY

The B/COF and LEB facilities are intended for occupancy and/or use by able-bodied military personnel only. In accordance with paragraph 3 (a) of the Deputy Secretary of Defense Memorandum dated 31 October 2008: DoD Access for People with Disabilities, facilities for able-bodied personnel are exempt from accessibility requirements. Headquarters buildings shall comply with the Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities as currently amended. In accordance with ADA Section 203.5 and ABA Section F203.6, the CCP is exempt from accessibility requirements.

3.2.2 B/COF

3.2.2.1 Functional Space Requirements - First Floor

(a) Vestibule: Provide an enclosed transition space between the exterior and interior of the building, at the primary entry point.

(b) Stair Vestibule: Stair vestibule shall be the secondary ground floor entry into the sleeping bays and shall be located at the fire exit stairwell located with the back end of the covered training area.

(c) Reception/CQ: Provide a reception area in the company operations area.

(d) Offices: Provide private offices for the Company Commander (CO), Executive Officer (XO), 1st Sergeant (1st SGT) and Training Office (TRO).

(e) Men's Toilet/Shower: Provide one shower stall and toilet facilities to serve the administrative personnel assigned to company. Provide a dressing area with a built-in wooden bench adjacent to the shower area. Length of bench shall be full width of shower minus 6 inches.

(f) Women's Toilet/Shower: Provide one shower stall and toilet facilities to serve the administrative personnel assigned to company. Provide a dressing area with a built-in wooden bench adjacent to the shower area. Length of bench shall be full width of shower minus 6 inches.

(g) Janitor: Provide a janitor’s closet. Janitor’s closet shall have a 10 inch deep floor mounted stainless steel mop sink, with hot and cold service faucet, a four holder mop rack and two 18 inch deep by 48 inch long heavy duty stainless steel shelves for storage of cleaning supplies. Janitor’s closet shall have space for storage of buckets and vacuum.

(h) Luggage Storage: Provide one lockable central luggage storage area partitioned into four separate and equal storage rooms. Each storage room shall be accessible from the central core of the central luggage storage area and shall have a lockable door.

(i) Supply: Provide storage space for company supplies and equipment, weapons, and consumable supplies. Shipping and receiving functions are performed from company supply area. Provide a 7 feet high by 8 feet wide, overhead coiling door with ramp for exterior vehicular access. A built-in issue counter with a laminated sliding glass window shall be integrated with a lockable rolling shutter door between this room and the queuing corridor. Issue counter opening shall be 36 inches wide and 42 inches high minimum. Provide space in the supply room area for two Supply NCOs.

(j) Secure Storage: Secure Storage shall comply with paragraph 3-6 and Appendix B-2 of AR 190-51 Security of Unclassified Army Property (Sensitive and Nonsensitive). Default to Risk Level I unless a risk assessment and threat analysis is provided by the installation identifying the necessary Risk Level. Provide a secure storage area for high value items of electronic equipment, e.g. night goggles. Secure storage area shall be adjacent to the arms vault and shall be accessible from the company supply area only. Secure storage shall have 18 inch deep built-in storage shelves, spaced at 18 inches on center vertically and capable of supporting a minimum of 20 pounds per linear foot. Total linear footage of storage shelves shall be three times the perimeter of the storage room.

(k) Mask Storage: Provide a mask storage room adjacent to the arms vault. Mask storage room shall have a lockable dutch-door with a supply shelf built into the bottom leaf. Mask storage room shall be accessible from the queuing corridor only. Mask storage room shall have 12 inch deep built-in storage shelves, spaced at 15 inches on center vertically and capable of supporting a minimum of 20 pounds per linear foot. Total linear footage of storage shelves shall be along the long wall of the storage room.

(l) Arms Vault: Arms vault for storage of arms shall comply with Appendix G of AR 190-11, Physical Security of Arms, Ammunition, and Explosives. Arms vault door shall incorporate a steel dutch-door type day-gate with a steel issue shelf built into the lower leaf of the day-gate. Arms vault shall be adjacent to the company supply storage room and shall be accessible from the queuing corridor only.

(m) Stairs: Provide 4 feet 6 inch minimum width stairs.

(n) Corridors: Provide 6 feet minimum width corridors. Corridor in front of the administrative offices shall be 10 feet minimum width, to serve as a waiting area.

(o) Queuing Corridor: Provide a queuing corridor minimum 6 feet wide, connecting the mask storage room, the arms vault and the company supply room.

(p) Multipurpose Room: Provide two multipurpose rooms for fitness training and other purposes as determined by the battalion. Locate one multipurpose room at the rear end of each covered training area beneath the bathroom wings of the upper floors. Each multipurpose room shall have 48 inches high dry-eraser marker boards along entire length of front and side walls and one power operated 8’-0” x 6’-0” ceiling flush mounted projection screen at front of the room. Projection screen shall be flame retardant, mildew resistant, and white matte with black masking borders. Furnish and install a low profile ceiling mounted projector mount system with each projection screen. Ceiling mount shall consist of a steel ball joint and universal projector bracket. Ceiling mount shall project a maximum 6 inches below finished ceiling height, and shall securely attach to ceiling and structure above. Steel ball joint shall attach to the universal projector bracket with twist-lock engagement. Mount shall provide up to 30° roll or pitch adjustment and 360° yaw adjustment at ball joint. Two setscrews lock ball joint in position. Projector mount shall be capable of supporting a 26 pound load. Furnish and install concealed electrical wiring, connections and accessories necessary for projector operation.

(q) Scrub Room: Provide two scrub rooms for equipment and weapons cleaning. Locate one scrub room at the rear end of each covered training area beneath the bathroom wings of the upper floors across from the multipurpose rooms. Each scrub room shall be furnished with a fixed continuous heavy gauge (minimum 16 gauge, type 304 stainless steel), 4 inches deep, stainless steel wash trough, sub-divided into six wash positions, along one wall. Each wash position shall be 4 feet wide and 3 feet deep, shall be separately drained and shall be furnished with a 9 inches high goose-necked, cold/hot water faucet with paddle type handles. Each scrub room shall also be furnished with a fixed 12 feet by 6 feet, minimum heavy gauge, type 304 stainless steel), 4 inches deep, stainless steel wash trough, sub-divided into four wash positions centered in the room for equipment cleaning. Each wash position shall be 6 feet wide and 3 feet deep, shall be separately drained and shall be furnished with a 9 inch high goose-necked, cold/hot water faucet with paddle type handles. Each scrub room shall be furnished with a fixed 3 feet deep by length of wall, minimum 16 gauge, type 304 stainless steel counter top, running the full length of one long wall of the room for weapons cleaning.

(r) Mechanical, Electrical, and Telecommunications Rooms: Mechanical rooms shall be sized to accommodate equipment maintenance and repair access without having to remove other equipment. Mechanical, electrical and telecommunications rooms shall be keyed separately for access by Installation maintenance personnel. First floor exterior access is required for centralized mechanical. All telecommunications rooms shall be conditioned space. Refer to Mechanical, Electrical and Telecommunications Sections for additional information.

(s) Covered Training Area: Provide two covered training areas located under the sleeping bays.

(t) Boot Wash: Provide an outdoor area for soldiers to rinse mud from field gear, boots and clothing. Boot Wash station shall be provided at three (3) locations- each building wing and the main building entrance. Each boot wash station shall consist of two freeze-proof hydrants located adjacent to a grated drain assembly complete with sand interceptor. Provide two spray nozzles on 60 inch long flexible hoses per hydrant.

(u) Recyclable Storage Area: Provide a recyclable storage area visible in areas of high circulation or adjacent to the main point of entry into the facility to serve as a single point of collection for recyclable materials in the facility. Provide the necessary number of bins for metal/plastic/glass/paper/cardboard items. Items may be combined to reduce the number of bins. If the installation has a single stream recycling system, provide a minimum of two bins to cover all items.

3.2.2.2 Functional Space Requirements - Second and Third Floor

(a) Entry Vestibule: Entry vestibule for the sleeping bays shall be at the primary stairwell on each sleeping bay floor.

(b) Stair Vestibule: Stair vestibule shall be the secondary entry into each sleeping bay and shall be located at the fire exit stairwell located with the bathroom and laundry at the rear of each sleeping bay.

(c) Sleeping Bay: Each sleeping bay shall be designed to accommodate sixty trainees in a dormitory layout. Sleeping bays must be of equal size and able to accommodate one bunk frame 84 inches long by 42 inches wide and one wardrobe 42 inches wide x 24 inches deep for each trainee, with adequate circulation. Surge capacity requirements will be met by using double bunks. A minimum ceiling height of 9 feet is required. One sleeping bay in each B/COF shall be divided into two equal halves along the length of the bay, by a full height, insulated, gender separation wall. Gender separation wall finish shall be a minimum of one layer of 5/8 inch impact resistant gypsum wallboard on each side of wall framing. Wall assembly shall have a minimum rating of STC 50 and shall be one-hour fire rated. All furniture listed here are GFGI.

(d) Toilet/Shower/Dressing: Each sleeping bay shall have two separate and equal toilet/showers/dressing rooms. Each toilet/shower/dressing room shall have a dressing area and shall be furnished with a minimum of ten shower stalls, six water closets and six lavatories. Urinals shall not be substituted for water closets. Dressing area shall be furnished with continuous hardwood benches and mirrors. Benches shall be mounted on powder-coated steel pedestals permanently anchored to the floor. Benches shall run the entire length of the two longest walls of the dressing area. Furnish and install four full length wall mirrors each 16 to 24 inches wide by 72 inches high, spaced evenly on one short wall of each dressing area. Furnish and install thirty wall mounted clothes hooks spaced evenly along the walls of each dressing area above the wood benches. Lavatories shall be provided in a continuous solid surface material vanity top. Each lavatory shall be furnished with a combination stainless steel framed mirror and stainless steel shelf. Mirror shall be minimum 18 inches wide by 24 inches high. Stainless steel shelf length shall be full width of mirror and minimum 5 inches deep. Extend ceramic tile shower surround to ceiling. Provide tamper resistant showerheads.

(e) Laundry: Each sleeping bay shall have two separate and equal laundry rooms. Locate one laundry room adjacent to each toilet/shower/dressing area. Each laundry room door shall be 36 inches wide minimum. Each laundry room shall accommodate a total of five heavy-duty, extra capacity, commercial washers and six heavy-duty, extra capacity, double stacked commercial dryers. Washers and dryers are GFGI. Contractor furnished and installed fixed heavy gauge stainless steel clothes folding/hanging tables measuring 2 feet deep by 5 feet wide, and one stainless steel laundry tray and sink are required features of each laundry room. Provide power receptacles, natural gas connection (where gas is available to site) and vent connections for all dryers. Dryers shall be exhausted to the exterior. Do not manifold dryer exhaust vents.

(f) Stair: Provide 4 feet 6 inch minimum width stairs.

(g) Corridors: Provide 6 feet minimum width corridors. Corridors along the platoon classroom area shall be 8 feet minimum width.

(h) Drill Instructor (DI) Office: Provide an administrative office adjacent to each sleeping bay on each floor. Each DI Office shall be designed to accommodate three work stations.

(i) DI Toilet/Shower: Provide a toilet and shower adjacent to the DI Office and accessible from the DI Office only. Furnish and install two single tier metal lockers in each DI toilet/shower. Each locker shall be 18 inches wide by 18 inches deep by 78 inches high, and shall be lockable.

(j) Platoon Classrooms: Provide a classroom adjacent to each sleeping bay on each floor. Each classroom shall be sized for 60-persons seating and space for an instructor. Each classroom shall have 48 inches high dry-eraser marker boards along entire length of front and side walls and two power operated 8’-0” x 6’-0” ceiling flush mounted projection screens at front of the classroom. Projection screens shall be flame retardant, mildew resistant, and white matte with black masking borders. Furnish and install a low profile ceiling mounted projector mount system with each projection screen. Ceiling mount shall consist of a steel ball joint and universal projector bracket. Ceiling mount shall project a maximum 6 inches below finished ceiling height, and shall securely attach to ceiling and structure above. Steel ball joint shall attach to the universal projector bracket with twist-lock engagement. Mount shall provide up to 30° roll or pitch adjustment and 360° yaw adjustment at ball joint. Two setscrews lock ball joint in position. Projector mount shall be capable of supporting a 26 pound load. Furnish and install concealed electrical wiring, connections and accessories necessary for projector operation. Windows shall have operable blinds.

(k) Platoon Classroom Storage: Provide a shared storage room for the two classrooms on each floor. Storage room shall have 18 inch deep built-in storage shelves, spaced at 18 inches on center vertically and capable of supporting a minimum of 20 pounds per linear foot. Total linear footage of storage shelves shall be two times the perimeter of the storage room.

(l) TA-50 Storage: Provide a TA-50 storage room for each sleeping bay on each floor. Each TA-50 storage room shall have 24 inch deep built-in storage shelves, spaced at 24 inches on center vertically and capable of supporting a minimum of 30 pounds per linear foot. Total linear footage of storage shelves shall be three times the perimeter of the storage room.

(m) General Storage: Provide one general storage room for each sleeping bay, adjacent to the TA-50 storage.

(n) Janitor: Provide one janitor’s closet on each floor, in the central core area. Janitor’s closet shall have a 10 inch deep floor mounted stainless steel mop sink, with hot and cold service faucet, a four holder mop rack and two 18 inch deep by 48 inch long heavy duty stainless steel shelves for storage of cleaning supplies. Janitor’s closet shall have space for storage of buckets and vacuum.

(o) Mechanical, Electrical, and Telecommunications Rooms: Mechanical rooms shall be sized to accommodate equipment maintenance and repair access without having to remove other equipment. Mechanical, electrical and telecommunications rooms shall be keyed separately for access by Installation maintenance personnel. First floor exterior access is required for centralized mechanical. All telecommunications rooms shall be conditioned space. Refer to Mechanical, Electrical Telecommunications Sections for additional information.

3.2.2.3 Space Allocation Table

B/COF MINIMUM SQUARE FOOTAGE REQUIREMENTS NET SQUARE FEET (NSF)			
	1st FLOOR	**2nd FLOOR**	**3rd FLOOR**
VESTIBULE	195	-	-
STAIR VESTIBULE	AS NEEDED	-	-
RECEPTION/CQ STATION	250	-	-
COMPANY COMMANDER (CO)	150	-	-
EXECUTIVE OFFICER (XO)	110	-	-
FIRST SARGEANT (1st SGT)	120	-	-
TRAINING OFFICE (TRO)	110	-	-
MEN'S TOILET/SHOWER	AS NEEDED	-	-
WOMEN'S TOILET/SHOWER	AS NEEDED	-	-
JANITOR	30	-	-

B/COF MINIMUM SQUARE FOOTAGE REQUIREMENTS NET SQUARE FEET (NSF)			
	1st FLOOR	2nd FLOOR	3rd FLOOR
COMPANY SUPPLY	800	-	-
SECURE STORAGE	245	-	-
LUGGAGE STORAGE	360	-	-
MASK STORAGE	200	-	-
ARMS VAULT	380	-	-
SCRUB ROOM	480 x 2		
MULTIPURPOSE ROOM	890 x 2	-	-
QUEUING CORRIDOR	AS NEEDED	-	-
STAIRS	AS NEEDED	-	-
CORRIDORS	AS NEEDED	-	-
COVERED TRAINING AREA	5,184 x 2		
MECHANICAL, ELECTRICAL AND TELECOMMUNICATIONS	AS NEEDED	-	-
STAIR VESTIBULE	-	AS NEEDED	AS NEEDED
ENTRY VESTIBULE	-	AS NEEDED	AS NEEDED
TOILET/ SHOWER/ DRESSING	-	AS NEEDED	AS NEEDED
JANITOR	-	30	30
LAUNDRY	-	AS NEEDED	AS NEEDED
SLEEPING BAY	-	5,184 x 2	5,184 x 2
DRILL INSTRUCTOR (DI) OFFICE	-	250 x 2	250 x 2
DI TOILET/SHOWER	-	84 x 2	84 x 2
TA-50 STORAGE	-	160 x 2	160 x 2
PLATOON CLASSROOMS	-	900 x 2	900 x 2
PLATOON CLASSROOM STORAGE	-	70	70
GENERAL STORAGE	-	120	120
CORRIDORS	-	min 6' wide	min 6' wide
TELECOMMUNICATIONS	-	100	100
MECHANICAL	-	AS NEEDED	AS NEEDED
ELECTRICAL	-	AS NEEDED	AS NEEDED

3.2.3 NOT USED

3.2.4 NOT USED

3.2.5 Lawn Equipment Building

Provide a lawn maintenance equipment storage building, based on 400 gross square feet per B/COF. LEB shall be divided with partitions, to provide an individually securable storage space with separate access for each B/COF. Access to each individual storage space shall be through a lockable overhead coiling door minimum eight feet wide by seven feet high.

3.3 SITE REQUIREMENTS

3.3.1 Not Used

3.3.2 Not Used

3.3.3 Not Used

3.3.4 Not Used

3.3.5 Building Relationship Hierarchy and Distances

BUILDING HIERARCHY	
Building Relationships	**Maximum Distance**
B/COF to DFAC	1680'
B/COF to PT Pits and Track	1200'
BNHQ to 1-story DFAC	1920'
BNHQ to 2-story DFAC	1800'
B/COF to BNHQ	1680'

3.4 ARCHITECTURAL REQUIREMENTS

3.4.1 Hardware

3.4.1.1 Fire Department Secure Lock-Box: Furnish and install a Knox-Vault 4400 Series (Single Lock Model) mounted at each building exterior adjacent to the main entry.

3.4.1.2 Finish Hardware: All hardware shall be consistent and shall conform to ANSI/BMHA standards for Grade 1. All requirements for hardware keying shall be coordinated with the Contracting Officer. Extension of the existing Installation's keying system shall be provided. The Installation keying system is Coordinate with the DPW Locksets shall have interchangeable cores. Cores shall have not less than seven pins. Cylinders shall have key-removable type cores. Disassembly of knob or lockset shall not be required to remove core from lockset. Locksets for mechanical, electrical and telecommunications rooms only shall be keyed to the existing Installation Master Keying System. HVAC terminal units that are accessed from a central corridor shall have a deadbolt to minimize protrusion into corridor. Plastic cores are unacceptable. Provide closers for all exterior doors, all doors opening to corridors and as required by codes. Exit devices shall be installed on all building egress doors.

3.4.1.3 Auxiliary Hardware: Provide wall or floor stops for all exterior doors that do not have overhead holder/stops. Provide other hardware as necessary for a complete installation.

3.4.1.4 Hardware for Fire Doors: Hardware for fire doors shall be installed in accordance with the requirements of applicable codes. Exit devices installed on fire doors shall have a visible label bearing the marking "Fire Exit Hardware". Other hardware installed on fire doors, such as locksets, closers, and hinges shall have a visible label or stamp indicating that the hardware items have been approved by an approved testing agency for installation on fire-rated doors. Hardware for smoke-control door assemblies shall be installed in accordance with applicable codes.

3.4.2 Special Acoustical Requirements

3.4.2.1 Exterior walls and roof/floor/ceiling assemblies, doors, windows and interior partitions shall be designed to provide for attenuation of external noise sources such as airfields in accordance with applicable criteria. Provide sound insulation to meet a minimum rating of STC 49 at walls and floor/ceiling assemblies. At interior doors provide solid core wood doors in metal frame with sound insulation to meet a minimum rating of STC 25. In addition to the sound insulation required, video teleconferencing areas shall meet a Noise Criteria (NC) 30 rating in accordance with ASHRAE Fundamentals Handbook. Provide sound insulation to meet a minimum rating of STC 50/IIC 55 at floors separating sleeping spaces.

3.4.2.2 Sound conditions and levels for interior spaces, due to the operation of mechanical and electrical systems and devices, shall not exceed levels as recommended by ASHRAE handbook criteria. Provide acoustical treatment for drain lines and other utilities to prevent noise transmission into the interior of all surrounding spaces.

3.4.3 Exterior Design Objectives

Provide durable and easily maintainable materials. Do not use exterior materials that require periodic repainting or similar refinishing processes. Material exposed to weather shall be factory pre-finished, integrally colored or provided with intrinsic weathering finish.

3.4.3.1 Exterior Walls: Provide durable materials. Where Exterior Insulation and Finish Systems (EIFS), or any other material except CMU or other Masonry material is used as exterior finish material, it shall be in conjunction with a CMU wainscot. EIFS shall be “high-impact” type and shall be “drainable” type.

3.4.3.2 Roof: Minimum roof slope for membrane roof systems shall be 1/2 inch per foot. Minimum roof slope for pitched roof systems shall be 3 inches per foot.

(a) Roof Mounted Equipment: For roof mounted equipment, provide permanent access walkways and platforms to protect roof. Roof mounted equipment on pitched roof systems is unacceptable.

(b) Roof access from building exterior is prohibited.

3.4.3.3 Trim and Flashing: Gutters, downspouts, and fascias shall be factory pre-finished metal and shall comply with SMACNA Architectural Sheet Metal Manual.

3.4.3.4 Bird Habitat Mitigation: The Contractor shall provide details in the design necessary to eliminate the congregating and nesting of birds at, on, and in the facility.

3.4.3.5 Exterior Doors and Frames:

(a) Main Entrance Doors: Aluminum storefront doors and frames with Architectural Class 1 anodized finish, fully glazed, with medium or wide stile for entry into lobbies or corridors. Provide doors complete with frames, framing members, subframes, transoms, sidelights, trim, applied muntins, and accessories. Framing systems shall have thermal-break design. Storefront systems shall comply with wind-load requirements of applicable codes and criteria including UFC 4-010-01.

(b) Exterior Non-entrance Doors: Exterior doors and frames opening to spaces other than corridors or lobbies shall be galvanized insulated hollow metal and comply with ANSI A250.8/SDI 100. Doors shall be heavy duty (grade 2) insulated with 18-gage steel cladding; top edge closed flush; A60 galvannealed. Frames shall be 12-gauge, with continuously welded mitered corners and seamless face joints. Doors and frames shall be constructed of hot dipped zinc coated steel sheet, complying with ASTM A653, Commercial Steel, Type B, minimum A40 coating weight; factory primed. Fire-rated openings shall comply with applicable codes, and the requirements of the labeling authority. Door and frame installation shall comply with applicable codes and criteria including UFC 4-010-01.

3.4.3.6 Exterior Windows: Provide insulated, high efficiency window systems, with thermally broken frames complying with applicable codes and criteria including UFC 4-010-01. Curtain wall systems shall be capable of withstanding area wind loads, thermal and structural movement required by location and project requirements, and shall comply with applicable codes and criteria including UFC 4-010-01. Window sills shall be designed to discourage bird nesting.

3.4.3.7 Exterior Louvers: Exterior louvers shall have bird, bug and or both screens and shall be designed to exclude wind-driven rain. Exterior louvers shall be made to withstand wind loads in accordance with the applicable codes. Wall louvers shall bear the Air Movement & Control Association (AMCA) International certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. Louver finish shall be factory applied.

3.4.4 Interior Design Objectives

Arrange spaces in an efficient, functional manner. Provide durable materials and furnishings that are easily maintained and replaced. Maximize use of daylighting. Provide interior surfaces that are easy to clean and light in color. Design B/COF barracks area with a residential ambience. Design B/COF company operations area with an office ambience. Interior spaces shall be structured to allow maximum flexibility for future modifications.

3.4.4.1 Signage: Provide room number sign with changeable two-line message strip signage. Changeable message strip signs shall be of same construction as standard room signs to include a clear sleeve that will accept a paper or plastic insert with identifying changeable text. The insert shall be prepared typeset message photographically enlarged to size and mounted on paper card stock.

3.4.4.2 Bulletin Boards: In each B/COF provide one bulletin board per floor. Locate bulletin board at the main vestibule on the first floor and at the entry vestibule on the second and third floors. Bulletin boards shall be 4 feet high and 6 feet wide. Bulletin boards shall have a header panel and shall have lockable, glazed doors.

3.4.4.3 Corner Guards: Provide surface mounted, high impact resistant, integral color, snap-on type resilient corner guards, extending from floor to ceiling for wall/column outside corners in high traffic areas. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards.

3.4.4.4 Chair Rail: Chair rails shall be installed in areas prone to hi-impact use, such as corridors and lobby seating area.

3.4.4.5 Casework: Provide cabinets complying with Architectural Woodwork Institute (AWI) Quality Standards. Countertops shall have waterfall front edge and integral coved backsplash. All countertops shall be solid surface.

3.4.4.6 Fire Extinguisher Cabinets and Fire Extinguishers: Furnish and install fire extinguisher cabinets as required by applicable codes and criteria. Fire extinguishers are GFGI. Furnish a list of installed fire extinguishers (including location, size and type) to the Contracting Officer’s Representative.

3.4.4.7 Interior Doors and Frames:

(a) Provide hollow metal doors, or flush solid core wood doors as required. All door frames shall be hollow metal.

(b) Wood Doors: All doors shall be wood doors except noted otherwise Provide flush solid core wood doors conforming to WDMA I.S.-1A. Stile edges shall be non-finger jointed hardwood compatible with face veneer. Provide Architectural Woodwork Institute (AWI) Grade A hardwood face veneer for transparent finished doors.

(c) Insulated Hollow Metal Doors: Comply with ANSI A250.8/SDI 100. Doors shall be minimum Level 2, physical performance Level B, Model 2; factory primed. Provide insulated hollow metal doors for utility rooms, storage rooms and toilets.

(d) Hollow Metal Frames: Comply with ANSI A250.8/SDI 100. Frames shall be minimum Level 2, 16 gauge, with continuously welded mitered corners and seamless face joints; factory primed.

(e) Fire-rated and Smoke Control Doors and Frames: Comply with applicable codes, criteria and requirements of labeling authority.

(f) STC ratings shall be of the sound classification required and shall include the entire door and frame assembly.

3.4.4.8 Window Treatment: Treatment shall be provided in all exterior windows. Uniformity of window covering color and material shall be maintained to the maximum extent possible throughout each building. Window stools shall be minimum ½ inch thick cast 100 percent acrylic polymer solid surfacing material. Blinds in B/COF barracks area shall be room darkening mini blinds.

3.4.4.9 Toilet Accessories: Furnish and install the items listed below and all other toilet accessories necessary for a complete and usable facility. All toilet accessories shall be Type 304 stainless steel with satin finish. Toilet accessories shall include the following:

(a) Toilet/Showers:

(1) Glass Mirror/Shelf – 18 inch by 24 inch glass mirror on stainless steel frame with shelf at each lavatory

(2) Hands free liquid soap dispenser – at each lavatory

(3) Hands free paper-towel dispenser

(4) Waste receptacle – recessed mounted at each lavatory/toilet area

(5) Sanitary napkin disposal at each female toilet

(6) Toilet paper dispenser – lockable multiple roll at each toilet

(7) Sanitary toilet seat cover dispenser – at each toilet stall

(8) Shower curtain rod, extra heavy duty – at each shower stall

(9) Shower curtain, white anti-bacterial nylon/vinyl fabric shower curtain – at each shower stall

(10) Soap dish – in shower

(11) Double robe hook – adjacent to shower enclosure entry

(12) Grab bars – as required by ABA

(b) Sleeping Bay Toilet/Shower/Dressing: Accessories shall include:

(1) Glass Mirror/Shelf – 18 inch by 24 inch glass mirror on stainless steel frame with shelf – at each lavatory

(2) Hands free liquid soap dispenser – at each lavatory

(3) Hands free paper towel dispenser at each lavatory/toilet area

(4) Waste receptacle – recessed mounted at each lavatory/toilet area

(5) Sanitary napkin disposal - at each toilet, in one toilet wing, in sleeping bay with gender separation wall

(6) Toilet paper dispenser – lockable double toilet paper dispenser at each toilet

(7) Sanitary toilet seat cover dispenser – at each toilet stall

(8) Shower curtain rod, extra heavy duty – at each shower stall

(9) Shower curtain, white anti-bacterial nylon/vinyl fabric shower curtain – at each shower stall

(10) Soap dish – in each shower

(11) Double robe hook – at each shower entry

(12) Combination tumbler/6 toothbrush holder – at each lavatory

(c) Drill Instructor Toilet/Shower

(1) Glass Mirror/Shelf – 18 inch by 24 inch glass mirror on stainless steel frame with shelf – at each lavatory

(2) Liquid soap dispenser – at each lavatory

(3) Combination paper towel dispenser/waste receptacle – recessed mounted at each lavatory/toilet area

(4) Toilet paper dispenser – lockable double toilet paper dispenser at each toilet

(5) Sanitary toilet seat cover dispenser – at each toilet

(6) Shower curtain rod, extra heavy duty – at each shower stall

(7) Shower curtain, white anti-bacterial nylon/vinyl fabric shower curtain – at each shower stall

(8) Soap dish – in each shower

(9) Double robe hook – in each shower dressing area

(10) Combination tumbler/6 toothbrush holder – at each lavatory

3.4.4.10 Drinking Fountains: Provide drinking fountains in accordance with International Plumbing Code (IPC). Provide a minimum of one per floor.

3.4.5 Finishes

3.4.5.1 Paint

(a) All paints used shall be listed on the "Approved Product List" of the Master Painters Institute (MPI). Application criteria shall be as recommended by MPI guide specifications for the substrate to be painted and the environmental conditions existing at the project site.

(b) Exterior surfaces, except factory pre-finished material or exterior surfaces receiving other finishes shall be painted a minimum of one prime coat and two finish coats. Paints having a lead content over 0.06 percent by weight of nonvolatile content are unacceptable. Paints containing zinc-chromate, strontium-chromate, mercury or mercury compounds, confirmed or suspected human carcinogens shall not be used on this project. Exterior paints and coating products shall be classified as containing low volatile organic compounds (VOCs) in accordance with MPI criteria. Application criteria shall be as recommended by MPI guide specifications. Provide an MPI Gloss Level 5 Finish (semi-gloss), unless otherwise specified.

(c) Interior surfaces, except factory pre-finished material or interior surfaces receiving other finishes, shall be painted a minimum of one prime coat and two finish coats. Paints having a lead content over 0.06 percent by weight of nonvolatile content are unacceptable. Paints containing zinc-chromate, strontium-chromate, mercury or mercury compounds, confirmed or suspected human carcinogens shall not be used on this project. Interior paints and coating products shall contain a maximum level of 150 grams per liter (g/l) of VOCs for non-flat coatings and 50 g/l of VOCs for flat coatings. Provide an MPI Gloss Level 5 Finish (semi-gloss) in wet areas and a flat finish in all other areas.

3.4.5.2 Minimum Interior Finishes-General

(a) Designers are not limited to finishes listed in the following INTERIOR FINISHES table(s) and are encouraged to offer higher quality finishes.

(b) Wall, ceiling and floor finishes and movable partitions shall conform to the requirements of the IBC, NFPA and UFC 3-600-01 Fire Protection Engineering for Facilities. Where code requirements conflict, the most stringent code requirement shall apply.

(c) Carpet shall not be used as a floor finish in the B/COF. Vinyl composition tile (VCT) shall be minimum 1/8 inch thick, conforming to ASTM F 1066, Class 2, through pattern tile, Composition 1, asbestos free, with color and pattern uniformly distributed throughout the thickness of the tile.

(d) All walls shall be minimum 5/8" painted gypsum board, except where stated otherwise. All gypsum board shall achieve a score of 10, the highest level of performance for mold resistance under the ASTM D 3273 test method. All gypsum board shall be transported, handled, stored and installed in accordance with the GYPSUM ASSOCIATION – Guidelines For Prevention Of Mold Growth On Gypsum Board (GA-238-03). Use impact resistant gypsum board in vestibule, corridors, stairs, laundry, vending areas and storage areas.

(e) All ceilings shall be minimum 5/8" painted gypsum board, except where stated otherwise. All gypsum board shall achieve a score of 10, the highest level of performance for mold resistance under the ASTM D 3273 test method. All gypsum board shall be transported, handled, stored and installed in accordance with the GYPSUM ASSOCIATION – Guidelines For Prevention Of Mold Growth On Gypsum Board (GA-238-03).

3.4.5.3 B/COF Interior Finishes

B/COF INTERIOR FINISHES

	Floors					Base			Walls				Ceiling					Remarks
	RESILIENT FLOORING	PORCELAIN OR QUARRY TILE	CERAMIC TILE	RECESSED ENTRY MAT	SEALED CONCRETE	RESILIENT BASE	PORCELAIN OR QUARRY TILE	CERAMIC TILE	GYPSUM WALL BOARD – PAINT	LAMINATED GLASS, INSUL. CURTAIN WALL SYSTEM	FULLY GROUTED REINF. CMU OR REINF. CONCRETE	CERAMIC TILE	GYSUM WALL BOARD - PAINT	ACOUSTICAL CEILING TILE	REINF. CONCRETE	EXPOSED	MINIMUM HEIGHT 8' EXCEPT STATED OTHERWISE	REFER TO NOTE
1ST FLOOR																		
VESTIBULE		•		•			•		•	•			•				9'	
STAIR					•	•			•				•				9'	NOTE 6

RECEPTION/CQ		●					●		●				●				9'	
CO	●					●			●					●				NOTE 10
XO	●					●			●					●				
1ST SGT	●					●			●					●				
TRO	●					●			●					●				
MEN'S TOILET/SHOWER			●					●	●			●	●					NOTE 1 AND 4
WOMEN'S TOILET/SHOWER			●					●	●			●	●					NOTE 1 AND 4
JANITOR			●					●	●			●	●					NOTE 2
LUGGAGE STORAGE					●	●			●				●					
COMPANY SUPPLY					●	●			●				●					
SECURE STORAGE					●	●			●				●					
MASK STORAGE					●	●			●				●					
ARMS VAULT					●	●					●				●			
STAIRS					●	●			●	●			●					NOTE 6
CORRIDORS		●					●		●				●				9'	
QUEUING CORRIDOR		●					●		●				●				9'	
MULTIPURPOSE ROOM	●					●			●				●				9'	
SCRUB ROOM			●					●	●			●	●				9'	NOTE 4 AND 8
MECHANICAL					●	●			●				●			●		NOTE 9
ELECTRICAL					●	●			●							●		NOTE 9
TELECOMMUNICATIONS	●					●			●				●			●	10'	NOTE 11
COVERED TRAINING AREA					●												9'	NOTE 7
2ND AND 3RD FLOOR																		
VESTIBULE					●		●		●	●			●				9'	
STAIR					●	●			●				●				9'	NOTE 6
SLEEPING BAY	●					●			●				●				9'	
TOILET/SHOWER/DRESSING			●					●	●			●	●					NOTE 1 AND 4
LAUNDRY		●					●		●				●					NOTE 4
STAIR	●				●	●			●	●			●					NOTE 6
CORRIDORS		●					●		●				●				9'	
DI OFFICE	●					●			●					●				
DI TOILET/SHOWER			●					●	●			●	●					NOTE 1 AND 4
PLATOON CLASSROOMS	●						●		●					●			10'	
STORAGE	●					●			●				●					
TA-50 STORAGE	●					●			●				●					
GENERAL STORAGE	●					●			●				●					
JANITOR			●					●	●			●	●					NOTE 2
MECHANICAL					●	●			●							●		NOTE 9
ELECTRICAL					●	●			●							●		NOTE 9
TELECOMMUNICATIONS	●					●			●				●			●	10'	NOTE 11

1. ALL WET WALLS IN TOILET ROOMS SHALL HAVE 4'-0" HIGH CERAMIC TILE WAINSCOT. ALL SHOWERS SHALL HAVE FULL HEIGHT CERAMIC TILE WALLS. VANITY TOPS SHALL BE CAST 100 PERCENT ACRYLIC POLYMER SOLID SURFACING MATERIAL WITH WATERFALL FRONT EDGE AND INTEGRAL COV
2. WALLS ADJACENT TO JANITOR'S SINK SHALL HAVE A 4'-0" HIGH CERAMIC TILE WAINSCOT.
3. NOT USED
4. ALL COUNTERS SHALL HAVE A MINIMUM OF 4" HIGH BACKSPLASH.
5. NOT USED

6. RISERS SHALL BE PAINTED STEEL. STAIR LANDINGS AND TREADS SHALL HAVE RESILIENT FLOORING OR SEALED CONCRETE. PROVIDE TREADS WITH SLIP RESISTANT NOSING.
7. PAINT STRUCTURE.
8. PROVIDE 6'-0" HIGH CERAMIC TILE WAINSCOT ON ALL WALLS.
9. CEILING MAY BE PAINTED EXPOSED STRUCTURE IF ALLOWED BY APPLICABLE CODE.
10. EXTEND PARTITIONS TO DECK. PROVIDE SOUND INSULATION TO MEET A MINIMUM STC RATING OF 49 AT WALLS AND A STC OF 28 AT DOORS.
11. COMPLY WITH THE REQUIREMENTS OF ANSI/TIA/EIA-596-B (GYPSUM BOARD CEILINGS ARE ACCEPTABLE)

3.4.5.4 Not Used

3.4.5.5 Not Used

3.4.5.6 LEB Interior Finishes:

Floors shall be sealed concrete with a resilient base. Walls shall be painted impact resistant gypsum wallboard.

3.4.5.7 B/COF Furniture Chart

B/COF FURNITURE CHART		
Description	**Comments**	**Furniture Required**
Command Office (CO, XO, OPS SGT, 1st SGT)	Private Office	Executive double pedestal desk unit, storage credenza, two guest chairs, one executive chair - CO, XO (or) one managerial chair - OPS SGT, 1st SGT
Open Workstation (DI Office)	Open Workstation	Systems furniture workstation, with work surfaces, file pedestals, and overhead storage, one task chair, one guest chair
Multi-Purpose	Multi-Purpose	To be determined by Installation
Classroom	Classroom	60 seats. Tables shall be 18" width by 4'. length (2 chairs per table).
Arms Vault	Storage	1 workstation
Supply	Storage	Systems furniture workstation, with work surfaces, file pedestals, and overhead storage, one task chair. 21 Heavy-duty shelving units
Reception Area	Reception Area	Systems furniture open office area for one staff member and 4 guest chairs
Sleeping Bay	Barracks	60 beds, 60 wardrobes

3.4.5.8 Not Used

3.5 STRUCTURAL REQUIREMENTS

Design and construct as a complete system in accordance with APPLICABLE CRITERIA.

3.5.1 Live Loads: Design live loads shall be per IBC but not lower than the following minimums:

(a) Elevated Floors — 60 pounds per square foot (psf) minimum

(b) Slab On Grade — 150 psf minimum

(c) Barracks Bays w/o Partitioned Rooms — 80 psf

(d) Centralized Laundry Area 150 psf, (but not less than actual equipment loads)

3.6 MECHANICAL REQUIREMENTS

3.6.1 Plumbing

3.6.1.1 Domestic water heating system shall be sized in accordance with UFC 3-420-01, Appendix E, except as amended herein. Hot water consumption shall be based on 2 gpm per shower head with a delivered temperature of 110 deg F. Peak period duration shall be 19 minutes (3 groups with 5 minutes of shower operation each and 2 minutes of transition between groups). In addition to simultaneous shower operation, all lavatories and washing machine demand must be included without diversity. Hot water storage capacity shall be based on 75% usable storage and a storage temperature of 140 deg F. Domestic hot water distribution shall be at 120 deg F from a central system mixing valve. Domestic hot water distribution piping shall be designed to handle up to 180 deg F water temperatures. Domestic hot water shall be provided by separate water heating boiler and tank systems or storage water heating systems, located within the barracks mechanical rooms.

Domestic hot and cold water pipe sizing shall be based on all fixtures operating simultaneously. Waste stacks, building waste drains, venting and lift stations shall be sized with consideration to the increased flow rates as well.

Domestic hot and cold water hose bibs shall be provided in laundry rooms and latrines for use in area cleanup/wash down.

Shower heads and lavatory faucets shall be water conserving type with a maximum rated flow rate of 2.0 gpm or less. Water closets shall be the siphon jet, flush valve type. All water closet and lavatory fixtures shall be hands free type operation.

3.6.1.2 Provide scrub room and boot wash drains with easily maintainable sand interceptors.

3.6.1.3 Laundry facilities shall be considered commercial laundries with respect to the International Plumbing Code (IPC) and shall be provided with easily maintainable solids interceptor(s) in accordance with the IPC.

3.6.1.4 Not Used

3.6.1.5 Drain Water Heat Recovery System. Gravity Film Heat Exchanger (GFX) is a vertical counter flow heat exchanger that extracts heat out of drain water and applies it to preheat the cold water and mixed with hot water to be used in the shower. The GFX consists of a 3 or 4 inch central copper pipe (that carries the warm waste water) with a ½-inch copper coils wound around the central pipe. Heat is transferred from the waste water passing through the large, central pipe to the cold water simultaneously moving upward through the cols on the outside of the pipe. GFX shall be provided on all shower drains and laundry drains.

3.6.2 Heating, Ventilating and Air-Conditioning (HVAC)

3.6.2.1 All HVAC air handling units shall be located in mechanical equipment rooms accessible through equipment room doors. Mechanical rooms shall be sized for ease of service and maintenance of equipment. Access for maintenance shall not require entry into the sleeping bays or classrooms. Air filters shall be located in duct or unit mounted filter boxes within the mechanical room. HVAC system selection shall be in accordance to ASHRAE 90.1. The HVAC system shall provide continuous outside air ventilation to each space and centralized exhaust systems with heat recovery between exhaust and the incoming outside air.

(a) Storage and laundry spaces may be served by single zone heating and ventilating fan coil and/or forced air systems, respectively. Laundry rooms must be provided with sufficient tempered makeup air either from transfer air via the air handling systems serving the sleeping bays or their own air handling systems. Storage and electrical spaces must be ventilated to limit summer interior temperatures and minimally heated (45 deg F). Communications spaces require separate cooling (24 hour cooling if required by the Installation Directorate of Information Management (DOIM) or similar organization).

(b) HVAC design loads must include plug loads of 6 watts/sf in classrooms and 1.5 watts/sf in sleeping bays. HVAC design loads must also account for surge population in sleeping bays and classrooms.

(c) Heating, mechanical ventilation and air-conditioning shall be in accordance with ASHRAE Standard 62; design supply air volumes in occupied spaces shall be not less than 0.8 cubic feet/minute/square foot (cfm/sq. ft).

Heating and cooling load calculations shall allow for a minimum of 0.3 air changes per hour from incidental infiltration for all building spaces. For severe winter climatic areas incorporation of low intensity, gas-fired infrared heating systems may be considered for adjoining covered training or assembly areas.

Continuous ventilation air must be provided throughout each building for indoor air quality, building pressurization, and makeup of exhausted air. Exhaust airflows and people ventilation shall be provided as required by ASHRAE Standard 62. In sleeping areas, provide either 15 cubic feet/min./person or 10% of supply airflow for building pressurization plus makeup air for all exhausts, whichever is greater. Exhaust calculations shall include all dryers on at same time (200 cubic feet/min./dryer) and exhaust for shower, drying areas and toilet exhaust, etc. The overall building shall be positively pressurized by approximately 10% to exclude unplanned infiltration. All ventilation air shall be provided using one or more dedicated outdoor air units. Dedicated outdoor air units shall continuously supply dehumidified, tempered air to the building. Supply air conditions from the dedicated outdoor air unit(s) shall be between 70 and 75 degrees F dry bulb and no greater than 51 degrees F dew point.

(d) For purposes of prevention of respiratory illness, supply and return air in sleeping bays must be arranged to prevent air movement across multiple bunks. Supply and return air must be ducted to air distribution devices located between every other bunk.

(e) Ductwork in sleeping bays shall be designed to prevent placement or concealment of contraband. Round ductwork is recommended. Ductwork and controls shall also be designed to provide two separate zones within each sleeping bay such that a longitudinal privacy partition may be installed to divide the bay.

(f) For freeze protection, air handling unit heating coils shall either be placed in the pre-heating position or preheating coils shall be provided where mixed air temperature may fall below design cooling supply air temperatures or less than 45 degrees F or where stratification may occur. Freeze protection provisions shall be specifically documented.

3.6.2.2 Due to possible fluctuations in trainee populations, HVAC controls must incorporate controls software and hardware to facilitate building or space shutdown or reduced utilization at various times during the year. During unoccupied times buildings or spaces must continue to be minimally heated (55 deg F), cooled (85 deg F dry bulb, 55 deg dew point) and ventilated (0.06 cfm/sf) to conserve energy, preclude molding problems, etc.

3.6.2.3 Not Used

3.6.2.4 Not Used

3.6.3 Fire Protection

Fire suppression systems shall be designed in accordance with the latest edition of UFC 3-600-01. However, the B/COF shall be classified as mission essential and shall be provided with sprinkler protection regardless of other criteria or code provisions. The facility shall be protected throughout by a complete automatic sprinkler system. Fire alarm systems shall be addressable type with addressable devices. The type, function and location of the fire alarm annunciator shall be coordinated with the local authority having jurisdiction.

3.7 ELECTRICAL AND TELECOMMUNICATIONS REQUIREMENTS

Select electrical characteristics of the power system to provide a safe, efficient, and economical distribution of power based upon the size and types of loads to be served. Use distribution and utilization voltages of the highest level that is practical for the load to be served. The effect of nonlinear loads such as computers, other electronic equipment and electronic ballasts shall be considered and accommodated as necessary. Voltage drop shall not exceed the maximum allowed per ASHRAE 90.1. Transient voltage surge protection shall be provided on service equipment.

3.7.1 Power

Power shall be provided for all installed equipment requiring power including all Government Furnished Contractor Installed equipment and all GFGI equipment. Power poles are not allowed. The following shall also be provided.

3.7.1.1 Provide 125-volt duplex receptacles per NFPA 70 in conjunction with the proposed equipment and furniture layouts, and as per other stated requirements elsewhere in the RFP.

3.7.1.2 In addition to receptacles required elsewhere in the RFP provide one 125-volt duplex receptacle per wall in all normally occupied spaces unless otherwise noted.

3.7.1.3 For housekeeping purposes provide a minimum of one 125-volt, duplex receptacle per corridor and a minimum of one 125-volt duplex receptacle on each wall with in the lobby . No point along bottom of corridor or lobby walls shall be more than 25 feet from a receptacle.

3.7.1.4 Provide 125-volt duplex receptacles mounted adjacent to lavatories. Provide a minimum of one for every two adjacent lavatories-. Each single lavatory shall also be provided a receptacle

3.7.1.5 Provide a- minimum of two 125-volt, duplex receptacles shall be provided in each mechanical room- in addition to NFPA 70 requirements. In addition, provide a minimum of one 125-volt duplex receptacle in each electrical room.

3.7.1.6 Provide six 125-volt duplex receptacles spaced evenly along exterior walls in each sleeping bay and two evenly spaced along each end wall.

3.7.1.7 Not Used

3.7.1.8 Not Used

3.7.1.9 Provide a minimum of two 125-volt, duplex receptacles in each of the separate secure spaces within the LEB. One receptacle shall be placed near the overhead roll up door and one shall be placed on the wall opposite the door.

3.7.2 Grounding

Grounding shall be provided in accordance with NFPA 70 andthe Technical Criteria for I3A. In addition raised flooring shall be grounded to the building's primary grounding electrode.

3.7.3 Lighting

Interior lighting controls shall be provided in accordance with ASHRAE 90.1. Compact fluorescent lamps of 12 watts or less shall not be used. Electronic ballast for linear fluorescent lamps shall be the high efficiency programmed start type. Provided lighting levels shall be within +/- 10% of required lighting levels.

3.7.3.1 Specific Requirements

(a) Local manual controls shall supplement automatic controls in offices, classrooms and specialized areas such as scrub rooms, multipurpose rooms and covered training areas.

(b) An un-switched fixture with emergency ballast shall be provided at the entrance to each arms vault. Fixture shall be vandal resistant.

(c) Covered training areas shall be illuminated to a level of 15 foot-candles.

(d) Reception area shall be illuminated to a level of 10 foot-candles. CQ workstation within the lobby shall be illuminated to a level of 30 foot-candles.

(e) Mechanical rooms, supply rooms, arms vault, TA-50 storage rooms, multipurpose rooms, mask storage room and electrical rooms shall be illuminated to a level of 30 foot-candles.

3.7.3.2 Not Used

3.7.3.3 Each secure space within the LEB shall be illuminated to a level of 10 foot-candles and each space shall be separately switched.

3.7.4 Telecommunications System

Telecommunication outlets shall be provided per the applicable criteria based on functional purpose of the space within the building and in accordance with other provisions of this RFP.

3.7.4.1 Provide voice and data connection capability to all workstations.

3.7.4.2 The required connection capability in classrooms is a minimum of one voice and one data outlet per room or partitioned area within the room.

3.7.4.3 Connectivity shall be provided for 10 pay phones within each covered training areas per local telephone company requirements.

3.7.5 Video Teleconferencing

3.7.5.1 Provide a dual (fiber optic and 8-pin modular)jack outlet for video teleconferencing connectivity in each:classroom

3.7.5.2 Not Used

3.7.6 Intrusion Detection System (IDS)

3.7.6.1 Infrastructure for an Intrusion Detection System (IDS) shall be provided for each arms vault. Infrastructure shall consist of conduit, pull wire and outlet boxes. Outlet boxes are required for a control panel, balanced magnetic switch, motion sensor, and duress switch unless specified otherwise in paragraph 6.10 System requirements shall be coordinated with the Installation.

3.7.6.2 Not Used

3.7.7 Cable Television (CATV)

All CATV outlet boxes, connectors, cabling, and cabinets shall conform to the Technical Criteria for I3A unless noted otherwise. All horizontal cabling shall be homerun from the CATV outlet to the nearest telecommunications room.

3.7.7.1 CATV connectivity shall be provided in: all classrooms, multipurpose rooms, drill instructor offices and private offices. See paragraph 6.10 for possible additional requirements.

3.7.7.2 Not Used

3.7.8 Mass Notification

Mass notification system shall be provided in accordance with UFC 4-021-01.

3.7.9 Not Used

3.7.10 Not Used

3.7.11 Security Infrastructure (Security Equipment Not in Contract)

3.7.11.1 Not Used

3.7.11.2 Not Used

3.7.12 Door Status/Alarm Monitoring System

A door monitoring system consisting of a door status/alarm panel and door balanced magnetic switches shall be provided. The monitoring system shall provide door status/alarms on all doors leading into and within sleeping bays in order to accommodate gender segregation. System shall allow each door alarm to be individually activated or deactivated. A door status/alarm panel that monitors all doors shall be located in the reception area near the CQ workstation. In addition, each Drill Instructor office (four total) shall have a door status/alarm panel that monitors only those doors associated with the adjacent sleeping bay. Panel shall provide both an audio and visual signal when alarm is activated.

3.7.13 Audio/Visual System

3.7.13.1 Provide an empty 1” conduit (with pull wire) above the ceiling from each GFGI ceiling mounted projector location to a wall mounted outlet box at the front of each classroom.

3.7.13.2 Not Used

3.8 FIRE ALARM REQUIREMENTS

3.8.1 All software, software locks, special tools and any other proprietary equipment required to maintain, add devices to or delete devices from the system, or test the Fire Alarm system shall become property of the Government and be furnished to the Contracting Officer’s Representative prior to final inspection of the system.

3.8.2 The fire alarm system shall be designed by a professional Fire Protection Engineer and installed by a National Institute for Certification of Engineering Technologies (NICET) 3 technician.

3.8.3 Smoke detectors shall be provided in all sleeping bays. Smoke detectors in bedrooms shall be monitored. Tampering with a smoke detector shall send a trouble signal. Trouble signals shall be transmitted to the fire department.

3.9 ENERGY CONSERVATION

3.9.1 Energy Performance

The building, including the building envelope, HVAC systems, service water heating, power, and lighting systems shall be designed to achieve a non-plug load energy consumption that is at least 40% below the consumption of a baseline building meeting the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1 2007 (see paragraph 5.9 Energy Conservation) (Note: Plug loads shall be included in building energy modeling but are subtracted in the final calculation of Energy Performance. See section “Design After Award” for additional guidance.)

3.9.2 Energy Conservation Features - B/COF

All items listed in the required energy conservation features table shall be provided as a minimum. Additional energy conservation features may be required to meet the above energy performance. The contractor is responsible for determining and providing additional energy conservation features to meet the energy performance requirement. Where equipment types are indicated, only minimum efficiencies apply.

3.9.3 Compliance Documentation

The required energy conservation features shown in the following tables contribute to the achievement of the above energy performance and are life cycle cost effective for a BT B/COF facility. Use of the required energy conservation features does not eliminate the requirement for energy analysis calculations documenting compliance. The D-B Contractor must document compliance with the above energy performance utilizing the methodology described in ASHRAE 90.1, Appendix G as discussed in section 01 33 16 Design After Award. The design analysis shall document each of the features selected to achieve the specified energy performance.

Climate Zone 4A, Energy Conservation Features Table

Item	Component	Minimum Requirements
Roof	Attic	R-40
	Surface reflectance	0.27
Walls	Light Weight Construction	R-20
Exposed Floors	Mass	R-10 c.i.
Slabs	Unheated	NR (2)
Doors	Swinging	U-0.70
	Non-Swinging	U-1.45

Infiltration		0.25 cfm/ft^2 @ 75 Pa $_{(3)}$
Vertical Glazing	Window to Wall Ratio (WWR)	10% - 20%
	Thermal transmittance	U-0.45
	Solar heat gain coefficient (SHGC)	0.31
Interior Lighting	Lighting Power Density (LPD)	0.9 W/ft^2
	Ballast	Electronic ballast
HVAC	Air Conditioner	4-Pipe Fan Coil with central chiller and boiler plus DOAS $_{(4)}$ with 14.0 SEER DX coil (3.52 COP) and HHW coil on central boiler SAT control 55ºF – 62ºF with OAT 75º – 54ºF
	Gas Furnace	none
	ERV	70% - 75% sensible effectiveness
Economizer		NR
Ventilation	Outdoor Air Damper	Motorized control
	Demand Control	NR
	Laundry Room	Decoupled $_{(5)}$
Ducts	Friction Rate	0.08 in. w.c./100 feet
	Sealing	Seal class B
	Location	Interior only
	Insulation level	R-6 $_{(6)}$
Service Water Heating	Gas storage	90% E_t
Drain Water Heat Recovery	None	Showers and washing machines drains only --30% efficient

Notes for Prescriptive Solution Technology Table:

(1) NOT USED

(2) NR means there is no requirement or recommendation for a component in this climate.

(3) Increased Building Air tightness. Building air leakage (measured in cfm/ft2) is the average volume of air(measured in cubic feet per minute) that passes through a unit area of the building envelope (measured in square feet) when the building is maintained at a specified internal pressure (measured in Pascals). Testing requirements are specified in Chapter 5..

(4) Dedicated Outdoor Air System. A central dedicated outdoor air system (DOAS) providing the following:

(a) Outside air for building indoor air quality and humidity control

(b) Make-up air for bathroom and kitchen exhausts

(c) Building pressurization to prevent infiltration which allows for reduction of heating/cooling and moisture loads on the system.

NOTE: The Central DOAS does not provide sensible heating or cooling. Sensible loads are provided by a complementing heating and cooling system

(5) Decoupling exhaust and supply systems for laundry rooms. To reduce unneeded energy use for heating and cooling of the make-up air and for air transportation of supply and exhausted air from the dryers, laundry exhaust and supply systems are separated in the efficient building model from the rest of the building exhaust and

supply systems. Laundry exhaust system and corresponding make-up systems operate only when dryers are operating.

(6) The duct and pipe insulation values are from the ASHRAE Advanced Energy Design Guide for Small Offices.

All design features not described above will be in accordance with the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1-2007 including conformance with paragraph 5.9.2, which requires purchase of Energy Star and FEMP designated products.

3.9.4 Schedules

The following facility schedules must be used in all facility energy simulations for purposes of documenting compliance with energy performance requirement.

Training Barracks Sleeping Bays Internal Load Schedules

Hr	Occupancy			Lighting			Plug Loads			Service Hot Water		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	1.00	1.00	1.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
2	1.00	1.00	1.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
3	1.00	1.00	1.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
4	1.00	1.00	1.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
5	1.00	1.00	1.00	0.90	0.90	0.90	0.05	0.05	0.05	0.10	0.10	0.10
6	0.00	0.00	0.00	0.50	0.50	0.50	0.05	0.05	0.05	0.00	0.00	0.00
7	0.00	0.00	0.00	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00
8	1.00	1.00	1.00	0.90	0.90	0.90	0.05	0.05	0.05	1.00	1.00	1.00
9	0.00	0.00	0.00	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00
10	0.00	0.00	0.00	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00
11	0.00	0.00	0.00	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00
12	0.00	0.00	0.00	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00
13	0.50	0.50	0.50	0.90	0.90	0.90	0.05	0.05	0.05	0.00	0.00	0.00
14	0.50	0.50	0.50	0.90	0.90	0.90	0.05	0.05	0.05	0.00	0.00	0.00
15	0.00	0.00	0.00	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00
16	0.00	0.00	0.00	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00
17	0.00	0.00	0.00	0.10	0.10	0.10	0.05	0.05	0.05	0.00	0.00	0.00
18	0.50	0.50	0.50	0.90	0.90	0.90	0.50	0.50	0.50	0.10	0.10	0.10
19	1.00	1.00	1.00	0.90	0.90	0.90	0.50	0.50	0.50	0.10	0.10	0.10
20	1.00	1.00	1.00	0.90	0.90	0.90	0.50	0.50	0.50	0.10	0.10	0.10
21	1.00	1.00	1.00	0.50	0.50	0.50	0.25	0.25	0.25	0.10	0.10	0.10
22	1.00	1.00	1.00	0.20	0.20	0.20	0.05	0.05	0.05	0.00	0.00	0.00
23	1.00	1.00	1.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
24	1.00	1.00	1.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
Peak	72 occ/floor			1.0 W/ft^2			0.25 kW/ft^2			1770 gal/hr		

Hr	Washer/Dryer			Washer SHW		
	Wk	Sat	Sun	Wk	Sat	Sun
18-Jan	0.00	0.00	0.00	0.00	0.00	0.00
19-21	1.00	1.00	1.00	1.00	1.00	1.00
22-24	0.00	0.00	0.00	0.00	0.00	0.00

Peak	8.4kW/zone	80gal/hr

Training Barracks Sleeping Bay Thermostat Set-Point Schedules

Hr	Heating (°F)			Heating (°C)			Cooling (°F)			Cooling (°C)		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
24-Jan	70	70	70	20	20	20	75	75	75	24	24	24

Training Barracks Company Operations First Floor Internal Load Schedules

Hr	Occupancy			Lighting			Plug Loads			Service Hot Water		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
2	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
3	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
4	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
5	0.07	0.07	0.07	0.90	0.90	0.90	0.05	0.05	0.05	0.10	0.10	0.10
6	0.07	0.07	0.07	0.50	0.50	0.50	0.05	0.05	0.05	0.00	0.00	0.00
7	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
8	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.10	0.00	0.00
9	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.50	0.05	0.05
10	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.10	0.05	0.05
11	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.10	0.05	0.05
12	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.10	0.05	0.05
13	0.50	0.50	0.50	0.50	0.20	0.20	0.50	0.20	0.20	0.10	0.05	0.05
14	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.10	0.05	0.05
15	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.10	0.05	0.05
16	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.10	0.05	0.05
17	0.90	0.20	0.20	0.50	0.20	0.20	0.50	0.20	0.20	0.00	0.00	0.00
18	0.20	0.20	0.20	0.50	0.20	0.20	0.25	0.20	0.20	0.00	0.00	0.00
19	0.07	0.07	0.07	0.05	0.05	0.05	0.10	0.05	0.05	0.00	0.00	0.00
20	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
21	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
22	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
23	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
24	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
Peak	15 occ/floor			1.0 W/ft^2			0.35 kW/ft^2			10 gal/hr		

Training Barracks Company Operations First Floor Thermostat Set-Point Schedules

Hr	Heating (°F)			Heating (°C)			Cooling (°F)			Cooling (°C)		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
24-Jan	70	70	70	20	20	20	75	75	75	24	24	24

Training Barracks Company Operations 2nd & 3rd Internal Load Schedules

Hr	Occupancy			Lighting			Plug Loads			Service Hot Water		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
2	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00

3	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
4	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
5	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.10
6	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
7	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.00	0.00
8	0.05	0.05	0.05	0.50	0.20	0.20	0.05	0.05	0.05	0.10	0.00	0.00
9	0.05	0.05	0.05	0.50	0.20	0.20	0.05	0.05	0.05	0.10	0.05	0.05
10	0.25	0.10	0.10	0.50	0.20	0.20	0.50	0.10	0.10	0.20	0.05	0.05
11	0.50	0.10	0.10	0.50	0.20	0.20	0.50	0.10	0.10	0.20	0.05	0.05
12	0.10	0.10	0.10	0.50	0.20	0.20	0.10	0.10	0.10	0.20	0.05	0.05
13	0.10	0.10	0.10	0.50	0.20	0.20	0.10	0.10	0.10	0.20	0.05	0.05
14	0.25	0.10	0.10	0.50	0.20	0.20	0.50	0.10	0.10	0.20	0.05	0.05
15	0.50	0.10	0.10	0.50	0.20	0.20	0.50	0.10	0.10	0.20	0.05	0.05
16	0.10	0.10	0.10	0.50	0.20	0.20	0.10	0.10	0.10	0.10	0.05	0.05
17	0.05	0.05	0.05	0.50	0.20	0.20	0.05	0.05	0.05	0.10	0.05	0.05
18	0.05	0.05	0.05	0.50	0.20	0.20	0.05	0.05	0.05	0.00	0.00	0.00
19	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
20	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
21	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
22	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
23	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
24	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00
Peak	15 occ/floor			1.0 W/ft^2			0.35 kW/ft^2			10 gal/hr		

Training Barracks Company Operations 2nd & 3rd Floor Thermostat Set-Point Schedules

Hr	Heating (°F)			Heating (°C)		
	Wk	Sat	Sun	Wk	Sat	Sun
24-Jan	55	55	55	12.8	12.8	12.8

BT/COF Unoccupied Zones (ie stairwells, mechanical rooms) Thermostat Set-Point Schedules

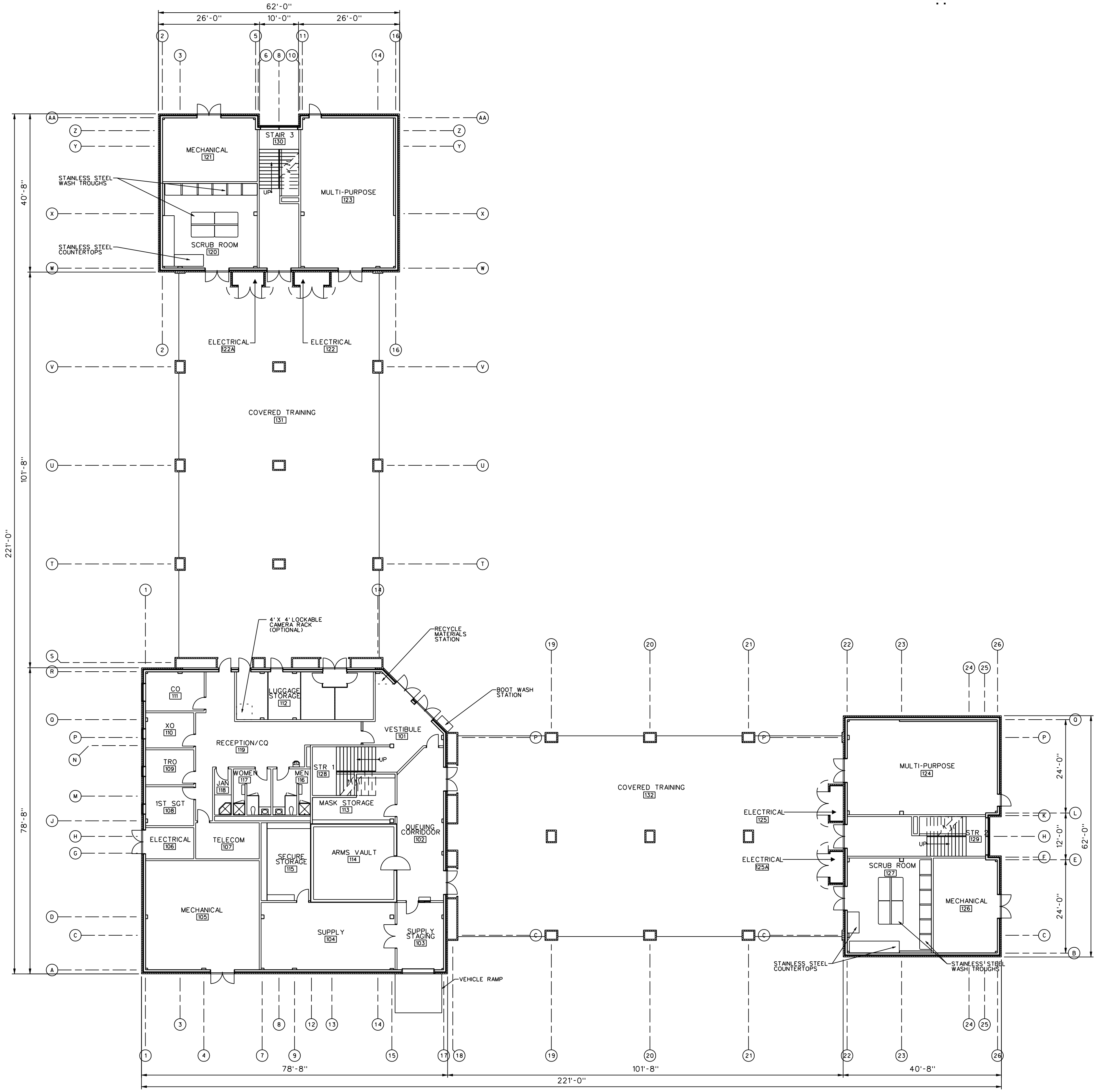
Hr	Heating (°F)			Heating (°C)			Cooling (°F)			Cooling (°C)		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
2	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
3	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
4	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
5	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
6	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
7	70	70	70	21	21	21	75	75	75	24	24	24
8	70	70	70	21	21	21	75	75	75	24	24	24
9	70	70	70	21	21	21	75	75	75	24	24	24
10	70	70	70	21	21	21	75	75	75	24	24	24
11	70	70	70	21	21	21	75	75	75	24	24	24
12	70	70	70	21	21	21	75	75	75	24	24	24
13	70	70	70	21	21	21	75	75	75	24	24	24
14	70	70	70	21	21	21	75	75	75	24	24	24
15	70	70	70	21	21	21	75	75	75	24	24	24
16	70	70	70	21	21	21	75	75	75	24	24	24

17	70	70	70	21	21	21	75	75	75	24	24	24
18	70	70	70	21	21	21	75	75	75	24	24	24
19	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
20	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
21	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
22	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
23	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4
24	60	60	60	15.6	15.6	15.6	85	85	85	29.4	29.4	29.4

ATTACHMENT A
AIT COMPLEX DRAWINGS AND DETAILS

Index

Section:



1ST FLOOR PLAN

1/16"=1'-0"

US Army Corps of Engineers
Fort Worth District

Symbol	Description	Tracking No.	Action	Date

U.S. ARMY ENGINEER DISTRICT,
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

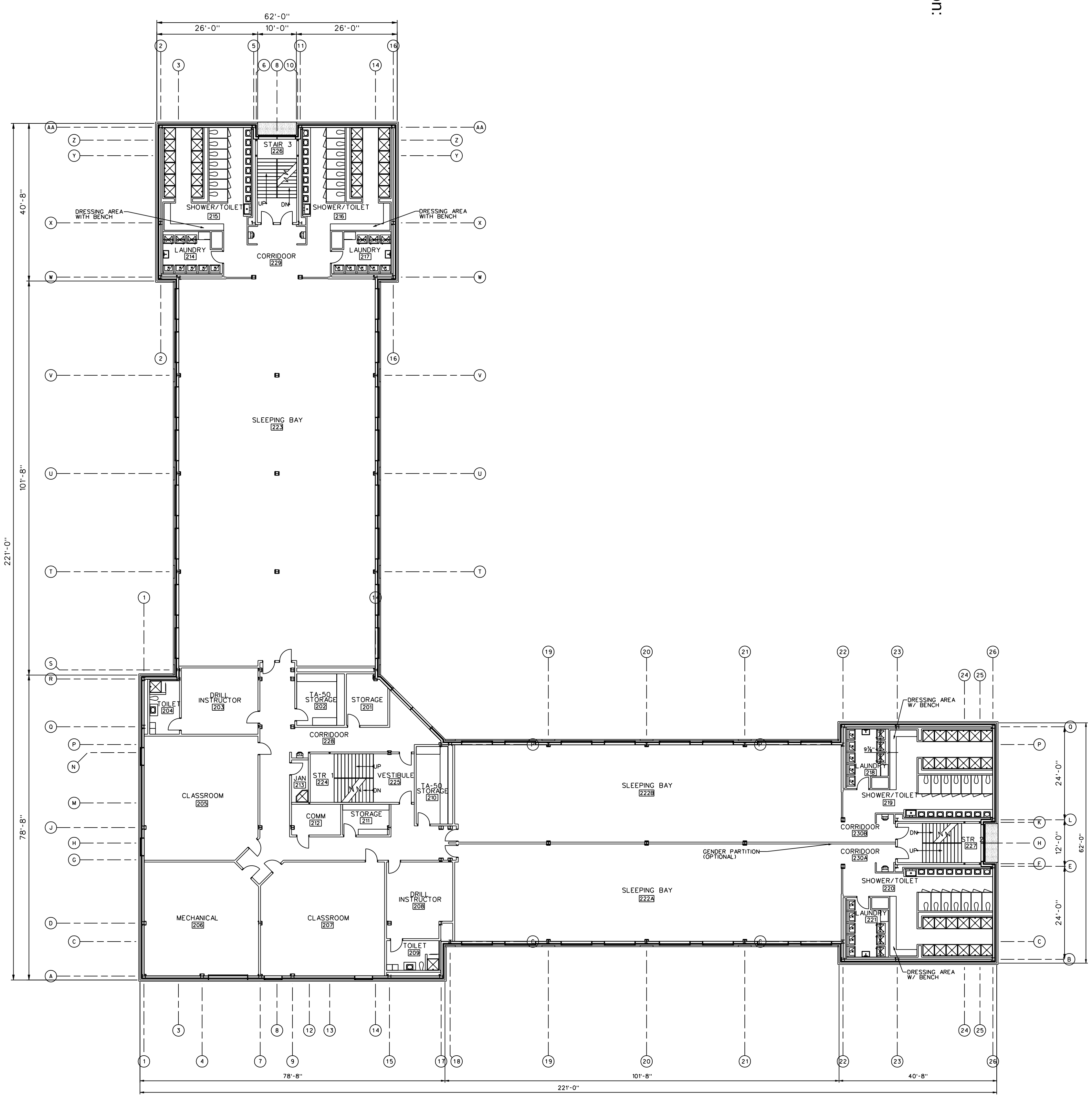
Designed by: | Date: | Rev.
Dwn by: | Sol No.
Reviewed by: | Contr No.
Submitted by: BILL BOYLE, A.I.A. CHIEF, ARCHITECTURAL SECTION
$$cadd file name$$ Plot date: $$date$$ Plot scale:

COS BT
BASIC TRAINING - BARRACKS
COMPANY OPERATIONS FACILITY
PN: 000000

FIRST FLOOR PLAN

Sheet reference number:
A101

Contr No.



2ND FLOOR PLAN

1/16"=1'-0"

N

US Army Corps of Engineers
Fort Worth District

Symbol	Description	Tracking No.	Action	Date

Designed by: | Date: | Rev.
Dwn by: | Sol No.
Reviewed by: | Contr No.
Submitted by: BILL BOYLE, A.I.A CHIEF, ARCHITECTURAL SECTION
File name: $$cadd file name$$
Plot date: $$date$$
Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

COS BT
BASIC TRAINING - BARRACKS
COMPANY OPERATIONS FACILITY
PN: 000000

SECOND FLOOR PLAN

Sheet reference number:

A102

Section:

Contr No.

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$$date$$
$$user$$
$$cadd file name$$

REFERENCE FILES:

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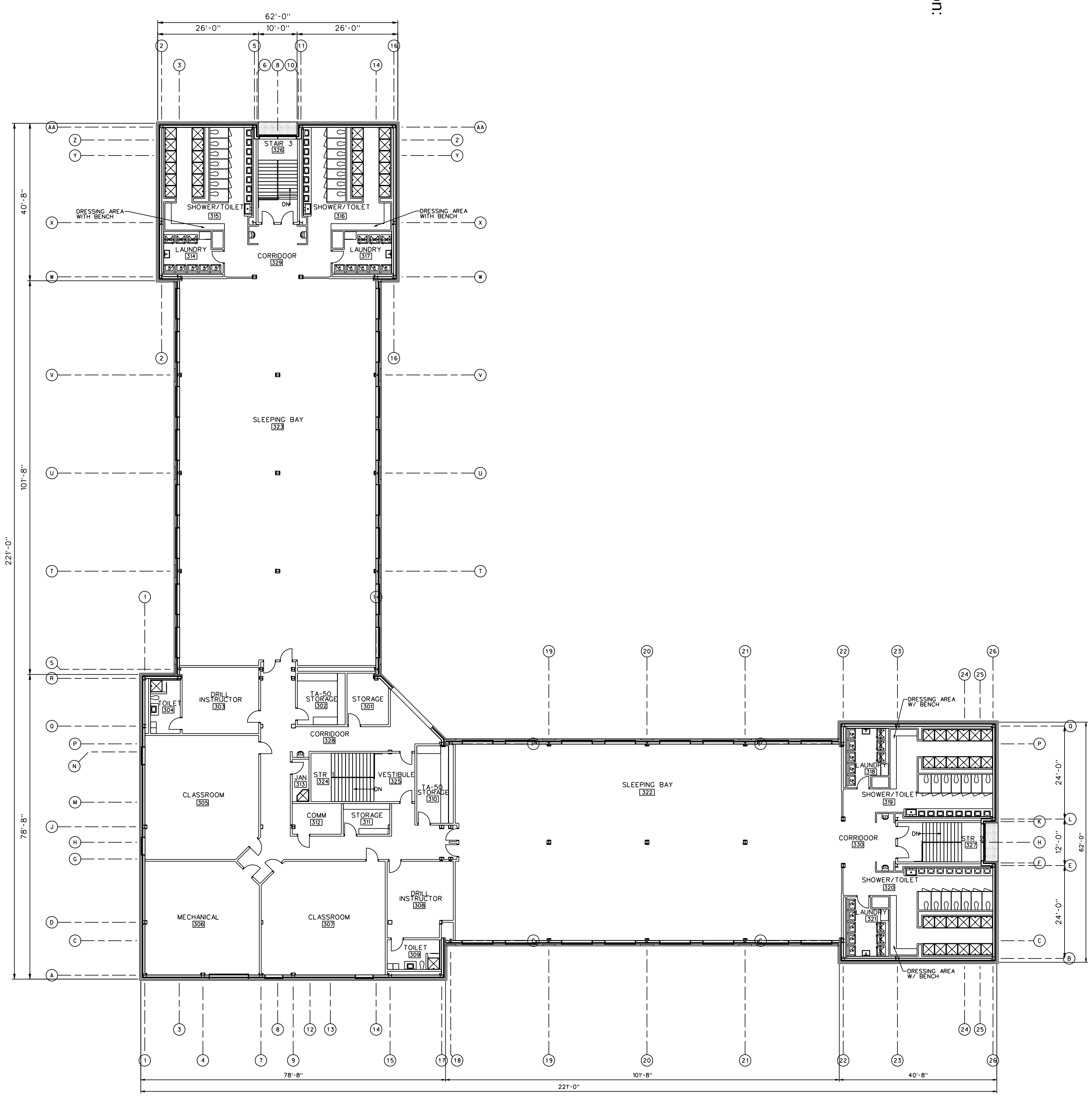

3RD FLOOR PLAN

1/16"=1'-0"

US Army Corps of Engineers
Fort Worth District

Symbol	Description	Tracking No.	Action	Date

Designed by: | Date: | Rev.
Dwn by: | Sol No.
Reviewed by: | Contr No.
Submitted by: BILL BOYLE, A.I.A. CHIEF, ARCHITECTURAL SECTION
$$cadd file name$$ Plot date: $$date$$ Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

COS BT
BASIC TRAINING - BARRACKS
COMPANY OPERATIONS FACILITY
PN: 000000

THIRD FLOOR PLAN

Sheet reference number:
A103

Contr No.

$$time$$
$$date$$
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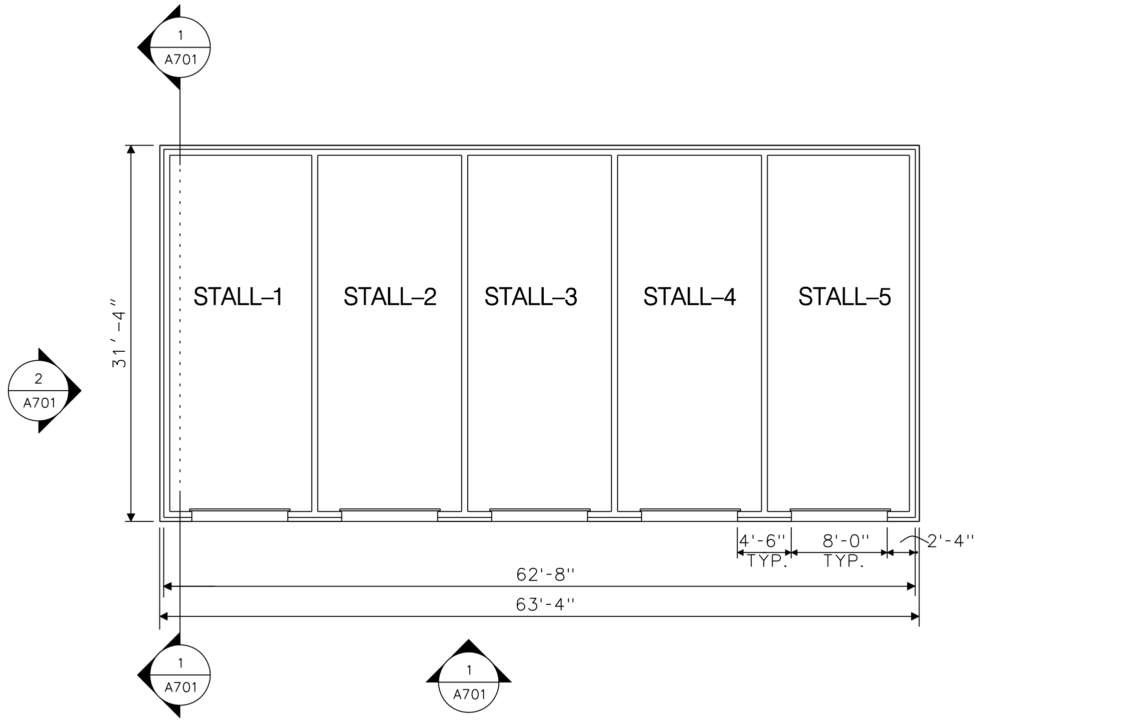
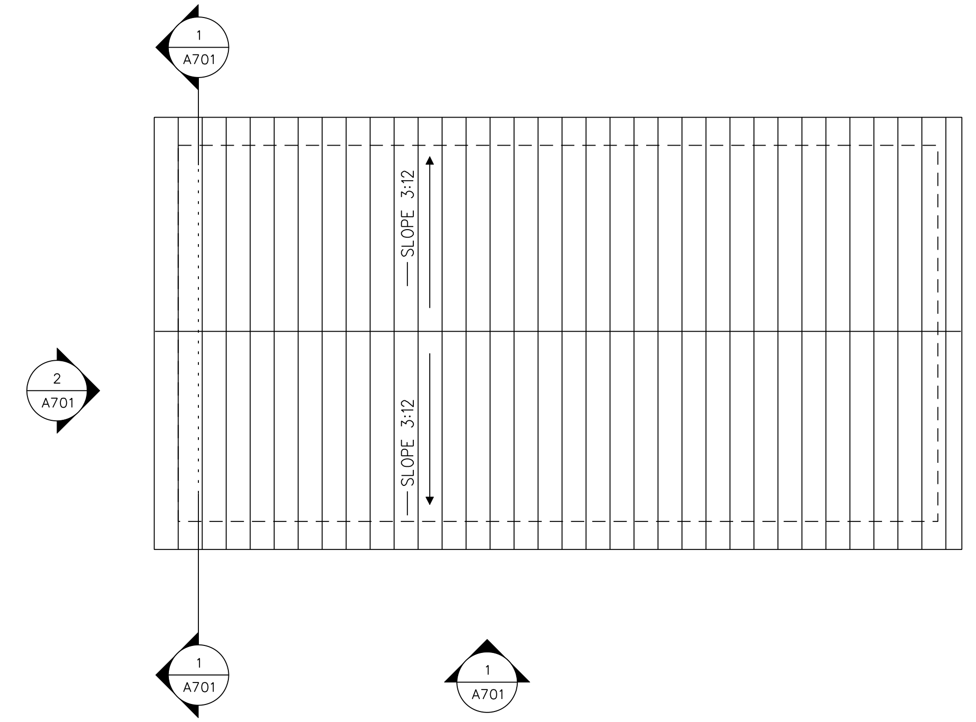
$$REFERENCEFILE2$$
$$REFERENCEFILE3$$
$$REFERENCEFILE4$$

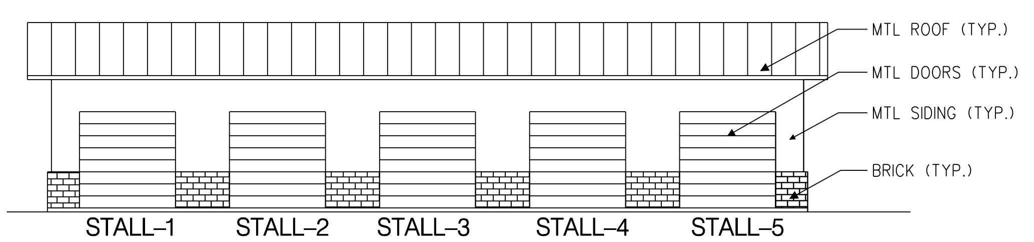
Section:



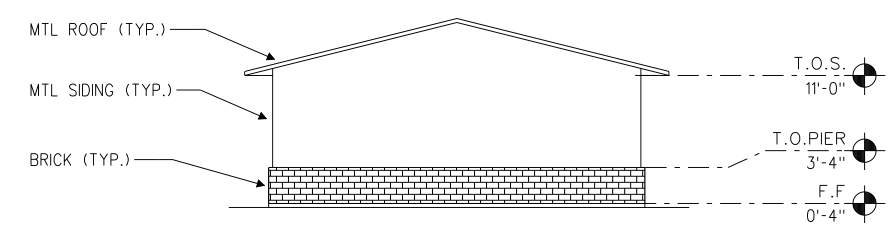
LAWN EQUIPMENT BUILDING PLAN
1/8"=1'-0"



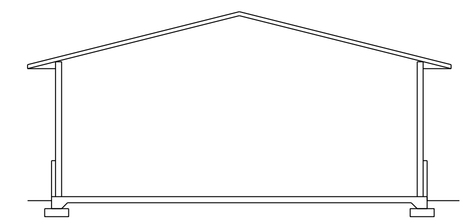
LAWN EQUIPMENT BUILDING ROOF PLAN
1/8"=1'-0"



1 LAWN EQUIPMENT BUILDING ELEVATION
1/8"=1'-0"



2 LAWN EQUIPMENT BUILDING ELEVATION
1/8"=1'-0"



1 LAWN EQUIPMENT BUILDING SECTION
1/8"=1'-0"

US Army Corps of Engineers
Fort Worth District

Symbol	Description	Tracking No.	Action	Date

Designed by: | Date: | Rev.
Dwn by: | Sol No.
Reviewed by: | Contr No.
Submitted by: BILL BOYLE, A.I.A. CHIEF, ARCHITECTURAL SECTION
$$cadd file name$$ Plot date: $$date$$ Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

COS BT
BASIC TRANING - BARRACKS
COMPANY OPERATIONS FACILITY
PN: 000000

LAWN EQUIPMENT BUILDING

Sheet reference number:
A701

Contr No.

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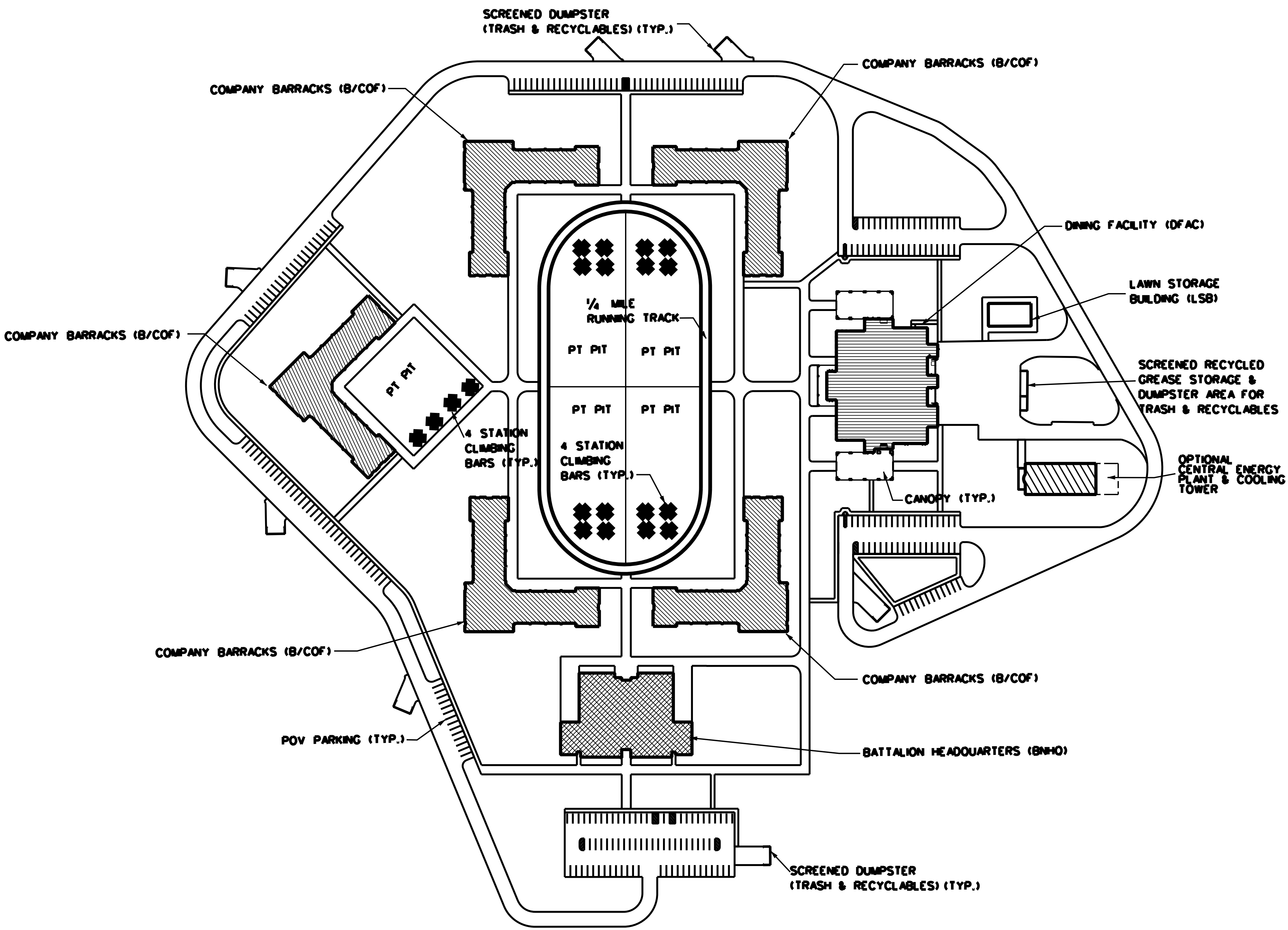
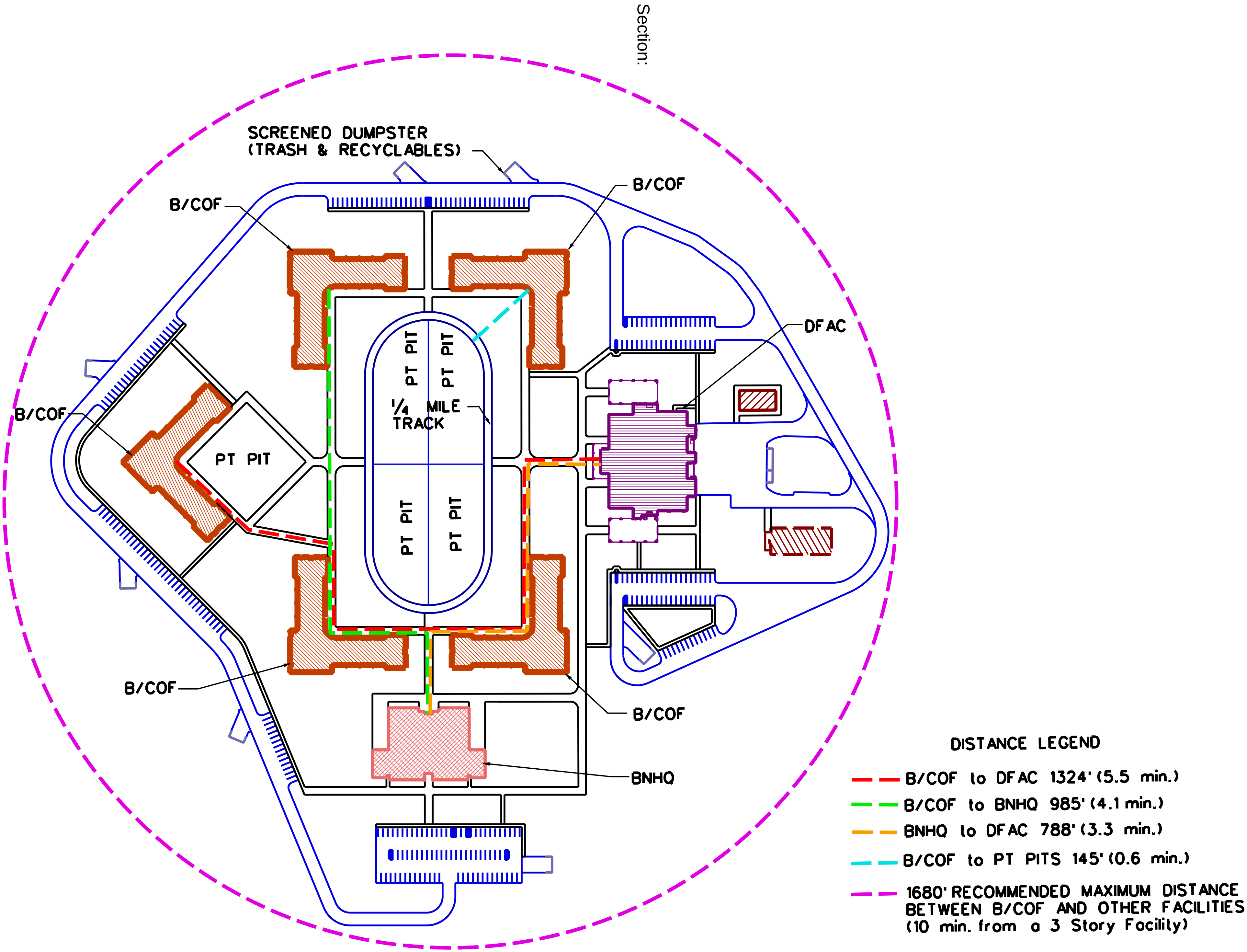
Section:



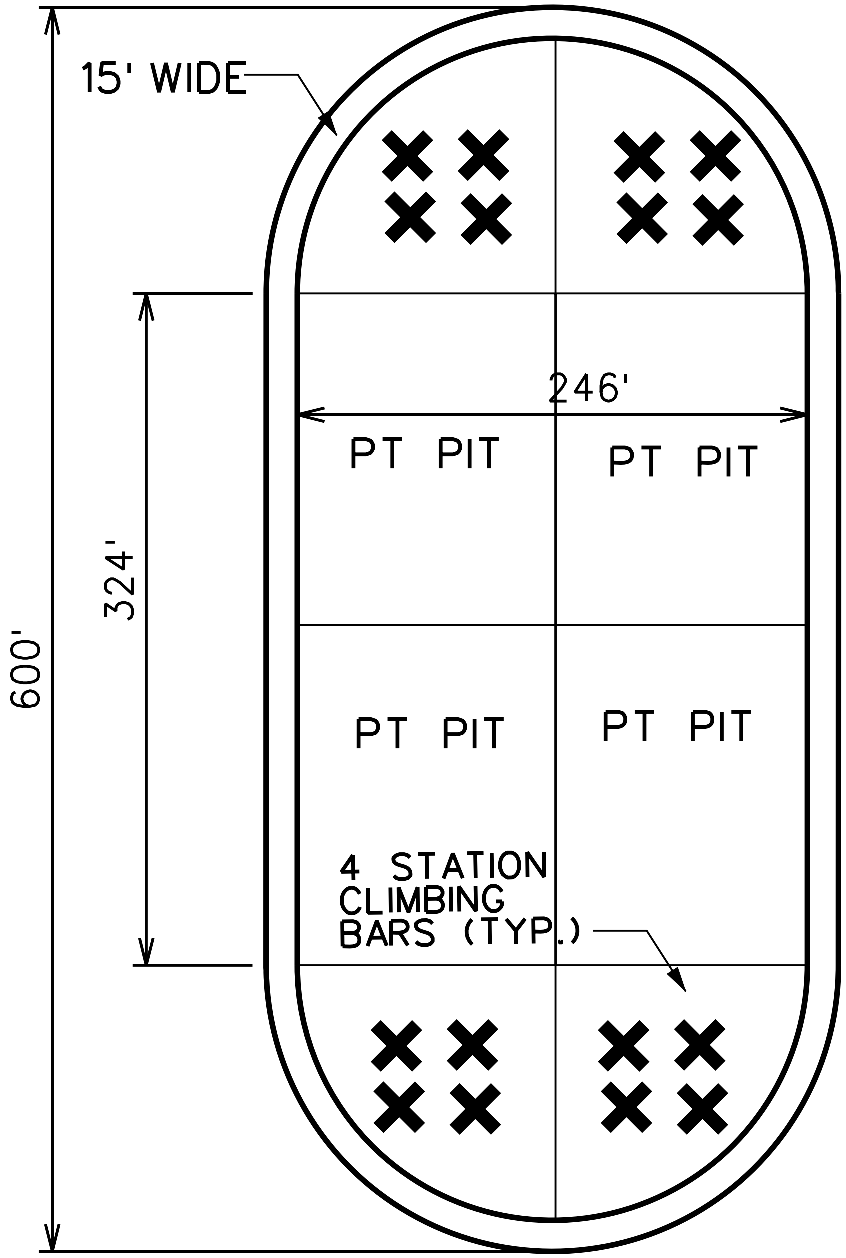
CONCEPTUAL BT/OSUT COMPLEX
SITE LAYOUT PLAN

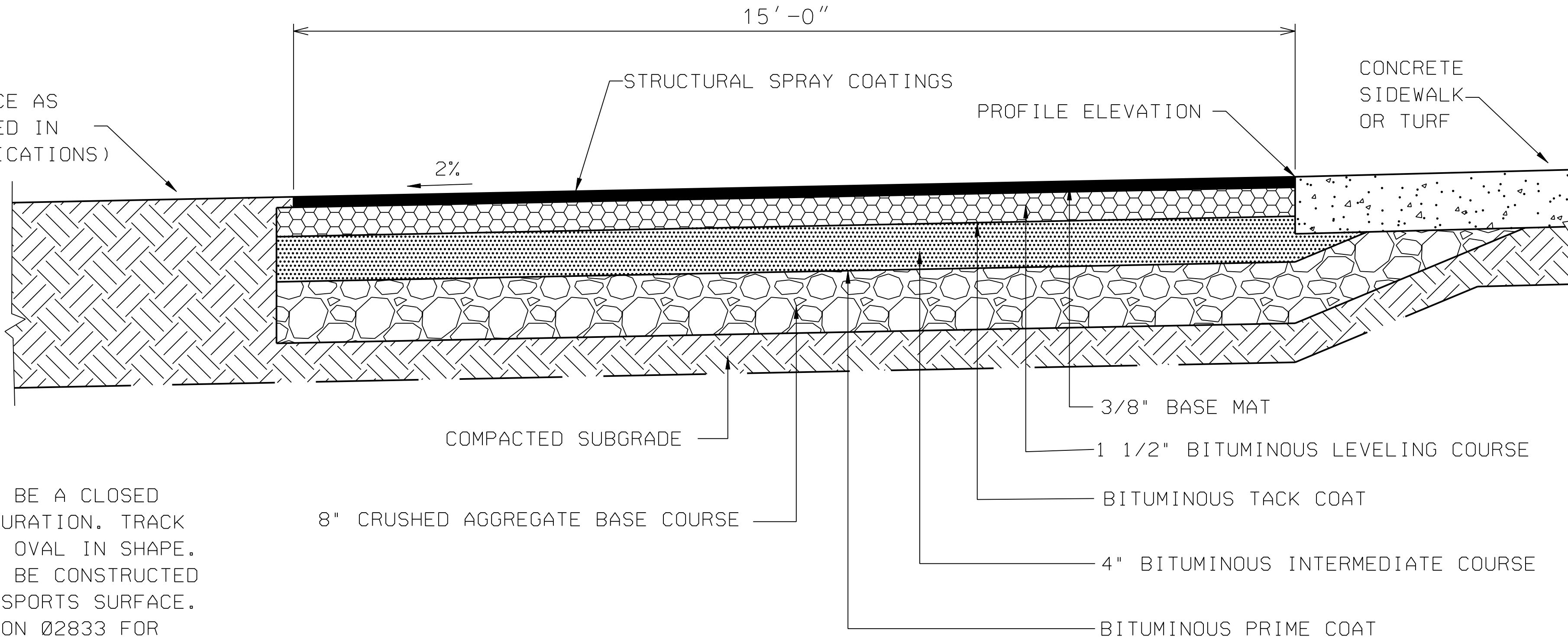


BASIC TRAINING AND ONE STATION UNIT TRAINING (BT/OSUT) COMPLEX

(31 ACRES AS SHOWN)

Section:


15' WIDE
246'
324'
600'
PT PIT
PT PIT
PT PIT
PT PIT
4 STATION
CLIMBING
BARS (TYP.)



NOTE:

THE TRACK SHALL BE A CLOSED 1/4 MILE CONFIGURATION. TRACK MAY BE ROUND OR OVAL IN SHAPE. THE TRACK SHALL BE CONSTRUCTED OF A SYNTHETIC SPORTS SURFACE. SEE SPECIFICATION 02833 FOR MATERIAL AND INSTALLATION REQUIREMENTS. TRACK AND PT PITS SHALL BE DESIGNED WITH SURFACE AND/OR SUBSURFACE DRAINAGE, AS REQUIRED TO ELIMINATE ALL STANDING WATER.

ATHLETIC RUNNING TRACK TYPICAL CROSS SECTION

NOT TO SCALE

FIGURE 2- RUNNING TRACK

SECTION 02 83 30

SYNTHETIC SPORTS SURFACE
01/03

PART 1 GENERAL

The product shall be an impermeable, synthetic sports surface, designed for track and field activities. The system shall consist of a base mat, and of recycled rubber granules bound with a polyurethane binder and a impermeable layer of bi-component urethane coating, and a pigmented spray-applied top finish of polyurethane spray-coating and EPDM rubber granules. The system shall be installed on site.

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Synthetic Sports Surface Material

The Contractor shall submit descriptive technical data on the primers,granules, impermeable layer, structural spray coating, and line marking paint.

The Contractor shall provide written instructions provided by the manufacturer of all the materials used in the construction of the synthetic running track.

SD-07 Certificates

Synthetic Sports Surface Material

The Contractor shall provide documentation showing that the installer and supplier meet the qualifications listed.

1.4 WARRANTY

The product shall be warranted against defects in workmanship, labor, and materials for 60 months at no extra cost to the government.

PART 2 PRODUCTS

2.1 PRIMER

Polyurethane-based primers shall be compatible with the base and track surfacing materials.

2.2 BLACK RECYCLED RUBBER GRANULES

The rubber granules for the base mat shall be recycled rubber, processed and chopped to 0.029 to 0.118 inches, containing less than 4% dust.

2.3 POLYURETHANE BINDER

Binder for the black rubber mat shall be an MDI-based mono-component, polyurethane binding agent. The binding agent shall not have a free TDI monomer level above 0.2%, must be clear in color, not milky, and must be solvent free. The binding agent must be specially formulated for compatibility with SBR stranded or rubber crumb.

2.4 EPDM GRANULES

The rubber granules for the structural spray wearing coats shall be EPDM peroxide cured, man-made rubber containing a minimum 20% EPDM, with a specific gravity of 1.5 +/-0.1, cryogenically processed and chopped to two different gradations, 0.019 to 0.059 and 0.029 to 0.118 inches. The EPDM rubber will be the same color as chosen by the government for the track surface.

2.5 IMPERMABLE LAYER

The resin for this application shall be a pigmented, thixotropic, two-component, polyol and isocyanate, moisture cured, urethane compound and shall be squeegee applied.

2.6 STRUCTURAL SPRAY COATING

The spray coating shall be a single component moisture cured, pigmented polyurethane, specifically formulated for compatibility with EPDM granules. The coating shall be the color red.

2.7 LINE MARKING PAINT (NOT USED)

PART 3 EXECUTION

3.1 ASPHALTIC SURFACE INSPECTION

Prior to the application of the synthetic track surface, the asphaltic concrete base shall be inspected for conformity to planarity requirements. The surface shall not deviate from the specified grade more than 1.26 inches in 10 feet measured in any direction. All areas not in conformance with the above requirements will be repaired by others, with materials as approved by the manufacturer and allowed to cure prior to application of synthetic course. The surface shall be constructed with a slope of 2.36 inches per 10 feet towards the inner edge.

3.2 CURING

The asphalt surface shall be cured for a minimum of 14 days before construction of the synthetic surface begins.

3.3 CLEANING

The area to be surfaced shall be clean and free of any loose particle or foreign substances (dirt, oil, etc.) prior to commencement of the work.

3.4 PRIMING

The primer shall be spray-applied in accordance with the manufacturer's specifications. Primer shall be applied within 12 hours of synthetic material installation.

3.5 BASE MAT

3.5.1 Mixing

SBR granules and binder shall be mixed according to manufacturer's instructions. Mixing time shall be 2 to 4 minutes.

3.5.2 Application

The material shall be spread onto the asphalt mat using a mechanical tandem leveler. The tandem leveler shall have a heated oscillating screed bar for smoothness and compaction. The heated screed shall be heated to between 158 and 176 degrees F.

The laying procedure shall be bay-to-bay and limiting the length of the passes so as not to have any cold (or cured) lints between the bays. At the beginning of each work day, the traverse joint from the previous day shall be tack coated to ensure adequate bond. Small irregularities remaining in the surface after the tandem leveler has passed shall be removed using a length polyethylene or a Teflon roller.

3.6 IMPERMEABLE LAYER

The components are mixed at the prescribed ration homogeneously with suitable mixing device. This may be a strong drilling machine with a mixing paddle, a static mixing machine, or an automatic mixer. Mixing shall be done for 2 to 4 minutes per batch, depending on the mixer used. The coating shall be squeegee-applied to the base mat, making it impermeable.

3.7 STRUCTURAL SPRAY WEAR COATS

The top layer installation shall commence after the black rubber and sealer coat have cured. The top layer shall consist of a spray coating and EPDM granules. The base mat shall be dry, clean, and free of dust, oils, and greases. The spray coating material shall be mixed with the EPDM granules in a suitable device. Application of the mixture shall include the use of a structure-spray-machine. The mixture shall be placed using two applications in alternate directions with approximately 0.14 pounds per square foot per coat.

3.8 LINE MARKINGS (NOT USED)

3.9 PHYSICAL REQUIREMENTS

The completed surface shall meet the following requirements:

Thickness: 0.512 inches or as specified in the drawings.

Shore A Hardness	ASTM D 2240	55 +/-5
Elongation at Break	ASTM D 412	110%
Tensile Strength	ASTM D 412	645 pounds/sq in (at 68 degrees F)
Compression Set Recovery	ASTM D 395	90-95% over 24 hour period (at 68 degrees F)
Abrasion Resistance	ASTM D 501	0.009 ounces loss after 100 cycles
Chalking	ASTM D 822	No change after 1000 hours

Coefficient of Friction	ASTM D 1984	Dry: 0.70 to 0.75 Wet: 0.60 to 0.65
Resilience	ASTM D 2632	38 to 42%
Tear Resistance	ASTM D 624	60-75 psi

3.10 CONTRACTOR QUALIFICATIONS

The contractor shall submit evidence of at least 20 surface installations in the last 3 years utilizing the type of system specified herein.

The surfacing contractor chosen shall show proof of manufacturing their own polyurethane coatings.

-- End of Section --

Climbing Bars

Figure B-1.

Climbing Bars Specifications

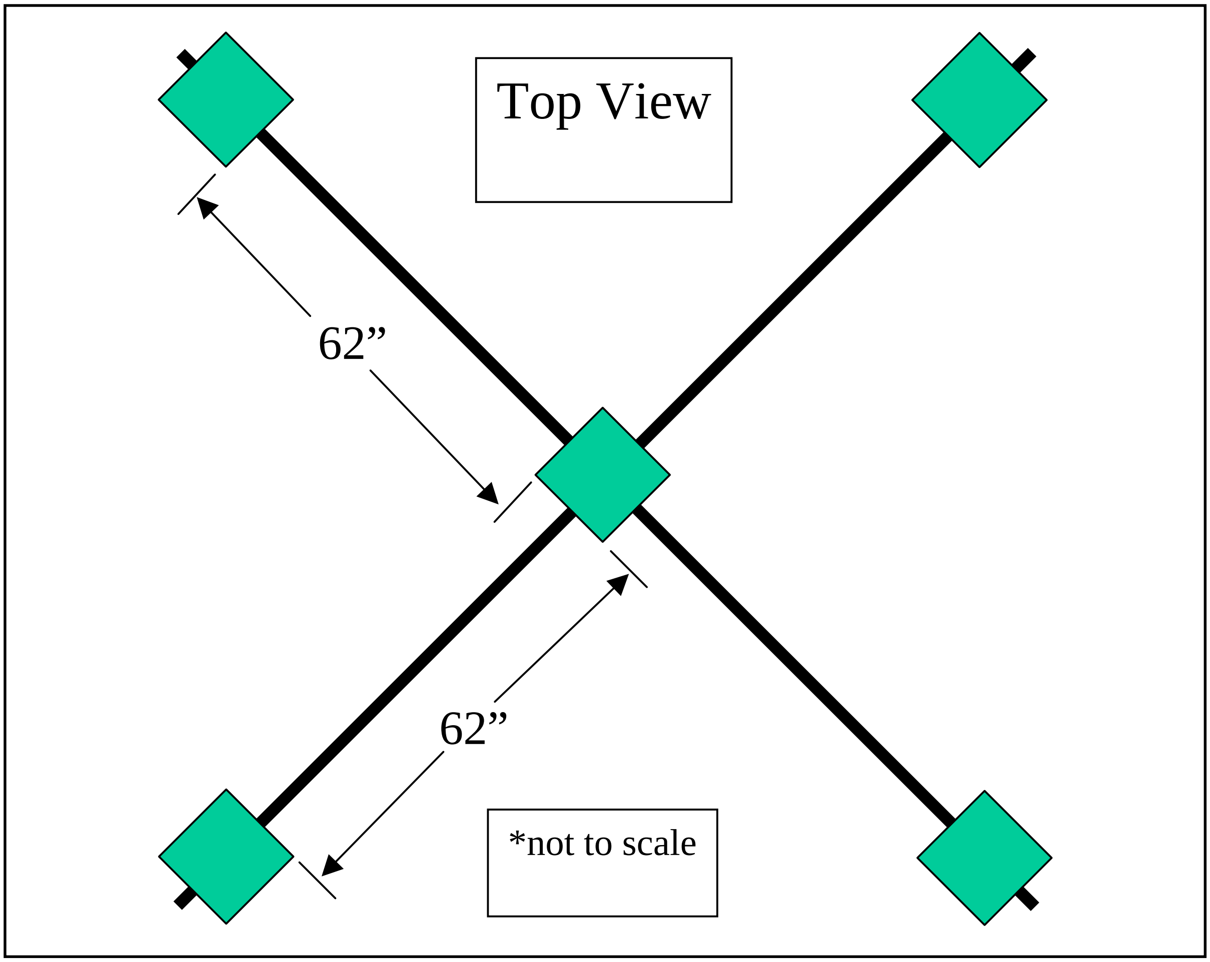


Figure B-2.

The specifications for the climbing bars are as follows:

- The posts (5) are 6” x 6” x 12’ and sunk 3 feet into the ground, anchored with concrete.
- The bars (2) are threaded water pipe, 1.0 inch inside diameter, 12 feet long with 1-inch end caps (4).
- The bars are throught the 6x6s at 7.5 and 8 feet above the ground.
- The distance from inside post edge to inside post edge is approximately 62 inches (refer to Figure B-2). This is to allow enough bar space to conduct all exercises safely.
- The step-ups (16 inches long) are cut from 4” x 4” x 8’ posts and secured to the 6x6s with 3 inch screws that are counter sunk.
- The step-ups on the outside 6x6 posts are 18 inches from the ground, the step-ups on the inside post are 24 inches above the ground (refer to Figure DB-3).

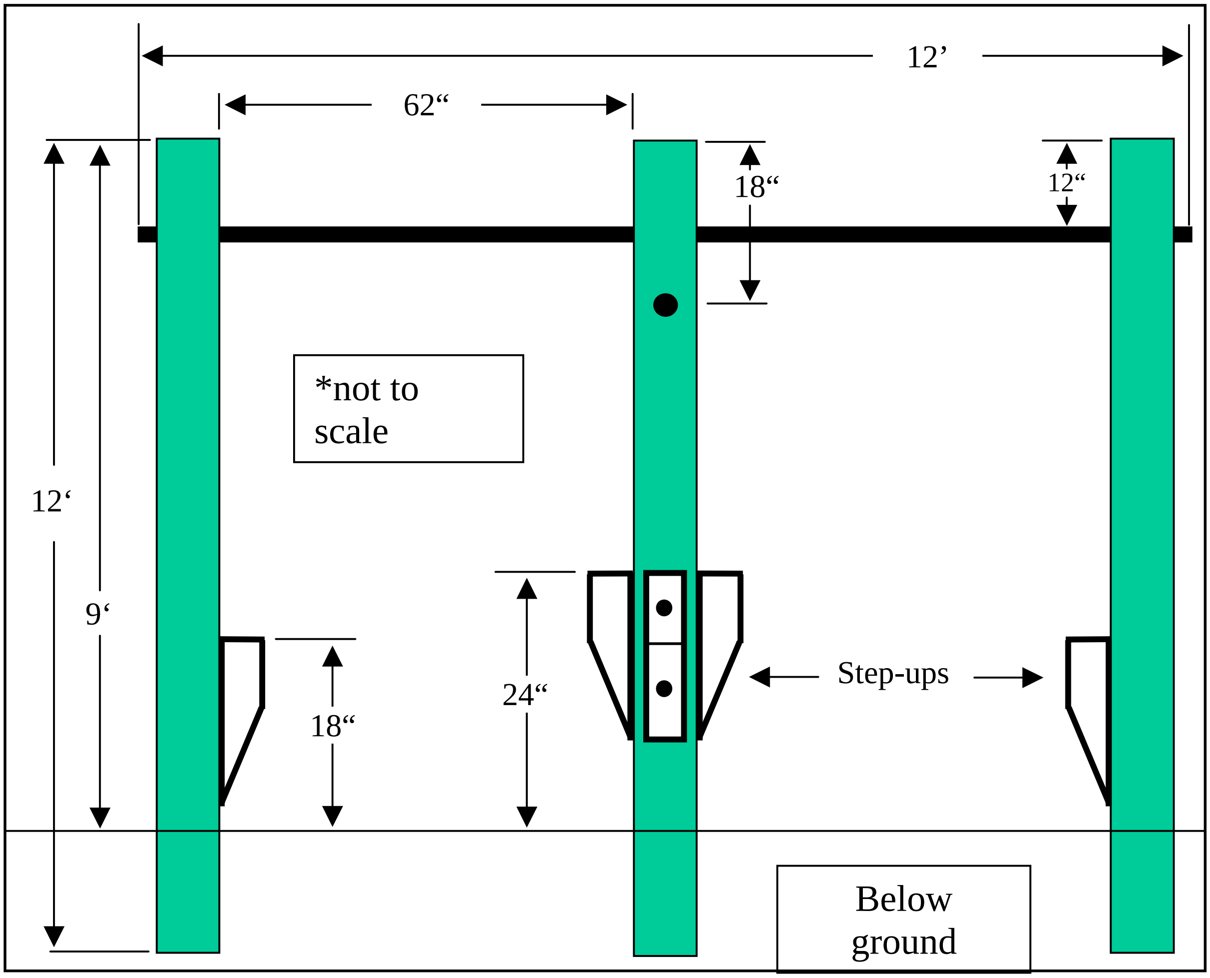
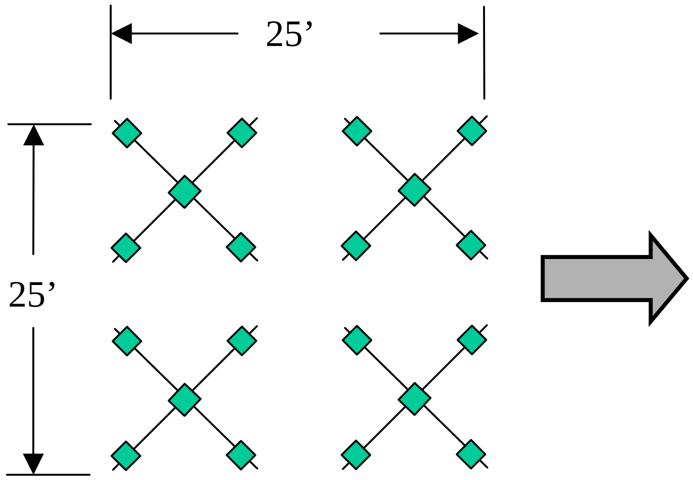


Figure B-3.

The following planning considerations apply:

- Climbing bars provide adequate space and facilitate better command and control than traditional pull-up bars. Traditional pull-up bars are too narrow to safely and efficiently conduct the climbing drills.
- Employment of multiple climbing bar “pods” as shown in Figure B-4 will allow for efficient mass training. The climbing drills require one bar for every three soldiers when performed as a single activity.
- The total ground surface area for four pods is only 625 square feet.
- Four pods will accommodate 16 stations x 3 soldiers per station for a total of 48 soldiers.
- Additional free-standing pods should be constructed to accommodate more soldiers.



Top view - not to scale

Resource Requirements:
(15) 6” x 6” x 12’ PT posts,

(8) 12’ x 1.5” pipe (bars),

(6) 4” x 4” x 8’ PT posts,

(48) 3” lag screws,

(16) pipe (bar) end caps,

(15) 60 lb bags of cement.

FIGURE B-4.

4.0 APPLICABLE CRITERIA

Unless a specific document version or date is indicated, use criteria from the most current references as of the date of issue of the contract or task order, including any applicable addenda, unless otherwise stated in the task order. In the event of conflict between References and/or Applicable Military Criteria, apply the most stringent requirement, unless otherwise specifically noted in the contract or task order.

4.1. INDUSTRY CRITERIA

Applicable design and construction criteria references are listed in Table 1 below. This list is not intended to include all criteria that may apply or to restrict design and construction to only those references listed. See also Paragraph 3 for additional facility-specific applicable criteria.

Table 1: Industry Criteria

Air Conditioning and Refrigeration Institute (ARI)	
ARI 310/380	Packaged Terminal Air-Conditioners and Heat Pumps
ARI 440	Room Fan-Coil and Unit Ventilator
ANSI/ARI 430-99	Central Station Air Handling Units
ARI 445	Room Air-Induction Units
ARI 880	Air Terminals
Air Movement and Control Association (AMCA)	
AMCA 210	Laboratory Methods of Testing Fans for Rating
American Architectural Manufacturers Association (AAMA)	
AAMA 605	Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
AAMA 607.1	Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum
AAMA 1503	Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections
American Association of State Highway and Transportation Officials (AASHTO)	
	Roadside Design Guide [guardrails, roadside safety devices]
	Standard Specifications for Transportation Materials and Methods of Sampling and Testing [Road Construction Materials]

	Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals
	Guide for Design of Pavement Structures, Volumes 1 and 2 [pavement design guide]
	A Policy of Geometric Design of Highways and Streets
American Bearing Manufacturers Association (AFBMA)	
AFBMA Std. 9	Load Ratings and Fatigue Life for Ball Bearings
AFBMA Std. 11	Load Ratings and Fatigue Life for Roller Bearings
American Boiler Manufacturers Association (ABMA)	
ABMA ISEI	Industry Standards and Engineering Information
American Concrete Institute	
ACI 302.2R	Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials
ACI 318	Building Code Requirements for Structural Concrete
ACI SP-66	ACI Detailing Manual
ACI 530	Building Code Requirements for Masonry Structures
ADA Standards for Accessible Design	
See US Access Board	ADA and ABA Accessibility Guidelines for Buildings and Facilities, Chapters 3-10.
American Institute of Steel Construction (AISC)	
	Manual of Steel Construction – 13th Edition (or latest version)
American Iron and Steel Institute	
AISI S100	North American Specification for the Design of Cold-Formed Steel Structural Members
American National Standards Institute 11 (ANSI)	

ANSI Z21.10.1	Gas Water Heaters Vol. 1, Storage water Heaters with Input Ratings of 75,000 Btu per Hour or less
ANSI Z124.3	American National Standard for Plastic Lavatories
ANSI Z124.6	Plastic Sinks
ANSI Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI/IEEE C2-2007	National Electrical Safety Code
ANSI/AF&PA NDS-2001	National Design Specification for Wood Construction
American Society of Civil Engineers (ASCE)	
ASCE 7	Minimum Design Loads for Buildings and Other Structures
ASCE 37	Design and Construction of Sanitary and Storm Sewers, Manuals and Reports on Engineering Practice [sanitary sewer and storm drain design criteria]
ASCE/SEI 31-03	Seismic Evaluation of Existing Buildings [Existing Building Alteration/Renovation]
ASCE/SEI 41-06	Seismic Rehabilitation of Existing Buildings [Existing Building Alteration/Renovation]
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)	
ASHRAE 90.1	ANSI/ASHRAE/IESNA 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE Guideline 0	The Commissioning Process
ASHRAE Guideline 1.1	The HVAC Commissioning Process
ASHRAE Handbooks	Fundamentals, HVAC Applications, Systems and Equipment, Refrigeration (Applicable, except as otherwise specified)
ASHRAE Standard 15	Safety Standard for Refrigeration Systems
ASHRAE Standard 62.1	Ventilation for Acceptable Indoor Air Quality
ASHRAE Standard 55	Thermal Environmental Conditions for Human Occupancy (Design portion is applicable)

American Society of Mechanical Engineers International (ASME)	
ASME BPVC SEC VII	Boiler and Pressure Vessel Code: Section VII Recommended Guidelines for the Care of Power Boilers
ASME A17.1	Safety Code for Elevators and Escalators
ASME B 31 (Series)	Piping Codes
American Water Works Association (AWWA)	
	Standards [standards for water line materials and construction]
American Welding Society	
	Welding Handbook
	Welding Codes and Specifications (as applicable to application, see International Building Code for example)
Architectural Woodwork Institute (AWI)	
Version 1.2	AWI Quality Standards 7th Edition
Associated Air Balance Council (AABC)	
AABC MN-1	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems
	AABC Associated Air Balance Council Testing and Balance Procedures
ASTM International	
ASTM C1060-90(1997)	Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings
ASTM E 779 (2003)	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
ASTM E1827-96(2002)	Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
Builders Hardware Manufacturers Association (BHMA)	
ANSI/BHMA	American National Standards for Builders Hardware

Building Industry Consulting Service International	
	Telecommunications Distribution Methods Manual (TDMM)
	Customer-Owned Outside Plant Design Manual (CO-OSP)
Code of Federal Regulations (CFR)	
49 CFR 192	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards
10 CFR 430	Energy Conservation Program for Consumer Products
Consumer Electronics Association	
CEA 709.1B	Control Network Protocol Specification
CEA 709.3	Free-Topology Twisted-Pair Channel Specification
CEA 852	Tunneling Component Network Protocols Over Internet Protocol Channels
Electronic Industries Association (EIA)	
ANSI/EIA/TIA 568	Structured Cabling Series
ANSI/EIA/TIA 569	Commercial Building Standard for Telecommunications Pathways and Spaces (includes ADDENDA)
ANSI/TIA/EIA-606	Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings
J-STD EIA/TIA 607	Commercial Building Grounding and Bonding Requirements for Telecommunications
Federal Highway Administration (FHWA)	
	Manual on Uniform Traffic Control Devices for Streets and Highways [signage and pavement markings for streets and highways]
FHWA-NHI-01-021	Hydraulic Engineering Circular No. 22, Second Edition, URBAN DRAINAGE DESIGN MANUAL
Illuminating Engineering Society of North America (IESNA)	
IESNA RP-1	Office Lighting

IESNA RP-8	Roadway Lighting
IESNA Lighting Handbook	Reference and Application
Institute of Electrical and Electronics Engineers Inc. (IEEE)	
	Standard for Use of the International System of Units (SI): the Modern Metric System
Standard 1100	Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
International Code Council (ICC)	
IBC	International Building Code Note: All references in the International Building Code to the International Electrical Code shall be considered to be references to NFPA 70. All references in the International Building Code to the International Fuel Gas Code shall be considered to be references to NFPA 54 and NFPA 58. All references in the International Building Code to the International Fire Code and Chapter 9 shall be considered to be references to Unified Facilities Criteria (UFC) 3-600-01.
IMC	International Mechanical Code – Note: For all references to “HEATING AND COOLING LOAD CALCULATIONS”, follow ASHRAE 90.1 Note: For all references to “VENTILATION”, follow ASHRAE 62.1
IRC	International Residential Code
IPC	International Plumbing Code
IEC	Energy Conservation Code (IEC) –Applicable only to the extent specifically referenced herein. Refer to Paragraph 5, ENERGY CONSERVATION requirements.
IGC	International Gas Code - not applicable. Follow NFPA 54, National Fuel Gas Code and NFPA 58, Liquified Petroleum Gas Code.
International Organization for Standardization (ISO)	
ISO 6781:1983	Qualitative detection of thermal irregularities in building envelopes –

	infrared method
LonMark International (LonMark)	
LonMark Interoperability Guidelines	(available at www.lonmark.org), including: Application Layer Guidelines, Layer 1-6 Guidelines, and External Interface File (XIF) Reference Guide
LonMark Resource Files	(available at www.lonmark.org), including Standard Network Variable Type (SNVT) definitions
Metal Building Manufacturers Association (MBMA)	
	Metal Building Systems Manual
Midwest Insulation Contractors Association (MICA)	
	National Commercial and Industrial Insulation Standards Manual
National Association of Corrosion Engineers International (NACE)	
NACE RP0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE RP0185	Extruded, Polyolefin Resin Coating Systems with Adhesives for Underground or Submerged Pipe
NACE RP0285	Corrosion Control of Underground Storage Tank Systems by Cathodic Protection
NACE RP0286	Electrical Isolation of Cathodically Protected Pipelines
National Electrical Manufacturers Association (NEMA)	
National Environmental Balancing Bureau (NEBB)	
	Procedural Standards Procedural Standards for Testing Adjusting Balancing of Environmental Systems
National Fire Protection Association (NFPA)	
NFPA 10	Standard for Portable Fire Extinguishers
NFPA 13	Installation of Sprinkler Systems
NFPA 13R	Residential Occupancies up to and Including Four Stories in Height Sprinkler Systems

NFPA 14	Standard for the Installation of Standpipes and Hose Systems
NFPA 20	Installation of Centrifugal Fire Pumps
NFPA 24 NFPA 25	Standard for the Installation of Private Fire Service Mains and Their Appurtenances [underground fire protection system design] Inspection, Testing And Maintenance Of Water-Based Fire Protection Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 30A	Motor Fuel Dispensing Facilities and Repair Garages
NFPA 31	Installation of Oil Burning Equipment
NFPA 54	National Fuel Gas Code
NFPA 58	Liquefied Petroleum Gas Code
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 76	Fire Protection of Telecommunications Facilities
NFPA 80	Standard for Fire Doors and Fire Windows
NFPA 90a	Installation of Air Conditioning and Ventilating Systems
NFPA 96	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
NFPA 101	Life Safety Code
NFPA 780	Standard for the Installation of Lightning Protection Systems
National Roofing Contractor's Association (NRCA)	
	Roofing and Waterproofing Manual
National Sanitation Foundation, International	
NSF/ANSI Std. 2, 3, 4, 5, 6, 7, 8, 12, 13, 18, 20, 21, 25, 29, 35, 36, 37, 51, 52, 59,	Food Equipment Standards

169	
ANSI/UL Std. 73, 197, 471, 621, 763	Food Equipment Standards
CSA Std. C22.2 No. 109, 120, 195	Food Equipment Standards
Occupational Safety and Health Administration (OSHA)	
Title 29, Part 1926	OSHA Construction Industry Standards, Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction
Plumbing and Drainage Institute (PDI)	
PDI G 101	Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data
PDI WH201	Water Hammer Arrestors
Precast Concrete Institute	
PCI Design Handbook	Precast and Prestressed Concrete
Sheet Metal and Air Conditioning Contractor’s National Association (SMACNA)	
SMACNA HVAC Duct Construction Standards	HVAC Duct Construction Standards - Metal and Flexible
SMACNA Architectural Manual	Architectural Sheet Metal Manual
SMACNA HVAC TAB	HVAC Systems - Testing, Adjusting and Balancing
State/Local Regulations	
	State Department of Transportation Standard Specifications for Highway and Bridge Construction
	Sedimentation and Erosion Control Design Requirements
	Environmental Control Requirements
	Storm Water Management Requirements
Steel Door Institute (SDI)	

ANSI A250.8/SDI 100	Standard Steel Doors and Frames
Steel Deck Institute	
	SDI Diaphragm Design Manual
Steel Joist Institute	
	Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders
Underwriters Laboratories (UL)	
UL 96A	Installation Requirements for Lightning Protection Systems
UL 300	Standard for Safety for Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas
UNITED STATES ACCESS BOARD: U.S. ARCHITECTURAL AND TRANSPORTATION BARRIERS COMPLIANCE BOARD	
ADA and ABA Accessibility Guidelines for Buildings and Facilities	ABA Accessibility Standard for DoD Facilities Derived from the ADA and ABA Accessibility Guidelines: Specifically includes: ABA Chapters 1 and 2 and Chapters 3 through 10. Use this reference in lieu of IBC Chapter 11. Excluded are: (a) Facilities, or portions of facilities, on a military installation that are designed and constructed for use exclusively by able-bodied military personnel (See Paragraph 3 for any reference to this exclusion). (b) Reserve and National Guard facilities, or portions of such facilities, owned by or under the control of the Department of Defense, that are designed and constructed for use exclusively by able-bodied military personnel. (See paragraph 3 for any reference to this exclusion).
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES	
	FDA National Food Code
U.S. GREEN BUILDING COUNCIL (USGBC)	
LEED-NC	Green Building Rating System for New Construction & Major Renovations
	Application Guide for Multiple Buildings and On-Campus Building Projects

4.2. MILITARY CRITERIA

The project shall conform to the following criteria. Certain design impacts and features due to these criteria are noted for the benefit of the offeror. However, all requirements of the referenced criteria will be applicable, whether noted or not, unless otherwise specified herein.

4.2.1. Energy Policy Act of 2005 (Public Law 109-58) (applies only to the extent specifically implemented in the contract, which may or may not directly cite or reference EPACT)

4.2.2. Executive Order 12770: Metric Usage In Federal Government

(a) Metric design and construction is required except when it increases construction cost. Offeror to determine most cost efficient system of measurement to be used for the project.

4.2.3. TB MED 530: Occupational and Environmental Health Food Sanitation

4.2.4. Unified Facilities Criteria (UFC) 3-410-01FA: Heating, Ventilating, and Air Conditioning - applicable only to the extent specified in paragraph 5, herein.

4.2.5. Deleted.

4.2.6. UFC 3-600-01 Design: Fire Protection Engineering for Facilities. Use the latest edition of the IBC in coordination with this UFC. Use Chapters 3, 6, 7, 33 and UFC 3-600-01. If any conflict occurs between these Chapters and UFC 3-600-01, the requirements of UFC 3-600-01 take precedence. Use UFC 3-600-01 in lieu of IBC Chapters 4, 8,9,10.

4.2.7. UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings

4.2.8. UFC 4-023-03 Design of Buildings to Resist Progressive Collapse (Use most recent version, regardless of references thereto in other publications)

(a) Note the option to use tie force method or alternate path design for Occupancy Category II.

4.2.9. UFC 4-021-01 Design and O&M: Mass Notification Systems

4.2.10. Technical Criteria for Installation Information Infrastructure Architecture (I3A)

(a) Email: DetrickISECI3Aguide@conus.army.mil

4.2.11. U.S. Army Information Systems Engineering Command (USAISEC) TG for the Integration of SECRET Internet Protocol (IP) Router Network (SIPRNET). See Paragraph 3 for applicability to specific facility type. May not apply to every facility. This is mandatory criteria for those facilities with SIPRNET.

5.0 GENERAL TECHNICAL REQUIREMENTS

This paragraph contains general technical requirements. See also Paragraph 3 for facility-specific technical requirements. Residential or similar grade finishes and materials are not acceptable for inclusion in these buildings, unless otherwise specifically allowed.

5.1. SITE PLANNING AND DESIGN

5.1.1. STANDARDS AND CODES: The site planning and design shall conform to APPLICABLE CRITERIA and to paragraph 6, PROJECT SPECIFIC REQUIREMENTS.

5.1.2. SITE PLANNING OBJECTIVES: Group buildings in configurations that create a sense of community and promote pedestrian use. See paragraph 3 for additional site planning requirements relating to building functions.

5.1.2.1. Provide enclosures and or visual screening devices for Outdoor Utility such as dumpsters, emergency generators, transformers, heating, ventilation, and air conditioning units from streetscape and courtyard views to limit visual impact. Enclosures shall be compatible with the building they serve and accessible by vehicle. The location of dumpsters can have a significant visual impact and should be addressed as part of an overall building design and incorporated in site planning.

5.1.2.2. Where included in the project, dumpster pads shall be concrete (minimum of 8 inches thick on 4 inch base course, unless site conditions dictate more conservative requirements) and directly accessible by way of a paved service drive or parking lot with adequate overhead clearance for collection vehicles. Provide space at dumpster areas for recycling receptacles. Coordinate with Installation on recycling receptacle types, sizes and access requirements and provide space at dumpster areas to accommodate them.

5.1.2.3. Vehicular Circulation. Apply design vehicle templates provided by the American Association of State Highway and Transportation Officials (AASHTO) to the site design. The passenger car class includes passenger cars and light trucks, such as vans and pick-ups. The passenger car template is equivalent to the non-organizational – privately owned vehicle (POV). The truck class template includes single-unit trucks, recreation vehicles, buses, truck tractor-semi-trailer combinations, and trucks or truck tractors with semi-trailers in combination with full trailers. Provide vehicle clearances required to meet traffic safety for emergency vehicles, service vehicles, and moving vans. Provide required traffic control signage Site entrances and site drive aisles shall maximize spacing between drives, incorporate right-angle turns, and limit points of conflict between traffic. Design Services Drives to restrict access to unauthorized vehicles by removable bollards, gates, or other barriers to meet Anti-Terrorism/Force Protection (ATFP) requirements. Orient service drives to building entrances other than the primary pedestrian entry at the front of the building.

5.1.2.4. Provide Emergency Vehicle Access around the facility and shall be in accordance with AT/FP requirements. Maintain a 33-foot clear zone buffer for emergency vehicles, designed to prevent other vehicles from entering the AT/FP standoff to the building.

5.1.2.5. Clear and grub all trees and vegetation necessary for construction; but, save as many trees as possible. Protect trees to be saved during the construction process from equipment.

5.1.2.6. Stormwater Management. Employ design and construction strategies (Best Management Practices) that reduce stormwater runoff, reduce discharges of polluted water offsite and maintain or restore predevelopment hydrology with respect to temperature, rate, volume and duration of flow to the maximum extent practicable. See paragraph 6, PROJECT SPECIFIC requirements for additional information.

5.1.3. EXTERIOR SIGNAGE: Provide exterior signage in accordance with Appendix H, Exterior Signage. Provide exterior NO SMOKING signage that conveys building and grounds smoking policy.

5.1.4. EXISTING UTILITIES: Base utilities maps and capacities for this site are included as part of this RFP. See paragraph 6 for more detailed information.

5.2. SITE ENGINEERING

5.2.1. STANDARDS AND CODES: The site engineering shall conform to APPLICABLE CRITERIA.

5.2.2. SOILS:

5.2.2.1. A report has been prepared to characterize the subsurface conditions at the project site and is **appended to these specifications.** The report provides a general overview of the soil and geologic conditions with detailed descriptions at discrete boring locations. The Contractor's team shall include a licensed geotechnical engineer to interpret the report and develop earthwork and foundation recommendations and design parameters in which to base the contractor's design. If any additional subsurface investigation or laboratory analysis is required to better characterize the site or develop the final design, the Contractor shall perform it under the direction of a licensed geotechnical engineer. There will be no separate payment for the cost of additional tests. If differences between the Contractor's additional subsurface investigation and the government provided soils report or the reasonably expected conditions require material revisions in the design, an equitable adjustment may be made, in accordance with the provisions of the Differing Site Conditions clause. The basis for the adjustment would be the design and construction appropriate for the conditions described in the Government furnished report or the reasonably expected conditions, in comparison with any changes required by material differences in the actual conditions encountered, in accordance with the terms of contract clause Differing Site Conditions.

5.2.2.2. The contractor's licensed geotechnical engineer shall prepare a final geotechnical evaluation report, to be submitted along with the first foundation design submittal, as described in Section 01 33 16, *Design After Award*.

5.2.3. VEHICLE PAVEMENTS: (as applicable to the project)

5.2.3.1. Design procedures and materials shall conform to one of the following: 1) the USACE Pavement Transportation Computer Assisted Structural Engineering (PCASE) program, 2) American Association of State Highway and Transportation Officials (AASHTO) or, 3) the applicable state Department of Transportation standards in which the project is located. See paragraph 5.2.2.2 and Section 01 33 16 for required information for the Contractor's geotechnical evaluation report. The minimum flexible pavement section shall consist of 2 inches of asphalt and 6 inches of base or as required by the pavement design, whichever is greater, unless specifically identified by the Government to be a gravel road. Design roads and parking areas for a life expectance of 25 years with normal maintenance. Parking area for tactical vehicles (as applicable to the project) shall be Portland Cement Concrete (PCC) rigid pavement design. For concrete pavements, submit joint layout plan for review and concurrence. Design pavements for military tracked vehicles (as applicable to the project) IAW USACE PCASE. Traffic estimates for each roadway area will be as shown on the drawings or listed in Section 01 10 00 Paragraph 6.4.4. Pavement markings and traffic signage shall comply with the Installation requirements and with the Manual on Uniform Traffic Control Devices.

5.2.3.2. Parking Requirements.

(a) All handicap POV parking lots (where applicable in the facility specific requirements) shall meet the ADA and ABA Accessibility Guidelines for accessible parking spaces.

(b) Design POV parking spaces for the type of vehicles anticipated, but shall be a minimum of 9 ft by 18 ft for POVs, except for two wheel vehicles.

5.2.3.3. Sidewalks. Design the network of walks throughout the complex (where applicable) to facilitate pedestrian traffic among facilities, and minimize the need to use vehicles. Incorporate sidewalks to enhance the appearance of the site development, while creating a sense of entry at the primary patron entrances to the buildings. Minimum sidewalk requirements are in Paragraph 3, where applicable.

5.2.4. CATHODIC PROTECTION: Provide cathodic protection systems for all underground metallic systems and metallic fittings/portions of non-metallic, underground systems, both inside and outside the building 5 foot line that are subject to corrosion. Coordinate final solutions with the installation to insure an approach that is consistent with installation cathodic protection programs.

5.2.5. UTILITIES: See paragraph 6.4.6 for specific information on ownership of utilities and utility requirements. Meter all utilities (gas, water, and electric, as applicable) to each facility. For Government owned utilities, install meters that are wireless data transmission capable as well as have a continuous manual reading option. All meters will be capable of at least hourly data logging and transmission and provide consumption data for gas, water, and electricity. Gas and electric meters will also provide demand readings based on consumption over a maximum of any 15 minute period. Configure all meters to transmit at least daily even if no receiver for the data is currently available at the time of project acceptance. For privatized utilities, coordinate with the privatization utility(ies) for the proper meter base and meter installation.

5.2.6. PERMITS: The CONTRACTOR shall be responsible for obtaining all permits (local, state and federal) required for design and construction of all site features and utilities.

5.2.7. IRRIGATION. Landscape irrigation systems, if provided, shall comply with the following:

5.2.7.1. Irrigation Potable Water Use Reduction. Reduce irrigation potable water use by 100 percent using LEED credit WE1.1 baseline (no potable water used for irrigation), except where precluded by other project requirements.

5.2.8. EPA WaterSense Products and Contractors. Except where precluded by other project requirements, use EPA WaterSense labeled products and irrigation contractors that are certified through a WaterSense labeled program where available.

5.3. ARCHITECTURE AND INTERIOR DESIGN:

This element will be evaluated per APPLICABLE CRITERIA under the quality focus.

5.3.1. STANDARDS AND CODES: The architecture and interior design shall conform to APPLICABLE CRITERIA.

5.3.2. GENERAL: Overall architectural goal is to provide a functional, quality, visually appealing facility that is a source of pride for the installation and delivered within the available budget and schedule.

5.3.3. COMPUTATION OF AREAS: See APPENDIX Q for how to compute gross and net areas of the facility(ies).

5.3.4. BUILDING EXTERIOR: Design buildings to enhance or compliment the visual environment of the Installation. Where appropriate, reflect a human scale to the facility. Building entrance should be architecturally defined and easily seen. When practical, exterior materials, roof forms, and detailing shall be compatible with the surrounding development and adjacent buildings on the Installation and follow locally established architectural themes. Use durable materials that are easy to maintain. Exterior colors shall conform to the Installation requirements. See paragraph 6.

5.3.4.1. Building Numbers: Each building shall have exterior signage permanently attached on two faces of the building indicating the assigned building number or address. Building number signage details and locations shall conform to Appendix H, Exterior Signage.

5.3.5. BUILDING INTERIOR

5.3.5.1. Space Configuration: Arrange spaces in an efficient and functional manner in accordance with area adjacency matrices.

5.3.5.2. Surfaces: Appearance retention is the top priority for building and furniture related finishes. Provide low maintenance, easily cleaned room finishes that are commercially standard for the facility occupancy specified, unless noted otherwise.

5.3.5.3. Color: The color, texture and pattern selections for the finishes of the building shall provide an aesthetically pleasing, comfortable, easily maintainable and functional environment for the occupants. Coordination of the building colors and finishes is necessary for a cohesive design. Color selections shall be appropriate for the building type. The use of color, texture and pattern shall be used to path or way find through the building. Trendy colors that will become dated shall be limited to non-permanent finishes such as carpet and paint. Finishes should be selected with regards to aesthetics, maintenance, durability, life safety and image. Limit the number of similar colors for each material. Color of Ceramic and porcelain tile grout shall be medium range color to help hide soiling. Plastic laminate and solid surface materials shall have patterns that are mottled, flecked or speckled. Finish colors of fire extinguisher cabinets, receptacle bodies and plates, fire alarms / warning lights, emergency lighting, and other miscellaneous items shall be coordinated with the building interior. Color of equipment items on ceilings (speakers, smoke detectors, grills, etc.) shall match the ceiling color.

5.3.5.4. Circulation: Circulation schemes must support easy way finding within the building.

5.3.5.5. Signage: Provide interior signage for overall way finding and life safety requirements. A comprehensive interior plan shall be from one manufacturer. Include the following sign types: (1) Lobby Directory, (2) Directional Signs; (3) Room Identification Signs; (4) Building Service Signs; (5) Regulatory Signs; (6) Official and Unofficial Signs (7) Visual Communication Boards (8) NO SMOKING signage that conveys building smoking policy. Use of emblems or logos may also be incorporated into the signage plan.

5.3.5.6. Window Treatment: Interior window treatments with adjustable control shall be provided in all exterior window locations for control of day light coming in windows or privacy at night. Uniformity of treatment color and material shall be maintained to the maximum extent possible within a building.

5.3.6. COMPREHENSIVE INTERIOR DESIGN

5.3.6.1. Comprehensive Interior Design includes the integration of a Structural Interior Design (SID) and a Furniture, Fixtures and Equipment (FF&E) design and package. SID requires the design, selection and coordination of interior finish materials that are integral to or attached to the building structure. Completion of a SID involves the selection and specification of applied finishes for the building's interior features including, but not limited to, walls, floors, ceilings, trims, doors, windows, window treatments, built-in furnishings and installed equipment, lighting, and signage. The SID package includes finish schedules, finish samples and any supporting interior elevations, details or plans necessary to communicate the building finish design and build out. The SID also provides basic space planning for the anticipated FF&E requirements in conjunction with the functional layout of the building and design issues such as life safety, privacy, acoustics, lighting, ventilation, and accessibility. See Section 01 33 16 for SID design procedures.

The FF&E design and package includes the design, selection, color coordination and of the required furnishing items necessary to meet the functional, operational, sustainability, and aesthetic needs of the facility coordinated with the interior finish materials in the SID. The FF&E package includes the specification, procurement documentation, placement plans, ordering and finish information on all freestanding furnishings and accessories, and a cost estimate. Coordinate the selection of furniture style, function and configuration with the defined requirements. Examples of FF&E items include, but are not limited to workstations, seating, files, tables, beds, wardrobes, draperies and accessories as well as marker boards, tack boards, and presentation screens. Criteria for furniture selection include function and ergonomics, maintenance, durability, sustainability, comfort and cost. See Section 01 33 16 for FFE design procedures.

5.4. STRUCTURAL DESIGN

5.4.1. STANDARDS AND CODES: The structural design shall conform to APPLICABLE CRITERIA.

5.4.2. GENERAL: The structural system needs to be compatible with the intended functions and components that allows for future flexibility and reconfigurations of the interior space. Select an economical structural system based upon facility size, projected load requirements and local availability of materials and labor. Base the structural design on accurate, site specific geotechnical information and anticipated loads for the building types and geographical location. Consider climate conditions, high humidity, industrial atmosphere, saltwater exposure, or other adverse conditions when selecting the type of cement and admixtures used in concrete, the concrete cover on reinforcing steel, the coatings on structural members, expansion joints, the level of corrosion protection, and the structural systems. Analyze, design and detail each building as a complete structural system. Design structural elements to preclude damage to finishes, partitions and other frangible, non-structural elements to prevent impaired operability of moveable components; and to prevent cladding leakage and roof ponding. Limit deflections of structural members to the allowable of the applicable material standard, e.g., ACI, AISC, Brick Industry Association, etc. When modular units or other pre-fabricated construction is used or combined with stick-built construction, fully coordinate and integrate the overall structural design between the two different or interfacing construction types. If the state that the project is located in requires separate, specific licensing for structural engineers (for instance, such as in Florida, California and others), then the structural engineer designer of record must be registered in that state.

5.4.3. LOADS: See paragraph 3 for facility specific (if applicable) and paragraph 6 for site and project specific structural loading criteria. Unless otherwise specified in paragraph 6, use Exposure Category C for wind. If not specified, use Category C unless the Designer of Record can satisfactorily justify another Exposure Category in its design analysis based on the facility Master Plan. Submit such exceptions for approval as early as possible and prior to the Interim Design Submittal in Section “Design After Award”. In addition to gravity, seismic and lateral loads, design the ancillary building items, e.g. doors, window jambs and connections, overhead architectural features, equipment bracing, for the requirements of UFC 4-010-01, DOD Minimum Antiterrorism Standards for Buildings. Ensure and document that the design of glazed items includes, but is not limited to, the following items under the design loads prescribed in UFC 4-010-01:

(a) Supporting members of glazed elements, e.g. window jamb, sill, header

(b) Connections of glazed element to supporting members, e.g. window to header

(c) Connections of supporting members to each other, e.g. header to jamb

(d) Connections of supporting members to structural system, e.g. jamb to foundation.

5.4.4. TERMITE TREATMENT: (Except Alaska) Provide termite prevention treatment in accordance with Installation and local building code requirements, using licensed chemicals and licensed applicator firm.

5.5. THERMAL PERFORMANCE

5.5.1. STANDARDS AND CODES: Building construction and thermal insulation for mechanical systems shall conform to APPLICABLE CRITERIA.

5.5.2. BUILDING ENVELOPE SEALING PERFORMANCE REQUIREMENT. Design and construct the building envelope for office buildings, office portions of mixed office and open space (e.g., company operations facilities), dining, barracks and instructional/training facilities with a continuous air barrier to control air leakage into, or out of, the conditioned space. Clearly identify all air barrier components of each envelope assembly on construction documents and detail the joints, interconnections and penetrations of the air barrier components. Clearly identify the boundary limits of the building air barriers, and of the zone or zones to be tested for building air tightness on the drawings.

5.5.2.1. Trace a continuous plane of air-tightness throughout the building envelope and make flexible and seal all moving joints.

5.5.2.2. The air barrier material(s) must have an air permeance not to exceed 0.004 cfm / sf at 0.3” wg (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178

5.5.2.3. Join and seal the air barrier material of each assembly in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of these assemblies and components.

5.5.2.4. Support the air barrier so as to withstand the maximum positive and negative air pressure to be placed on the building without displacement, or damage, and transfer the load to the structure.

5.5.2.5. Seal all penetrations of the air barrier. If any unavoidable penetrations of the air barrier by electrical boxes, plumbing fixture boxes, and other assemblies are not airtight, make them airtight by sealing the assembly and the interface between the assembly and the air barrier or by extending the air barrier over the assembly.

5.5.2.6. The air barrier must be durable to last the anticipated service life of the assembly.

5.5.2.7. Do not install lighting fixtures with ventilation holes through the air barrier

5.5.2.8. Provide a motorized damper in the closed position and connected to the fire alarm system to open on call and fail in the open position for any fixed open louvers such as at elevator shafts.

5.5.2.9. Damper and control to close all ventilation or make-up air intakes and exhausts, atrium smoke exhausts and intakes, etc when leakage can occur during inactive periods.

5.5.2.10. Compartmentalize garages under buildings by providing air-tight vestibules at building access points.

5.5.2.11. Compartmentalize spaces under negative pressure such as boiler rooms and provide make-up air for combustion.

5.5.2.12. Performance Criteria and Substantiation: Submit the qualifications and experience of the testing entity for approval. Demonstrate performance of the continuous air barrier for the opaque building envelope by the following tests:

(a) Test the completed building and demonstrate that the air leakage rate of the building envelope does not exceed 0.25cfm/ft2 at a pressure differential of 0.3" w.g.(75 Pa) in accordance with ASTM's E 779 (2003) or E-1827-96 (2002). Accomplish tests using either pressurization or depressurization or both. Divide the volume of air leakage in cfm @ 0.3" w.g. (L/s @ 75 Pa) by the area of the pressure boundary of the building, including roof or ceiling, walls and floor to produce the air leakage rate in cfm/ft2 @ 0.3" w.g. (L/s.m2 @ 75 Pa). Do not test the building until verifying that the continuous air barrier is in place and installed without failures in accordance with installation instructions so that repairs to the continuous air barrier, if needed to comply with the required air leakage rate, can be done in a timely manner.

(b) Test the completed building using Infrared Thermography testing. Use infrared cameras with a resolution of 0.1deg C or better. Perform testing on the building envelope in accordance with ISO 6781:1983 and ASTM C1060-90(1997). Determine air leakage pathways using ASTM E 1186-03 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems, and perform corrective work as necessary to achieve the whole building air leakage rate specified in (a) above.

(c) Notify the Government at least three working days prior to the tests to provide the Government the opportunity to witness the tests. Provide the Government written test results confirming the results of all tests.

5.6. PLUMBING

5.6.1. STANDARDS AND CODES: The plumbing system shall conform to APPLICABLE CRITERIA.

5.6.2. PRECAUTIONS FOR EXPANSIVE SOILS: Where expansive soils are present, the design for underslab piping systems and underground piping serving chillers, cooling towers, etc, shall include features to control forces resulting from soil heave. Some possible solutions include, but are not necessarily limited to, features such as flexible expansion joints, slip joints, horizontal offsets with ball joints, or multiple bell and spigot gasketed fittings. For structurally supported slabs, piping should be suspended from the structure with adequate space provided below the pipe for the anticipated soil movement.

5.6.3. HOT WATER SYSTEMS: For Hot Water heating and supply, provide a minimum temp of 140 Deg F in the storage tank and a maximum of 110 Deg F at the fixture, unless specific appliances or equipment specifically require higher temperature water supply.

5.6.4. SIZING HOT WATER SYSTEMS: Unless otherwise specified or directed in paragraph 3, design in accordance with ASHRAE Handbook Series (appropriate Chapters), ASHRAE Standard 90.1, and the energy conservation requirements of the contract. Size and place equipment so that it is easily accessible and removable for repair or replacement.

5.6.5. JANITOR CLOSETS: In janitor spaces/room/closets, provide at minimum, a service sink with heavy duty shelf and wall hung mop and broom rack(s).

5.6.6. FLOOR DRAINS: As a minimum, provide floor drains in mechanical rooms and areas, janitor spaces/rooms/closets and any other area that requires drainage from fixtures or equipment, drain downs, condensate, as necessary.

5.6.7. URINALS: Urinals shall be vitreous china, wall-mounted, wall outlet, non-water using, with integral drain line connection, and with sealed replaceable cartridge or integral liquid seal trap. Either type shall use a biodegradable liquid to provide the seal and maintain a sanitary and odor-free environment. Install, test and maintain in accordance with manufacturer's recommendations. Slope the sanitary sewer branch line for non-water use urinals a minimum of 1/4 inch per foot. Do not use copper tube or pipe for drain lines that connect to the urinal. Manufacturer shall provide an operating manual and on-site training to installation operations personnel for the proper care and maintenance of the urinal. For complexes, non-water using urinals are not required for barracks type spaces.

5.6.8. BUILDING WATER USE REDUCTION. Reduce building potable water use in each building 30 percent using IPC fixture performance requirements baseline.

5.6.9. Do not use engineered vent or Sovent® type drainage systems.

5.6.10. Where the seasonal design temperature of the cold water entering a building is below the seasonal design dew point of the indoor ambient air, and where condensate drip will cause damage or create a hazard, insulate plumbing piping with a vapor barrier type of insulation to prevent condensation. Do not locate water or drainage piping over electrical wiring or equipment unless adequate protection against water (including condensation) damage is provided. Insulation alone is not adequate protection against condensation. Follow ASHRAE Fundamentals Chapter 23, Insulation for Mechanical Systems, IMC paragraph 1107 and International Energy Conservation Code for pipe insulation requirements.

5.7. ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

5.7.1. STANDARDS AND CODES: The electrical systems for all facilities shall conform to APPLICABLE CRITERIA.

5.7.2. MATERIALS AND EQUIPMENT: Materials, equipment and devices shall, as a minimum, meet the requirements of Underwriters Laboratories (UL) where UL standards are established for those items. Wiring for branch circuits shall be copper. Motors larger than one-half horsepower shall be three phase. All electrical systems shall be pre-wired and fully operational unless otherwise indicated. Wall mounted electrical devices (power receptacles, communication outlets and CATV outlets) shall have matching colors, mounting heights and faceplates.

5.7.3. POWER SERVICE: Primary service from the base electrical distribution system to the pad-mounted transformer and secondary service from the transformer to the building service electrical equipment room shall be underground. See paragraph 6 for additional site electrical requirements.

5.7.3.1. Spare Capacity: Provide 10% space for future circuit breakers in all panelboards serving residential areas of buildings and 15% spaces in all other panelboards.

5.7.4. TELECOMMUNICATION SERVICE: The project's facilities must connect to the Installation telecommunications (voice and data) system through the outside plant (OSP) telecommunications underground infrastructure cabling system per the I3A Criteria. Connect to the OSP cabling system from each facility main cross connect located in the telecommunications room.

5.7.5. LIGHTING: Comply with the recommendations of the Illumination Engineering Society of North America (IESNA), the National Energy Policy Act and Energy Star requirements for lighting products..

5.7.5.1. Interior Lighting:

(a) Reflective Surfaces: Coordinate interior architectural space surfaces and colors with the lighting systems to provide the most energy-efficient workable combinations.

(b) High Efficiency Fluorescent Lighting: Utilize NEMA premium electronic ballasts and energy efficient fluorescent lamps with a Correlated Color Temperature (CCT) of 4100K. Linear fluorescent and compact fluorescent fixtures shall have a Color Rendering Index of (CRI) of 87 or higher. Fluorescent lamps shall be the low mercury type qualifying as non-hazardous waste upon disposal. Do not use surface mounted fixtures on acoustical tile ceilings. Provide an un-switched fixture with emergency ballast shall be provided at each entrance to the building.

(c) Solid State Lighting: Fixtures shall provide lighting with a minimum Correlated Color Temperature (CCT) of 4100K and shall have a Color Rendering Index of (CRI) of 75 or higher. Verify performance of the light producing solid state components by a test report in compliance with the requirements of IESNA LM 80. Verify performance of the solid state light fixtures by a test report in compliance with the requirements of IESNA LM 79. Provide lab results by a NVLAP certified laboratory. The light producing solid state components and drivers shall have a life expectancy of 50,000 operating hours while maintaining at least 70% of original illumination level. Provide a complete five year warranty for fixtures.

(d) Metal Halide Lighting (where applicable): Metal Halide lamp fixtures in the range of 150-500 Watts shall be pulse start type and have a minimum efficiency rating of 88%.

(e) Lighting Controls: ANSI/ASHRAE/IESNA 90.1 has specific lighting controls requirements. Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (classrooms, conference rooms) to promote the productivity, comfort and well being of the building occupants. In office spaces, the preferred lighting should be a 30 FC ambient lighting level with occupancy sensor controlled task lighting in the work spaces to provide a composite lighting level of 50 FC on the working surfaces. Consider incorporating daylighting techniques for the benefit of reducing lighting energy requirements while improving the quality of the indoor spaces. If daylight strategies are used, additional coordination is required with the architect and mechanical engineer. Additionally, incorporate electric lighting controls to take advantage of the potential energy savings.

(f) Exterior Lighting: See paragraph 6.9 for site specific information, if any, on exterior lighting systems. Minimize light pollution and light trespass by not over lighting and use <u>cutoff type</u> exterior luminaries.

5.7.6. TELECOMMUNICATION SYSTEM: All building telecommunications cabling systems (BCS) and OSP telecommunications cabling system shall conform to APPLICABLE CRITERIA to include I3A Technical Criteria. An acceptable BCS encompasses, but is not limited to, copper and fiber optic (FO) entrance cable, termination equipment, copper and fiber backbone cable, copper and fiber horizontal distribution cable, workstation outlets, racks, cable management, patch panels, cable tray, cable ladder, conduits, grounding, and labeling.. Items included under OSP infrastructure encompass, but are not limited to, manhole and duct infrastructure, copper cable, fiber optic cable, cross connects, terminations, cable vaults, and copper and FO entrance cable.

5.7.6.1. Design, install, label and test all telecommunications systems in accordance with the I3A Criteria and ANSI/TIA/EIA 568, 569, and 606 standards. A Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) with at least 2 yrs related experience shall develop and stamp telecommunications design, and prepare the test plan. See paragraph 5.8.2.5 for design of environmental systems for Telecommunications Rooms.

5.7.6.2. The installers assigned to the installation of the telecommunications system or any of its components shall be regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. Key personnel; i.e., supervisors and lead installers assigned to the installation of this system or any of its components shall be BICSI Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel. In lieu of BICSI certification, supervisors and installers shall have a minimum of 5 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

5.7.6.3. Perform a comprehensive end to end test of all circuits to include all copper and fiber optic cables upon completion of the BCS and prior to acceptance of the facility. The BCS circuits include but are not limited to all copper and fiber optic(FO) entrance cables, termination equipment, copper and fiber backbone cable, copper and fiber horizontal distribution cable, and workstation outlets. Test in accordance with ANSI/EIA/TIA 568 standards. Use test instrumentation that meets or exceeds the standard. Submit the official test report to include test procedures, parameters tested, values, discrepancies and corrective actions in electronic format. Test and accomplish all necessary corrective actions to ensure that the government receives a fully operational, standards based, code compliant telecommunications system.

5.7.7. LIGHTNING PROTECTION SYSTEM: Provide a lightning protection system where recommended by the Lightning Risk Assessment of NFPA 780, Annex L.

5.8. HEATING, VENTILATING, AND AIR CONDITIONING

5.8.1. STANDARDS AND CODES: The HVAC system shall conform to APPLICABLE CRITERIA.

5.8.2. DESIGN CONDITIONS.

5.8.2.1. Outdoor and indoor design conditions shall be in accordance with UFC 3-410-01FA. Outdoor air and exhaust ventilation requirements for indoor air quality shall be in accordance with ASHRAE 62.1. All Buildings with minimum LEED Silver requirement (or better) will earn LEED Credit EQ 7.1, Thermal Comfort-Design.

5.8.2.2. Design systems in geographical areas that meet the definition for high humidity in UFC 3-410-01FA in accordance with the special criteria for humid areas therein.

5.8.2.3. Cooling equipment may be oversized by up to 15 percent to account for recovery from night setforward. Heating equipment may be oversized by up to 30 percent to account for recovery from night setback. Design single zone systems and multi-zone systems to maintain an indoor design condition of 50% relative humidity for cooling only. For heating only where the indoor relative humidity is expected to fall below 20% for extended periods, add humidification to increase the indoor relative humidity to 30%. Provide ventilation air from a separate dedicated air handling unit (DOAU) for facilities using multiple single zone fan-coil type HVAC systems. Do not condition outside air through fan coil units. Avoid the use of direct expansion cooling coils in air handling units with constant running fans that handle outside air.

5.8.2.4. Locate all equipment so that service, adjustment and replacement of controls or internal components are readily accessible for easy maintenance.

5.8.2.5. Environmental Requirements for Telecommunications Rooms,(including SIPRNET ROOMS, where applicable for specific facility type). Comply with ANSI/EIA/TIA 569 and the I3A.

5.8.2.6. Fire dampers: dynamic type with a dynamic rating suitable for the maximum air velocity and pressure differential to which the damper is subjected. Test each fire damper with the air handling and distribution system running.

5.8.3. BUILDING AUTOMATION SYSTEM. Provide a Building Automation System consisting of a building control network , and integrate the building control network into the UMCS as specified.

The building control network shall be a single complete non-proprietary Direct Digital Control (DDC) system for control of the heating, ventilating and air conditioning (HVAC) systems as specified herein. The building control network shall be an Open implementation of LONWORKS® technology using ANSI/EIA 709.1B as the only communications protocol and use only LonMark Standard Network Variable Types (SNVTs), as defined in the LonMark® Resource Files, for communication between DDC Hardware devices to allow multi-vendor interoperability.

5.8.3.1. The building automation system shall be open in that it is designed and installed such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without further dependence on the original Contractor. This includes, but is not limited to the following:

(a) Install hardware such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.

(b) Necessary documentation (including rights to documentation and data), configuration information, configuration tools, programs, drivers, and other software shall be licensed to and otherwise remain with the Government such that the Government or its agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

5.8.3.2. All DDC Hardware shall:

(a) Be connected to a TP/FT-10 ANSI/EIA 709.3 control network.

(b) Communicate over the control network via ANSI/EIA 709.1B exclusively.

(c) Communicate with other DDC hardware using only SNVTs

(d) Conform to the LonMark® Interoperability Guidelines.

(e) Be locally powered; link power (over the control network) is not acceptable.

(f) Be fully configurable via standard or user-defined configuration parameter types (SCPT or UCPT), standard network variable type (SNVT) network configuration inputs (*nci*), or hardware settings on the controller itself to support the application. All settings and parameters used by the application shall be configurable via standard or user-defined configuration parameter types (SCPT or UCPT), standard network variable type (SNVT) network configuration inputs (*nci*), or hardware settings on the controller itself

(g) Provide input and output SNVTs required to support monitoring and control (including but not limited to scheduling, alarming, trending and overrides) of the application. Required SNVTs include but are not limited to: SNVT outputs for all hardware I/O, SNVT outputs for all setpoints and SNVT inputs for override of setpoints.

(h) To the greatest extent practical, not rely on the control network to perform the application..

5.8.3.3. Controllers shall be Application Specific Controllers whenever an ASC suitable for the application exists. When an ASC suitable for the application does not exist use programmable controllers or multiple application specific controllers.

5.8.3.4. Application Specific Controllers shall be LonMark Certified whenever a LonMark Certified ASC suitable for the application exists. For example, VAV controllers must be LonMark certified.

5.8.3.5. Application Specific Controllers (ASCs) shall be configurable via an LNS plug-in whenever t an ASC with an LNS plug-in suitable for the application exists.

5.8.3.6. Each scheduled system shall accept a network variable of type SNVT_occupancy and shall use this network variable to determine the occupancy mode. If the system has not received a value to this network variable for more than 60 minutes it shall default to a configured occupancy schedule.

5.8.3.7. Gateways may be used provided that each gateway communicates with and performs protocol translation for control hardware controlling one and only one package unit.

5.8.3.8. Not Used

5.8.3.9. Perform all necessary actions needed to fully integrate the building control system. These actions include but are not limited to:

- Configure M&C Software functionality including: graphical pages for System Graphic Displays including overrides, alarm handling, scheduling, trends for critical values needing long-term or permanent monitoring via trends, and demand limiting.
- Install IP routers or ANSI/CEA-852 routers as needed to connect the building control network to the UMCS IP network. Routers shall be capable of configuration via DHCP and use of an ANSI/CEA-852 configuration server but shall not rely on these services for configuration. All communication between the UMCS and building networks shall be via the ANSI/CEA-709.1B protocol over the IP network in accordance with ANSI/CEA-852.

5.8.3.10. Provide the following to the Government for review prior to acceptance of the system:

- The latest version of all software and user manuals required to program, configure and operate the system.
- Points Schedule drawing that shows every DDC Hardware device. The Points Schedule shall contain the following information as a minimum:
    - Device address and NodeID.
    - Input and Output SNVTs including SNVT Name, Type and Description.
    - Hardware I/O, including Type (AI, AO, BI, BO) and Description.
    - Alarm information including alarm limits and SNVT information.
    - Supervisory control information including SNVTs for trending and overrides.
    - Configuration parameters (for devices without LNS plug-ins) Example Points Schedules are available at https://eko.usace.army.mil/fa/besc/
- Riser diagram of the network showing all network cabling and hardware. Label hardware with ANSI.CEA-709.1 addresses, IP addresses, and network names.
- Control System Schematic diagram and Sequence of Operation for each HVAC system.
- Operation and Maintenance Instructions including procedures for system start-up, operation and shut-down, a routine maintenance checklist, and a qualified service organization list.
- LONWORKS® Network Services (LNS®) database for the completed system.
- Quality Control (QC) checklist (below) completed by the Contractor's Chief Quality Control (QC) Representative

Table 5-1: QC Checklist

Instructions: Initial each item, sign and date verifying that the requirements have been met.		
#	Description	Initials
1	All DDC Hardware is installed on a TP/FT-10 local control bus.	
2	Communication between DDC Hardware is only via EIA 709.1B using SNVTs. Other protocols and network variables other than SNVTs have not been used.	
3	All sequences are performed using DDC Hardware.	
4	LNS Database is up-to-date and accurately represents the final installed system	
5	All software has been licensed to the Government	
6	M&C software monitoring displays have been created for all building systems, including all override and display points indicated on Points Schedule drawings.	
7	Final As-built Drawings accurately represent the final installed system.	
8	O&M Instructions have been completed and submitted.	
9	Connections between the UMCS IP network and ANSI/CEA-709.1B building networks are through ANSI/CEA-852 Routers.	
By signing below I verify that all requirements of the contract, including but not limited to the above, been met.		
Signature:____________________________ Date:______________		

5.8.3.11. Perform a Performance Verification Test (PVT) under Government supervision prior to system acceptance. During the PVT demonstrate that the system performs as specified, including but not limited to demonstrating that the system is Open and correctly performs the Sequences of Operation.

5.8.3.12. Provide a 1 year unconditional warranty on the installed system and on all service call work. The warranty shall include labor and material necessary to restore the equipment involved in the initial service call to a fully operable condition.

5.8.3.13. Provide training at the project site on the installed building system Upon completion of this training each student, using appropriate documentation, should be able to start the system, operate the system, recover the system after a failure, perform routine maintenance and describe the specific hardware, architecture and operation of the system.

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5.8.4. TESTING, ADJUSTING AND BALANCING. Test and balance air and hydronic systems, using a firm certified for testing and balancing by the Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or the Testing Adjusting, and Balancing Bureau (TABB). The prime contractor shall hire the TAB firm directly, not through a subcontractor. Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB TABES, or SMACNA HVACTAB unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard shall be considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practicable to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB Standard, the TAB Specialist shall develop TAB procedures. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements are mandatory.

5.8.5. COMMISSIONING: Commission all HVAC systems and equipment, including controls, and all systems requiring commissioning for LEED Enhanced commissioning, in accordance with ASHRAE Guideline 1.1, ASHRAE Guideline 0 and LEED. Do not use the sampling techniques discussed in ASHRAE Guideline 1.1 and in ASHRAE Guideline 0. Commission 100% of the HVAC controls and equipment. Hire the Commissioning Authority (CA), certified as a CA by AABC, NEBB, or TABB, as described in Guideline 1.1. The CA will be an independent subcontractor and not an employee of the Contractor nor an employee or subcontractor of any other subcontractor on this project, including the design professionals (i.e., the DOR or their firm(s)). The CA will communicate and report directly to the Government in execution of commissioning activities. The Contracting Officer's Representative will act as the Owner's representative in performance of duties spelled out under OWNER in Annex F of ASHRAE Guideline 0. All buildings with Minimum LEED Silver (or better) requirement will earn LEED Credit EA3 Enhanced Commissioning.

5.9. ENERGY CONSERVATION

5.9.1. The building including the building envelope, HVAC systems, service water heating, power, and lighting systems shall meet the Mandatory Provisions and the Prescriptive Path requirements of ASHRAE 90.1. Substantiation requirements are defined in Section 01 33 16, Design After Award.

5.9.2. Design all building systems and elements to meet the minimum requirements of ANSI/ASHRAE/IESNA 90.1. Design the buildings, including the building envelope, HVAC systems, service water heating, power, and lighting systems to achieve an energy consumption that is at least 40% below the consumption of a baseline building meeting the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1. Energy calculation methodologies and substantiation requirements are defined in Section 01 33 16, Design After Award.

5.9.3. Purchase Energy Star products, except use FEMP designated products where FEMP is applicable to the type product. The term "Energy Star product" means a product that is rated for energy efficiency under an Energy Star program. The term "FEMP designated product" means a product that is designated under the Federal Energy Management Program of the Department of Energy as being among the highest 25 percent of equivalent products for energy efficiency. When selecting integral sized electric motors, choose NEMA PREMIUM type motors that conform to NEMA MG 1, minimum Class F insulation system. Motors with efficiencies lower than the NEMA PREMIUM standard may only be used in unique applications that require a high constant torque speed ratio (e.g., inverter duty or vector duty type motors that conform to NEMA MG 1, Part 30 or Part 31).

5.9.4. Solar Hot Water Heating. Provide at least 30% of the domestic hot water requirements through solar heating methodologies, unless the results of a Life Cycle Cost Analysis (LCCA) developed utilizing the Building Life Cycle Cost Program (BLCC) which demonstrates that the solar hot water system is not life cycle cost effective in comparison with other hot water heating systems. The type of system will be established during the contract or task order competition and award phase, including submission of an LCCA for government evaluation to justify non-selection of solar hot water heating. The LCCA uses a study period of 25 years and the Appendix K utility cost information. The LCCA shall include life cycle cost comparisons to a baseline system to provide domestic hot water without solar components, analyzing at least three different methodologies for providing solar hot water to compare against the baseline system.

5.9.5. Process Water Conservation. When potable water is used to improve a building's energy efficiency, employ lifecycle cost effective water conservation measures, except where precluded by other project requirements.

5.9.6. Renewable Energy Features. The Government's goal is to implement on-site renewable energy generation for Government use when lifecycle cost effective. See Paragraph 6, PROJECT SPECIFIC REQUIREMENTS for renewable energy requirements for this project.

5.10. FIRE PROTECTION

5.10.1. STANDARDS AND CODES Provide the fire protection system conforming to APPLICABLE CRITERIA.

5.10.2. Inspect and test all fire suppression equipment and systems, fire pumps, fire alarm and detection systems and mass notification systems in accordance with the applicable NFPA standards. The fire protection engineer of record shall witness final tests. The fire protection engineer of record shall certify that the equipment and systems are fully operational and meet the contract requirements. Two weeks prior to each final test, the contractor shall notify, in writing, the installation fire department and the installation public work representative of the test and invite them to witness the test.

5.10.3. Fire Extinguisher Cabinets: Provide fire extinguisher cabinets and locations for hanging portable fire extinguishers in accordance with NFPA 10 Standard for Portable Fire Extinguishers.

5.10.4. Fire alarm and detection system: Required fire alarm and detection systems shall be the addressable type. Fire alarm initiating devices, such as smoke detectors, heat detectors and manual pull stations shall be addressable. When the system is in alarm condition, the system shall annunciate the type and location of each alarm initiating device. Sprinkler water flow alarms shall be zoned by building and by floor. Supervisory alarm initiating devices, such as valve supervisory switches, fire pump running alarm, low-air pressure on dry sprinkler system, etc. shall be zoned by type and by room location.

5.10.5. Fire Protection Engineer Qualifications: In accordance with UFC 3-600-01, FIRE PROTECTION ENGINEERING FOR FACILITIES, the fire protection engineer of record shall be a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCEES), or a registered P.E. in a related engineering discipline with a minimum of 5 years experience, dedicated to fire protection engineering that can be verified with documentation.

5.11. SUSTAINABLE DESIGN

5.11.1. STANDARDS AND CODES: Sustainable design shall conform to APPLICABLE CRITERIA. See paragraph 6, PROJECT-SPECIFIC REQUIREMENTS for which version of LEED applies to this project. The LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects (AGMBC) applies to all projects. Averaging may be used for LEED compliance as permitted by the AGMBC but is restricted to only those buildings included in this project. Each building must individually comply with the requirements of paragraphs ENERGY CONSERVATION and BUILDING WATER USE REDUCTION.

5.11.2. LEED RATING, REGISTRATION, VALIDATION AND CERTIFICATION: See Paragraph PROJECT-SPECIFIC REQUIREMENTS for project minimum LEED rating/achievement level, for facilities that are exempt from the minimum LEED rating, for LEED registration and LEED certification requirements and for other project-specific information and requirements.

5.11.2.1. Innovation and Design Credits. LEED Innovation and Design (ID) credits are acceptable only if they are supported by formal written approval by GBCI (either published in USGBC Innovation and Design Credit Catalog or accompanied by a formal ruling from GBCI). LEED ID credits that require any Owner actions or commitments are acceptable only when Owner commitment is indicated in paragraph PROJECT-SPECIFIC REQUIREMENTS or Appendix LEED Project Credit Guidance

5.11.3. OPTIMIZE ENERGY PERFORMANCE. : Project must earn, as a minimum, the points associated with compliance with paragraph ENERGY CONSERVATION. LEED documentation differs from documentation requirements for paragraph ENERGY CONSERVATION and both must be provided. For LEED-NC v2.2 projects you may substitute ASHRAE 90.1 2007 Appendix G in its entirety for ASHRAE 90.1 2004 in accordance with USGBC Credit Interpretation Ruling dated 4/23/2008.

5.11.4. COMMISSIONING. See paragraph 5.8.5 COMMISSIONING for commissioning requirements. USACE templates for the required Basis of Design document and Commissioning Plan documents are available at http://en.sas.usace.army.mil (click on Engineering Criteria) and may be used at Contractor's option.

5.11.5. DAYLIGHTING. Except where precluded by other project requirements, do the following in at least 75 percent of all spaces occupied for critical visual tasks: achieve a 2 percent glazing factor (calculated in accordance with LEED credit EQ8.1) OR earn LEED Daylighting credit, provide appropriate glare control and provide either automatic dimming controls or occupant-accessible manual lighting controls.

5.11.6. LOW-EMITTING MATERIALS. Except where precluded by other project requirements, use materials with low pollutant emissions, including but not limited to composite wood products, adhesives, sealants, interior paints and finishes, carpet systems and furnishings,

5.11.7. CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT. Except where precluded by other project requirements, earn LEED credit EQ 3.1 Construction IAQ Management Plan, During Construction and credit EQ 3.2 Construction IAQ Management Plan, Before Occupancy.

5.11.8. RECYCLED CONTENT. In addition to complying with section RECYCLED/RECOVERED MATERIALS, earn LEED credit MR4.1, Recycled Content, 10 percent except where precluded by other project requirements.

5.11.9. BIOBASED AND ENVIRONMENTALLY PREFERABLE PRODUCTS. Except where precluded by other project requirements, use materials with biobased content, materials with rapidly renewable content, FSC certified wood products and products that have a lesser or reduced effect on human health and the environment over their lifecycle to the maximum extent practicable.

5.11.10. FEDERAL BIOBASED PRODUCTS PREFERRED PROCUREMENT PROGRAM (FB4P). The Farm Security and Rural Investment Act (FSRIA) of 2002 required the U.S. Department of Agriculture (USDA) to create procurement preferences for biobased products that are applicable to all federal procurement (to designate products for biobased content). For all designated products that are used in this project, meet USDA biobased content rules for them except use of a designated product with USDA biobased content is not required if the biobased product (a) is not available within a reasonable time, (b) fails to meet performance standard or (c) is available only at an unreasonable price. For biobased content product designations, see http://www.biopreferred.gov/ProposedAndFinalItemDesignations.aspx.

5.12. CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT: Achievement of 50% diversion, by weight, of all non-hazardous C&D waste debris is required. Reuse of excess soils, recycling of vegetation, alternative daily cover, and wood to energy are not considered diversion in this context, however the Contractor must tracked and report it. A waste management plan and waste diversion reports are required, as detailed in Section 01 57 20.00 10, ENVIRONMENTAL PROTECTION.

5.13. SECURITY (ANTI-TERRORISM STANDARDS): Unless otherwise specified in Project Specific Requirements, only the minimum protective measures as specified by the current Department of Defense Minimum Antiterrorism Standards for Buildings, UFC 4-010-01, are required for this project. The element of those standards that has the most significant impact on project planning is providing protection against explosives effects. That protection can either be achieved using conventional construction (including specific window requirements) in conjunction with establishing relatively large standoff distances to parking, roadways, and installation perimeters or through building hardening, which will allow lesser standoff distances. Even with the latter, the minimum standoff distances cannot be encroached upon. These setbacks will establish the maximum buildable area. All standards in Appendix B of UFC 4-010-01 must be followed and as many of the recommendations in Appendix C that can reasonably be accommodated should be included. The facility requirements listed in these specifications assume that the minimum standoff distances can be met, permitting conventional construction. Lesser standoff distances (with specific minimums) are not desired, however can be provided, but will require structural hardening for the building. See Project Specific Requirements for project specific siting constraints. The following list highlights the major points but the detailed requirements as presented in Appendix B of UFC 4-010-01 must be followed.

(a) Standoff distance from roads, parking and installation perimeter; and/or structural blast mitigation

(b) Blast resistant windows and skylights, including glazing, frames, anchors, and supports

(c) Progressive collapse resistance for all facilities 3 stories or higher

(d) Mass notification system (shall also conform to UFC 4-021-01, Mass Notification Systems)

(e) For facilities with mailrooms (see paragraph 3 for applicability) – mailrooms have separate HVAC systems and are sealed from rest of building

6.0 PROJECT SPECIFIC REQUIREMENTS

6.1. GENERAL

The requirements of this paragraph augment the requirements indicated in Paragraphs 3 through 5.

6.2. APPROVED DEVIATIONS

The following are approved deviations from the requirements stated in Paragraphs 3 through 5 that only apply to this project.

6.2.1 LEED version 2.2 has been replaced with LEED version 3.0. The contractor shall be required to use LEED 3.0 to meet all LEED requirements of this RFP. LEED version 3.0 shall be used as the replacement foe all references to LEED version 2.2 within this RFP.

6.2.2 Reference Spec Section 01 10 00, Paragraph 5.8.4. Paragraph to include test and balance for Domestic Hot Water systems, Renewable Energy Systems, and other systems prescribed under LEED commissioning using a firm meeting the requirements listed in paragraph 5.8.4. Testing, Adjusting, and Balancing.

6.3. SITE PLANNING AND DESIGN

6.3.1. General:

General

Coordinate access to the Installation with the Contracting Officer. The B/COF Contractor shall coordinate with Installation Security if access to the site is modified based on the FPCON level at the Installation.

6.3.1.1 Site Description:

The BCT III-South project site is located adjacent to the existing BCT I Complex at the southwest corner of Iowa Avenue and South Dakota Avenue, Fort Leonard Wood. The site is currently undeveloped although major utilities are located at or near the site.

The B/COF contract includes the construction of the first phase of the Basic Combat Training (BCT) III-South Complex. The facilities included in Phase 1 are 1- Battalion Headquarters (BNHQ), 2-Barracks/Company Operations Facilities (B/COF), running track, training pit and 1- Lawn Equipment Storage Building (LEB). The BNHQ facility will be constructed under a separate contract. Site preparation for the entire BCT III-South Complex (phases 1 and 2) is included in Phase 1 of this project.

BCT III-South, Phase 2 is the associated project which will result in the completion of the BCT III-South Complex. Phase 2 of BCT III-South includes the construction of the remaining three B/COF's and the Dining Facility (DFAC), including associated parking. Subsurface preparation, building pad construction and utility connection points for all Phase 2 facilities are included in the Phase 1 construction package (Appendix J).

6.3.1.2 Utility Coordination: Prior to the commencement of construction, the B/COF Contractor shall verify utility locations, utility extension requirements and conduct utility coordination meetings with the Contracting Officer, Fort Leonard Wood utility personnel, private and utility service providers. The B/COF Contractor shall identify all utility lines impacted by the project construction and coordinate the proposed work with the each utility. Utility coordination shall identify the proposed method of maintaining service to existing facilities during construction. The B/COF Contractor shall coordinate utility placement and connection points with the BNHQ Contractor as they relate to the BNHQ facility which will be constructed concurrently. See sections; 6.3.2 Site Structure and Amenities, 6.4.6 Base Utility Information for specific utility information and Appendix FF, Demarcation Matrix for more information.

6.3.1.3 Utility Road Crossings: When utilities are required to cross streets the installation standard street cut detail shows 6" compacted subgrade under pavement. Street trenches shall be patched using compacted crushed rock overlaid with six inches of concrete. The concrete patch shall span the trench plus two feet of undisturbed soil/base course on each side of the trench. Utilities crossing Iowa Street shall be bored or jacked. Cuts in Iowa (FLW-1) will not be allowed. Coordinate utility road crossings and tie in points with the Contracting Officer.

6.3.1.4 Tree Removal: Mature trees shall be preserved to the greatest extent possible. Trees which will be disturbed or require removal shall be identified and submitted by the Contractor to the FLW Environmental for their review. Tree removal may occur between the dates of November 1st and March 31st. In the event that tree removal is required outside of the stated dates, the FLW Environmental will survey the potentially affected tress to determine if there is any active roosting of the Indiana Gray Bat.

6.3.2. Site Structures and Amenities

POV Parking: POV parking includes 144 new parking spaces including 2 handicap accessible spaces for the BNHQ facility. Parking lot surfaces shall not exceed a 4% grade.

6.3.3. Site Functional Requirements:

6.3.3.1. Stormwater Management (SWM) Systems.

6.3.3.1 Stormwater Management Systems (SMS): Storm Drainage/Storm Water Management: Storm drains and appurtenant structures shall be designed and constructed in accordance with TM 5-820-4 Drainage for Areas Other than Airfields. Stormwater management system shall be based on a 10 year 24 hour storm frequency, using the NRCS method. Erosion both on site and off site due to construction shall be addressed.

a. Because the existing project site is undeveloped, uncontrolled storm water runoff will significantly exceed the existing conditions a Stormwater Pollution Prevention Plan (SWPPP) shall be designed to meet the “no net increase” requirement as outlined in The Energy Independence and Security Act of 2007 and the Energy Policy Act of 2005 (EPAct05). The Contractor shall identify what low impact development practices will be utilized to achieve the “no net increase” requirement Low impact stormwater practices should be integrated throughout the landscape plan and may include the use of infiltration bioswales, engineered wetlands or other innovative practices to aid in the infiltration, evaporation, and transporation of stormwater. The stormwater management areas shown in Appendix J do not represent detention basins but are solely intended to allocate space to accommodate the stormwater management design. The B/COF Contractor shall ensure that all BMP’s selected adhere to the Missouri Department of Natural Resources (MDNR) stormwater regulations. See Appendix FF, Demarcation Matrix for more information.

6.3.3.2. Erosion and Sediment Control

Construction site storm water runoff shall be controlled and erosion and sedimentation control Best Management Practices (BMPs) shall be designed in compliance with Missouri Department of natural Resources (MDNR) and National Pollutant Discharge Elimination System (NPDES) requirements. All erosion and sediment measures and other protective measures shall be maintained by the Contractor, at the Contractor's expense, in effective operating condition. All temporary structural practices shall be removed once the corresponding disturbed drainage area has been permanently stabilized. The Contractor is required to obtain an NPDES permit in accordance with MDNR following approval of the application by DPW Environmental.

6.3.3.3. Vehicular Circulation.

a. Tracking of mud from the construction site onto adjacent roads and parking areas shall be kept to a minimum. A temporary, stabilized stone pad shall be constructed at points where vehicular traffic will be leaving the construction site and moving directly onto a paved road or street. The entrance shall be maintained in a condition which will prevent tracking or flow of mud onto adjacent roads or streets. If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the stone, then the tires of the vehicles shall be washed before entering the road or street. Any mud which is tracked onto roads or streets shall be removed at least once daily.

b. The Contractor shall identify proposed access and truck routes on the contract drawings.

c. The construction of the BNHQ is anticipated during the same timeframe as the B/COF Contract. The B/COF and BNHQ Contractors shall coordinate construction activities so as they do not adversely impact the adjacent Installation activities and traffic circulation.

d. Fire emergency vehicle access shall be provided on a minimum of two sides from the structure. Access shall be a minimum of 20 feet wide and be located within 30 feet of the building. Subgrade pavers capable of supporting FLW fire equipment are acceptable.

e. Provide vehicle access to service yards and on-grade mechanical rooms. Access should be integrated with the site and landscape plan.

6.3.3.5 Dumpster Enclosure and Pads: Dumpster enclosures and pads will be constructed for each B/COF facility. The dumpster enclosure for the BNHQ facility will be constructed by the B/COF Contractor in a location convenient to the BNHQ. The BNHQ Contractor shall coordinate the capacity, location and access requirements to accurately define the dumpster enclosure and pad. See Appendix FF for the project Demarcation Matrix.

6.3.3.6 Conceptual Site Plan: A conceptual site plan is included in Appendix J for informational purposes only and shows some, but not all of the functional relationships and requirements. Specific site features such as sidewalks and pads as they relate to the building design and specific connections to site features such as parking lots and other BCT III-South Complex site design elements.

6.4. SITE ENGINEERING

6.4.1. Existing Topographical Conditions

The BCT III-South site has a considerable amount of relief with approximately 30 feet of fall from a highpoint near the center of the site to the low points along the east edge and in the northeast corner of the site. Generally, the site slopes range from 2% to 5% in all directions from the highpoint with steeper slopes ranging from 10% to 20% along the north, south, and west boundaries. Currently, site runoff is collected in road side ditches and culverts on the north, east, and west sides of the site and is collected in inlets and catch basins associated with the BCT I Complex on the south side. From this area, the FLW storm sewer system flows north and east where it eventually discharges to a tributary of the Big Piney River.

The B/COF Contractor will provide utility connection points, subsurface preparation and a building pad for each phase 1 and phase 2 facility in the BCT III-South Complex. Finish floor elevations shall be coordinated with the BNHQ Contractor and designed to provide positive drainage away from the structure in conjunction with the B/COF finish grading. See Appendix FF, Demarcation Matrix for more information.

6.4.2. Existing Geotechnical conditions: See Appendix A for a preliminary geotechnical report.

See Appendix A for the preliminary geotechnical report.

6.4.3. Fire Flow Tests See Appendix D for results of fire flow tests to use for basis of design for fire flow and domestic water supply requirements.

The water distribution system is operated by the FLW DPW. General fire protection criteria and requirements for the facility are provided in UFC 3-600-01, Fire Protection Engineering for Facilities. Hydrants shall be located per UFC, NFPA, and other applicable codes listed in paragraph 4.

The B/COF Contractor shall provide fire protection for each facility in the BCT III-South Complex. Fire Hydrants shall be Mueller Super Centurion Fire Hydrants, or approved equal, with 5 ¼ inch main value opening three-way (two hose nozzles and one pumper nozzle). The contractor shall install fire hydrant meeting manufacturer/NFPA standards and provide a fire water flow test data in accordance of NFPA. Fire hydrants shall be painted Nutmeg Brown and the brim of bonnets shall have flow marking IAW NFPA 291 using reflective marine tape. Hydrants located adjacent to parking areas or other vehicle traffic areas, must be protected by bollards. The bollards must be located so they are not directly in front of an outlet. See Appendix FF, Demarcation Matrix for more information.

The BCT III-South Complex will be served by the existing BCT I Complex water distribution system/pump station (Building 941). BCT I Complex As-Built drawings indicated that a bypass line is in place to serve the BCT III-South Complex directly from the existing site distribution system. The system will require further evaluation to determine the required pump configuration and surge capacity requirements. Any modification made to the pump station shall be coordinated with the DPW and shall provide uninterrupted service to the BCT I Complex.

6.4.3.1 Temporary Use: The temporary use of fire hydrants as sources of water is not authorized without prior approval by the FLW Fire Department, (573-596-0886). Fire hydrant connections shall include an approved backflow preventer. Use of backflow preventers must comply with Missouri Department of Natural Resources, Division 60, Public Drinking Water Program, Chapter 11 - Backflow Prevention, Title 10CSR60-11. The Contractor shall be required to sign a hand receipt prior to obtaining a backflow preventer. The Contractor shall be accountable to return the checked out backflow preventer equipment undamaged and as soon as possible. The Contractor shall furnish and use an approved fire plug wrench to open and close the hydrant. Pipe wrenches shall not be used. When the hydrant is not being used it shall be shut off. When the need for the hydrant is finished, the hydrant shall be shut off, the temporary connection and backflow preventer shall be removed, the fire hydrant caps shall be replaced and the Fire Department shall be notified that the hydrant will longer be used (POC, FLW Fire Department (573) 596-0886).

6.4.4. Pavement Engineering and Traffic Estimates:

The Contractor is responsible for determining the specific traffic requirements for loading areas required to support passenger vehicles, commercial trucks and service equipment. The Contractor shall determine the specific vehicles for the paved areas, except as otherwise specified for pedestrian traffic. The Contractor’s geotechnical report shall contain both flexible and rigid pavement design(s) including design CBR, modulus of subgrade reaction and required subgrade compaction criteria.

6.4.4.1 Section Thicknesses: The pavement design section thickness shall conform to the specified requirements, except that the pavement design shall not be less than the following minimum requirements:

a. Hot Mix Asphalt: Regardless of the pavement design, a minimum flexible pavement section shall consist of at least 4-inches of asphalt concrete pavement, on 4-inches of aggregate base course, on 4-inches of aggregate subbase. The compacted thickness for each lift of asphalt concrete pavement shall be between 2 to 3-inches.

b. Portland Cement Concrete: Regardless of the pavement design, a minimum rigid concrete pavement section for areas required to support trucks and cargo trailers, tracked vehicles, and organizational vehicles and equipment traffic shall consist of at least 8-inches of rigid concrete pavement, on 4-inches of aggregate base course, on 4-inches of aggregate subbase. The minimum rigid concrete pavement design for areas required to support passenger automobile traffic shall consist of at least 6-inches of rigid concrete pavement, on 4-inches of aggregate base course, on 4-inches of aggregate subbase.

6.4.4.2 Traffic Type and Material: Pavements for areas required to support trucks and cargo trailers, tracked vehicles, and organizational vehicles and equipment traffic shall be Portland cement concrete (PCC), except as otherwise specified or directed. Pavements for areas required to support passenger automobile traffic may be hot mix asphalt concrete (HMA) or Portland cement concrete (PCC), except as otherwise specified or directed.

6.4.4.3 Underdrainage: Design and construct an underdrain system for rigid PCC pavement over cohesive soil subgrade and all pavements in areas with high water tables. A properly designed geotextile filter fabric shall serve as a separation layer under the underdrain system. The geotextile separation layer prevents pumping of soil fines into the underdrain system.

6.4.4.4 Subgrade: Pavement subgrades shall conform to the materials and pavement design recommendations for this project as outlined in the baseline geotechnical report and verified by the B/COF Contractor’s final geotechnical report and design. The subgrade surface for aggregate and paved surfaces subject to vehicular traffic shall be prepared and compacted. The site may include a low permeable clay subgrade, and is in an area subject to frost design conditions. Provide adequate drainage of the subgrade surface and aggregate courses. Grade and slope subgrade surfaces to ensure drainage of the subgrade surface. For areas with cohesive subgrade soils, lime modify at least the top 8-inches of subgrade, except as otherwise specified. When lime-modifying subgrade soils, evaluate the soils for soluble sulfate content in accordance with AASHTO T 290. If the soil contains soluble sulfates greater than 300 mg/kg, do not perform lime-modification. When soluble sulfate concentrations exceed 300 mg/kg, replace the top 8-inches of the subgrade with aggregate subbase materials (partial subgrade replacement).

6.4.4.5 Aggregate Subbase and Aggregate Base Course: Design and construct pavements on an aggregate base course underlain by a separation layer. The separation layer may consist of a subbase course or properly designed geotextile fabric. The separation layer prevents pumping of soil fines into the aggregate base course. Historically at this installation, a graded aggregate subbase course has been used as the separation course on the lime-modified subgrade.

6.4.4.6 Portland Cement Concrete Design Requirements:

a. Joint Layout and Spacing: Provide a concrete joint layout plan for all rigid concrete pavements. Show joint spacing and joint types. Pavement joint plan and joint details for Portland cement concrete pavements shall conform to UFC 3-250-01FA, or to MoDOT State Specifications and MoDOT standard details. The maximum joint spacing shall not exceed 15 feet. Pavement slabs shall not exceed a length to width ratio of 1.25 for non-reinforced slabs.

b. Joints Between Separate Features: Joints between exterior slab on grade pavements and vertical surfaces of buildings and other vertical construction shall be a full depth expansion joint. Joints between exterior slab on grade pavements and vertical surfaces of buildings at vehicle entrances to the buildings shall be a thickened edge expansion joint conforming to Figure 15-5b from UFC 3-250-01FA. Edges of pavement slabs abutting other rigid pavement areas shall be thickened edge expansion or thickened edge slip joints. Edges of pavement slabs abutting HMA pavement, or edges subject to traffic shall be thickened edge.

c. Reinforcement: Reinforce odd shaped slabs, slabs that are not square or rectangular, and slabs where the length to width ratio of the slab is 1.25 or more, with crack control steel reinforcement in accordance with UFC 3-250-01FA.

6.4.4.7 Pavement Markings, Traffic Signage and Traffic Signals

Pavement markings, traffic signage, and signals shall comply with the Installation requirements and with the Manual on Uniform Traffic Control Devices, except as otherwise specified or directed.

6.4.4.8 Materials and Construction Requirements:

a. General: Materials and construction shall conform to MoDOT State Specifications, 2004 edition and MoDOT Standard Details. Paragraphs pertaining to measurement and payment in the State Specifications shall not be used. References to State or Engineer in the State Specifications shall be understood to be the Contracting Officer. The Contractor shall be responsible for all materials sampling and testing required.

b. Subgrade Preparation and Modification: Prepare and compact the subgrade in accordance with the Contractor's geotechnical report and MoDOT State Specification requirements. Lime modification of the subgrade soil shall conform to State Specification Section 205 SUBGRADE STABILIZATION. The amount of lime required varies depending on the plasticity index and gradation of the native subgrade soils. The hydrated lime addition rate will be at least 8 percent by weight based on the dry weight of the soil, or at least 6 percent by dry weight of soil if quicklime is used. If the lime-modification does not provide a stable subgrade, the top 8-inches of the subgrade soils shall be replaced in accordance with the requirements for partial subgrade replacement.

c. Partial Subgrade Replacement: In areas where lime modification is determined to be impractical the Contractor may use partial subgrade replacement, subject to Contracting Officer's approval. Partial subgrade replacement involves the over-excavation of cohesive soils and replacement with non-cohesive granular materials. Use MoDOT Specification Section 303 ROCK BASE, except over-excavate a minimum of 8 inches instead of 18 inches. The finished surface shall be the subgrade surface and shall conform to MoDOT State Specification Section 209 SUBGRADE PREPARATION, and Section 210 SUBGRADE COMPACTION.

d. Offset Requirements: Extend each course of the pavement structure and the modified subgrade layer at least 12 inches beyond the edge of the next overlying course in the pavement section. Where curb and gutters are used, extend the layers shall at least 12 inches beyond the back of curb and gutters.

e. Underdrain System: Construct the underdrain system to conform to MoDOT State Specification Section 302 STABILIZED PERMEABLE BASE, and MoDOT Standard Details for underdrain systems. MoDOT Standard Drawing number 605.10H shows details for underdrain systems. If a geotextile filter fabric is proposed for use, verify that the geotextile is compatible with highly alkaline soil conditions.

f. Base Course and Subbase Course Aggregates: Aggregate base courses and subbase courses shall conform to MoDOT Specification Section 304 AGGREGATE BASE COURSE. Aggregate base course shall conform to State specification Section 1007 AGGREGATE FOR BASE, Type 1. Aggregate subbase course shall conform to State specification Section 1007 AGGREGATE FOR BASE, Type 5.

g. Surface Course Aggregates: Aggregate surfaced areas shall conform to MoDOT State Specifications Section 310 AGGREGATE SURFACE.

h. Portland Cement Concrete Pavement: Portland cement concrete pavements and related work shall conform to State specification Division 500. All joints shall be cleaned and sealed with an elastomeric joint sealant.

i. Hot Mix Asphalt Pavement: Asphalt concrete pavements and related work shall conform to MoDOT State Specification Division 400.

6.4.4.9 Exterior Equipment Pads: Any exterior mechanical or electrical equipment shall be installed on concrete pads. The pads shall be a minimum of 8 inches thick and shall be designed to adequately support the equipment load. Design of exterior pads shall be coordinated with the mechanical and electrical system designs. See Appendix FF, Demarcation Matrix for more information.

6.4.4.10 Bollards: Bollards or a functionally equivalent device shall be utilized to prevent automobile traffic from entering unauthorized areas within the BCT Complex. The use of such devices shall not prevent the access of authorized maintenance or safety equipment. Protective devices shall be integrated into the landscape design as practicable.

6.4.5. Traffic Signage and Pavement Markings

Traffic signage and striping shall be provided for all areas where vehicular access is required to regulate safety and convenience. Signage and striping shall be designed in accordance with Appendix H and the Manual on Uniform Traffic Control Devices (MUTCD). Parking areas shall be striped with non-reflectorized paint. Roads and streets shall be striped with reflectorized paint. Parking stalls shall be delineated with 4-inch wide white stripes.

6.4.6. Base Utility Information

Utilities available at or near the site include sanitary sewer, water and power. Utility service design shall be coordinated with each privatized utility and the FLW DPW. Connection will be required for each by the B/COF Contractor. See Appendix FF, Demarcation Matrix for more information.

All non-metallic utilities, sanitary sewer, and storm drain line shall have #12 AWG TW (thermal-weather resistant) insulated, solid copper wire, installed with and 6 inches above the utility for the reception of a located transmitter signal. Construct test station with cap and with 36 inches of coiled wire. Marking tape shall be placed in trench 6 inches below finish grade.

Survey of As-Built Utility Lines: All proposed underground utility lines shall be located by the Contractor during installation utilizing survey equipment and methods. The Contractor shall survey pipe invert of gas, water, sanitary sewer, storm sewer, roof drains and culverts and top of duct bank of electrical power and communications lines. Storm drains and sanitary sewer lines shall be surveyed where pipes enter manholes and inlets. The inverts of all cleanouts and tees shall be surveyed. Inverts at each end of culverts shall be surveyed. Electrical power, communications gas and water lines shall be surveyed at all manholes, tees, valves, corners and changes in direction and at intervals along the line which will accurately depict the location of the line both horizontally and vertically (50-foot maximum interval). Survey accuracy shall meet or exceed National Map Standards for 1”=50’ mapping. Survey shall be in Missouri State Plane Coordinate System North Zone. The horizontal and vertical control reference datum’s shall be NAD 83 and NAVD 88 respectively.

Utilities shall be capable of incorporating wireless technologies.

Primary power distribution at Fort Leonard Wood is privatized and maintained by Laclede Electric under contract with the DPW. Laclede Electric provides all primary services including transformers, wireless meter and concrete pads for the BCT III-South facilities which meet EPACT regulations.

The BNHQ will be served by a 3-phase, outdoor, pad-mounted distribution transformer rated 12470-480Y/277 volts. All necessary conduit required for connecting the BNHQ to the transformer shall be installed by the BNHQ Contractor. The concrete pad location will be located a minimum of 33 feet from the edge the building. The distribution transformers will be connected to an underground, medium voltage (12.47 kV) loop around the BCT III-South perimeter. The underground loop for the BCT III-South area will be installed by the B/COF Contractor.

The DPW and B/COF Contractor will coordinate all pertinent BNHQ project information with Laclede to obtain pricing. All electrical utility work up to and including the transformer and pad will be installed by Laclede under a separate government contract.

The B/COF Contractor shall be responsible for providing temporary power at the construction site per Section 01500. A utility sales agreement shall be reached with the Department of Public Works for the cost of the energy. Contact Laclede Electric directly for the installation of the temporary power meter. The expense of the temporary power meter shall be the B/COF Contractor's responsibility.

Domestic Water Service: The potable water distribution system is operated by the DPW and is available at the site (Appendix J). Design and construction of follow the domestic water service shall be in accordance with the most current version of the FLW-DPW Water Construction Requirements as applicable. The Contractor shall coordinate the design of the domestic water with DPW, Operations (POC, Mr. Keith Pendleton (573) 596-0946).

Domestic water service will be provided through an integrated design of the BCT I water service and the existing booster pump station (Building 941). The existing system shall be evaluated to ensure adequate capacity exists to serve the BCT III-South Complex without adversely impacting the existing BCT I Complex. Any modifications required shall be coordinated with the Contracting Officer and DPW.

A single water service entrance shall be provided for each building with a water meter, isolation valve and a double check type backflow preventer. The service assembly shall be located in a conditioned space and/or protected from freezing with electric heat tape. Coordinate water service piping installation to maintain clearances above and in front of electric panels. Provide isolation valves for domestic water and fire protection systems.

a. Water Metering: The Contractor shall provide and install a Turbine Type water meterconforming to AWWA Class I, installed with a strainer. The main casing shall be bronze with stainless steel external fasteners. Registers shall be straightreading type, permanently sealed and read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Isolation valves shall be provided to allow maintenance to be performed without shutting water off to the facility. Register type shall be an encoder type remote register designed in accordance with AWWA C707. Meters shall comply with the accuracy and capacity requirements of AWWA C701. The meter shall be wireless data transmission capable as well as have a continuous manual reading option. Water meter will be capable of at least hourly data logging and transmission and provide consumption data. Water meter will be configured to transmit at least daily even if no receiver for the data is currently available at the time of project acceptance. Contractor shall provide and install the raceway and wiring between the water meter and the DDC/BPOC Panel Conduct and provide fire hydrant tests preconstruction (for design analysis) and post construction (to verify sufficiency). Provide flow data to include static pressures, residual pressures, flow rates, date, time tests were conducted, and name of personnel conducting the fire hydrant flow tests on final drawings. Flow test in accordance with AWWA M17. The Contractor shall be responsible for the fire flow test data used in his design and construction.

b. Disinfection: The Contractor shall disinfect all new water lines and any remaining lines which do not remain fully pressurized during construction or connection. The Contractor shall notify the Contracting Officer prior to disinfection of the water lines. Disinfection shall be in accordance with the American Water Works Association Standard AWWA C652 & C651 (except Calcium Hypochlorite shall not be used as a disinfection chemical in potable water systems) and shall not be considered complete until two consecutive days of bacteriological samples show no contamination. All bacteriological, lead and copper tests shall be performed by Environmental Protections Agency (EPA) certified laboratories. Copies of results of the analyses shall be forwarded by the Contractor, upon receipt to the Contracting Officer. The Design Analysis shall address the residual chlorine levels, system flushing and provide calculations.

c. Cathodic Protection: Ferrous fittings shall be cathodically protected in addition to coatings or wrappings. A cathodic protection system shall be designed by a NACE certified professional and shall include test stations.

Cathodic Protection for metallic piping shall have test station spacing shall not exceed 500 feet and be constructed of 4 inch diameter, 36 inch minimum long, PVC pipe with a threaded cap with a flush female square drive. Test stations, cleanouts and valve boxes shall have a concrete collar (4"x18"x18"minimum) or be in pavement. Include CP summary in the design analysis.

Where there is a conflict between UFC 3-230-10A and the State criteria, the State criteria shall be followed. The successful Offeror shall be responsible for protection of existing waterlines. If any potable waterlines are damaged during construction, the successful Offeror must immediately notify the Contracting Officer.

d. Extensions of water and sewer systems require submission of stamped design to MoDNR. Contractor shall notify and schedule Acceptance Testing so they may witnessed by the FLW Fire & Emergency Services Fire Protection Inspector (POC, FLW Fire Department (573) 596-0886).

Sanitary Sewer: Sanitary sewer collection and treatment system is operated by the FLW DPW. Sanitary sewer is available at the site and will be connected at manhole numbers (741 and 754) (Appendix J). Sanitary sewer lines shall be PVC. Provide cleanouts with 18"x 18"x4" minimum PCC collar. Cleanouts are normally located within five feet outside buildings. Manholes shall be constructed at changes in slope and grade and not more than 400 feet apart. As part of the scope of work for the utility design the Contractor shall provide total load to the receiving sanitary sewer manhole. The sewer design analysis executive summary will include the capacity of the system at the receiving manhole before construction, after construction of this contract and final state including existing and all facilities identified in this paragraph. Flows exceeding capacity shall be brought to the attention of the CO. Extensions of system require submission of stamped design through DPW-Environmental to MoDNR. Design and construction of the sanitary sewer service shall be in accordance with the most current version of the FLW-DPW Sewer Construction Requirements as they apply to the BCT III-South site. The Contractor shall coordinate the design of the sanitary sewer with DPW, Operations (POC, Mr. Keith Pendleton (573) 596-0946).

The natural gas distribution system is a privatized utility that is operated by Omega Pipeline Company, LLC (Omega). The Contractor shall coordinate with DPW (POC, Mr. Earl Bivens (573) 596-0214) and Omega for gas service location and design. Omega will provide natural gas distribution from the PRV. Omega will provide service lines to the meter for each building within the BCT III-South Complex. Omega shall provide the wireless meter and the Contractor shall provide service from the meter to each building. Omega is responsible for the design, routing, tie-in, and installation of the exterior gas distribution system (up to and including the gas meter/regulator assembly). The Contractor is responsible for performing the piping connection to the meter outlet and shall provide all required piping and appurtenances downstream of the gas/regulator assembly and within the facility. The Contractor is responsible for coordinating gas utility information and design features (i.e. meter/regulator assembly characteristics and location, with Omega policies, standards, and specification requirements. The Contractor shall provide calculated heating loads, gas flow rates, and meter outlet pressure requirements to DPW and Omega for distribution system design purposes. The Contractor is not responsible for costs incurred for services provided by Omega. Omega will provide a pressure of 2 psi at the regulator outlet on the gas riser located outside the building. Higher outlet pressures shall be coordinated with Omega. The B/COF and BNHQ contractors shall provide secondary pressure regulator(s) to accommodate pressure requirements for all gas-fired equipment located within the buildings that are to be constructed by both Contractors. The B/COF and BNHQ contractors shall provide the raceway and wiring (18 gauge 2-pair twisted/shield cable) from the Direct Digital Controls (DDC)/Building Point of Connection (BPOC) Panel out to the gas meter for the connection to the pulse reader. Omega Gas Company will make the actual connection at the gas meter reader. Omega's gas meters are compatible with the base Lonworks DDC control system. The BDC shall program into the BPOC that one pulse from the gas meter equals 100 cubic feet of gas to allow the DPW ability to read gas meters via the LAN. Firm gas exists at Fort Leonard Wood.

The local cable television (CATV) company shall provide and install service cabling throughout the project site and terminating in the main communications room of each facility. Coordinate the site work and site/facility interfaces with the local cable company.

a. Provide 4 feet by 4 feet handhole a minimum of 10 feet from facility for vendor interface and cable entry into the building. Provide a 4-inch conduit from the handhole to a wall mounted enclosure inside the facility. The local Cable TV Company shall install the service coaxial CATV cables from the handhole through the 4-inch conduit to the wall mounted enclosure in the building’s main communications room. See Paragraph 6.10.4 for additional requirements.

6.4.7. Cut and Fill

6.4.7.1 Grading: Positive site drainage shall be provided for all areas and existing drainage ways shall be maintained and utilized to the extent possible. Drainage shall be directed away from all buildings. New paving areas shall be constructed such that storm water is directed off to the sides and not to the center of paved area. Stockpile topsoil onsite for reuse onsite. Topsoil shall be placed at a minimum depth of 3 inches.

6.4.7.2 Grades Away from Building:

a. Minimum of 5 percent for 10 feet. Contractor consideration shall be given to the use of area inlets, trench drains, culvert pipes, etc., to provide adequate drainage. Exception to this is for paved areas adjacent to buildings.

b. Maximum of 10 percent for 10 feet.

c. All walks and parking areas shall meet all accessibility grade requirements.

6.4.7.3 Adjustment of Existing Structures: All manholes, valve boxes, handholes or inlets of any nature within the project that do not conform to the new finish grade in either surfaced or unsurfaced areas shall be adjusted to the new finish grade. Where inlets, manholes, valve boxes, or handholes fall within a surfaced or unpaved roadway or parking, the existing frame and cover shall be removed and replaced with a heavy-duty frame and cover (minimum 375 lb.). The structure shall be adjusted as needed to fit the new conditions.

6.4.8. Borrow Material

Borrow material shall be obtained from an offsite location. Borrow material shall be free of contaminants and other unsuitable materials. Contractor shall provide analytical results as proof that borrow material is suitable and free of contaminants to the Contracting Officer.

6.4.9. Haul Routes and Staging Areas

See site drawings (Appendix J) for project location. Proposed haul routes shall be submitted in writing by the Contractor and approved by the Contracting Officer prior to use. No disposal area is available on the installation. Disposal fees shall be the responsibility of the Contractor. See Appendix FF, Demarcation Matrix for more information.

6.4.10. Clearing and Grubbing:

The BCT III-South Complex development footprint, including the phase 2 facilities will be prepared by the B/COF Contractor. To the extent possible, all mature trees located on the project site should be preserved. Tree removal shall be coordinated with FLW Environmental. All non-paved areas will be cleared, grubbed, and the topsoil stripped and stockpiled for use on the project site. No disposal sites are currently available within the Installation. All organic debris shall be removed and disposed of at an approved location outside the Installation. See Appendix FF, Demarcation Matrix for more information.

6.4.11. Landscaping:

The Contractor shall provide a Landscape Plan and construction as part of the design package. The Landscape Plan shall be designed to visually enhance the new facility with color, form and screening, while providing shade and windbreak for the parking area and building in as much as possible. Xeriscape plantings shall consist of low maintenance, low water plants appropriate to the region/installation. The use of berms to accent the building and plant beds is encouraged. Existing trees shall be protected and retained in as much as possible. Existing trees damaged by construction activities shall be replaced at the same interval as those lost. Fort Leonard Wood has identified the specific requirements for trees, seeds and grasses that are appropriate for the region with minimal maintenance (Appendix I). All plantings should be coordinated with the FLW DPW, Environmental Division. Any coniferous plantings selected shall be discussed in the design analysis with respect to diseases particular to the region such as the Diplodia twig blight or Pinewilt disease. Vehicle access to all service yards and at-grade mechanical rooms shall be accommodated in the landscape plan.

Plantings shall consist of low maintenance plantings and should be arranged for ease of access for weeding, mulching, and watering; typically in defined planting beds. A minimum of four difference tree species should be selected with note than 50 percent of any single species. The planting of individual trees in turfed areas is not permitted. Plants shall be considered unhealthy or dead when the main leader has died back or 25 percent of the crown is dead. Unhealthy or dead plants shall be removed immediately and replaced as soon as seasonal conditions permit. Furnished plant material shall be guaranteed to be in a vigorous growing condition for a minimum period of 12 months, regardless of contract time period. Plant establishment period shall continue until 12 months from the BOD (Beneficial Occupancy Date) of the B/COF Complex. A maintenance plan shall be developed and provided to the Government and maintenance reports submitted monthly. Plantings shall comply with the acceptable plant list in Appendix I. See Appendix FF for the project Demarcation Matrix.

6.4.12. Turf:

All areas disturbed by construction shall be seeded. Turf seed shall contain 50% turf fescue and 50% winter rye. Weed seed shall not exceed 1% by weight of the total mixture. Wet, moldy or otherwise damaged seed will be rejected. Prior to seeding, all surface soils shall be loosened to a minimum depth of three inches and broken up to fine, working textures suitable for seeding. A minimum of 3 inches of topsoil shall be placed on all disturbed areas. All newly turfed areas shall have a “starter” fertilizer applied at the recommended rate of the product. A soil test shall be made to determine any significant nutrient deficiencies or pH extremes, particularly in the areas near building foundations or in soil fill areas (submit FIO the test results to the COR). Seed shall be applied at the rate of 7 pounds per 1,000 square feet. Seeded areas shall be overlain with loose straw to control erosion and loss of seeded surface. Maintain turf by watering, weeding, and fertilizing as required to establish healthy, viable plantings. See Appendix FF for the project Demarcation Matrix.

6.4.13 Termite Treatment

The Contractor shall provide termite treatment with a 5 year warranty for each facility constructed under this contract. The Contractor shall comply with 7 USC Section 136 for requirements on contractor’s licensing, certification, and record keeping. The Contractor shall maintain daily records using Pest Management Maintenance Record, DD Form 1532-1 and submit copies of records when requested by the Contracting Officer.

Upon completion of this work, the Contractor shall submit the Pest Management Report, DD Form 1532 identifying the targeted pest(s), type of operation, brand name and pesticide manufacturer (including formulation, concentration or rate of application utilized). The BCOF Contractor shall confirm that final grading and landscaping installation will not disturb the treatment of the soil on the exterior sides of the foundation walls, grade beams or similar structures.

6.5. ARCHITECTURE

6.5.1. General: To the maximum extent possible within the contract cost limitation, the buildings shall conform to the look and feel of the architectural style and shall use the same colors as adjacent facilities as expressed herein . The Government will evaluate the extent to which the proposal is compatible with the architectural theme expressed in the RFP during the contract or task order competition. The first priority in order of importance is that the design provides comparable building mass, size, height, and configuration compared to the architectural theme expressed herein. The second priority is that design is providing compatible exterior skin appearance based upon façade, architectural character (period or style), exterior detailing, matching nearby and installation material/color pallets, as described herein.

6.5.2. **Design**

6.5.2.1. Appendix F is provided “For Information Only”, to establish the desired site and architectural themes for the area. Appendix F identifies the desired project look and feel based on Fort Leonard Wood**’s** Installation Architectural Theme from existing and proposed adjacent building forms; i.e. building exterior skin, roof lines, delineation of entrances, proportions of fenestration in relation to elevations, shade and shadow effects, materials, textures, exterior color schemes, and organizational layout.

6.5.2.2. The design should address Fort Leonard Wood’s identified preferences. Implement these preferences considering the following:

(a) Achievable within the Construction Contract Cost Limitation (CCL)

(b) Meets Milestones within Maximum Performance Duration.

(c) Achieves Full Scope indentified in this Solicitation

(d) Best Life-Cycle Cost Design

(e) Meets the Specified Sustainable Design and LEED requirements

(f) Complies with Energy Conservation Requirements Specified in this RFP.

6.5.2.3. Priority #1. Visual Compatibility: Facility Massing (Size, Height, Spacing, Architectural Theme, etc.) Exterior Aesthetic Considerations: The buildings massing, exterior functional aesthetics, and character shall create a comprehensive and harmonious blend of design features that are sympathetic to the style and context of the Installation. The Installation's intent for this area is:

To use durable, low-maintenance materials. Configure building massing and use exterior elements and material detailing to provide human scale. Exterior must be visually compatible with surrounding buildings.

6.5.2.4. Priority #2. Architectural Compatibility: Exterior Design Elements (Materials, Style, Construction Details, etc.) Roofs, Exterior Skin, and Windows & Door Fenestrations should promote a visually appealing compatibility with the desired character while not sacrificing the integrity and technical competency of building systems.

6.5.2.5. See Appendix F for exterior colors that apply to Architectural character at Fort Leonard Wood. The manufacturers and materials referenced are intended to establish color only, and are not intended to limit manufacturers and material selections.

6.5.2.6. Additional architectural requirements:

(a) Install fall protection anchor points on all roofs with a slope greater than 2:12

(b) Exterior Signage: Quantity, type, size, location of building mounted identification signs and signage illumination requirements (where applicable) shall be designed and installed by the Contractor and shall conform to Fort Leonard Wood's requirements, as specified in Appendix H. The Contractor is also responsible for the BNHQ facility signage located outside the building's 5' line.

6.5.3. Programmable Electronic Key Card Access Systems:

Not Used

6.5.4. INTERIOR DESIGN

6.5.4.1 FURNISHINGS

Acquisition and installation of furnishings will be provided by the Government. The Contractor shall provide design of furnishings throughout facilities as required by code, as indicated in the Scope of Work, or as necessary for complete function of the room or space. Furnishings shall be designed for compliance with ADAAG. Furniture materials and finishes shall be coordinated as described in Section 01 33 16, Design After Award, Structural Interior Design (SID) and Furniture, Fixtures and Equipment (FF&E) design.

Interior building signage requirements:

6.5.4.1 Restricted areas signs shall be placed at Barracks entrances per AR 190-11 4-22 b 1. Restricted signs and IDS signs shall be place outside the arms vault doors per AR 190-11 4-15 and 4-16. The restricted area signs must provide information on it as prescribed by AR 190-11, 4-15e.

6.6. STRUCTURAL DESIGN

6.6.1 General

Consider mission effectiveness, the most economical system in the locality, life-cycle economics, and space adaptability in choosing the structural systems. Space adaptability includes future reorganization or reallocation of space.
Analyze, design, and detail each building as a complete structural system. Design structural elements to preclude

damage to finishes, partitions, and other frangible, nonstructural elements; to prevent impaired operability of moveable components; and to prevent cladding leakage and roof ponding. Limit deflections of structural members to the allowable of the applicable material standard, e.g. ACI, AISC, Brick Industry Association (BIA).
Consider climate conditions, high humidity, industrial atmosphere, saltwater exposure, or other adverse conditions when selecting the type of cement and admixtures used in concrete, the concrete cover on reinforcing steel, the coatings on structural members, expansion joints, the level of corrosion protection, and the structural systems. All concrete shall be a minimum of 3,000 psi and shall be steel reinforced. Place floor mounted mechanical and electrical equipment on a 4” minimum concrete pad.
In addition to gravity, seismic, and lateral loads, design ancillary building items, e.g. doors, window jambs and connections, overhead architectural features, equipment bracing, for the requirements of UFC 4-010-01, DOD Minimum Antiterrorism Standards for Buildings. Ensure and document that the design of glazed items includes, but is not limited to, the following items under the design loads prescribed in UFC 4-010-01:
(a) Supporting members of glazed elements, e.g. window jamb, sill, header
(b) Connections of glazed element to supporting members, e.g. window to header
(c) Connections of supporting members to each other, e.g. header to jamb
(d) Connections of supporting members to structural system, e.g. jamb to foundation.

6.6.2 Applicable Standards, Codes, and Criteria
The structural design shall fully comply with the following listed criteria in addition to the provisions provided in Section 01 10 00 paragraph 4.0 Applicable Criteria. Use the latest edition of the International Building Code (IBC) for design guidance, and coordinate design with UFC 4-010-01. For buildings three stories and taller, design for progressive collapse in accordance with UFC 4-023-03, Design of Buildings to Resist Progressive Collapse.

6.6.3 Project Specific Design Loads:

6.6.3.1. Live loads shall be per the IBC but not lower than the minimums in paragraph 3.5 Structural Requirements.

6.6.3.2. Ground Snow: 20 psf

6.6.3.3. Wind Speed: 90 mph

6.6.3.4. Frost Penetration: 36 inches

6.6.3.5. Seismic Design Data: The mapped maximum considered earthquake (MCE) spectral response accelerations for site class B are:
Ss (at short periods) = 30 % g
S1 (at 1-second period) = 12 % g.
The acceleration values identified are for the general location of the facility. Verify and use site specific criteria based on the final site location of the facility. Adjust site class per IBC to match specific site information in geotechnical report.

6.6.3.6 Antiterrorism/Force Protection loads and minimum requirements are per UFC 4-010-01. For design of structural components subjected to dynamic loads, the U.S. Army Corps of Engineers Protective Design Center (PDC) developed SBEDS, Single-Degree-of-Freedom Blast Effects Design Spreadsheets (SBEDS). SBEDS is available at the software tab of the PDC website, HYPERLINK "https://pdc.usace.army.mil/"https://pdc.usace.army.mil/.

6.6.4 Foundation
The foundation is site specific and must be designed upon known geotechnical considerations by an engineer knowledgeable of the local conditions, e.g. highly expansive soils, groundwater levels. Coordinate the need for a

vapor barrier with the architectural floor finishes and requirements of the geotechnical report. All slab-on-grade to receive a coating (e.g. epoxy) or to receive an overlaying finish (e.g. carpet or tile), shall be underlain by a vapor barrier system with a minimum 10-mil polyethylene membrane.

6.6.5 Site Features - Retaining Walls/Bridges/etc.
Design site features, e.g. retaining walls, culverts, bridges, in accordance with the appropriate American Association of State Highway and Transportation Officials (AASHTO) criteria including AASHTO LRFD Bridge Design Specifications, AASHTO Standard Specifications for Highway Bridges, and AASHTO Guide Specifications for Design of Pedestrian Bridges. Consider operation and maintenance requirements, e.g. painting, mowing, inspecting, routine maintenance. Design site features to drain properly in order to meet loading assumptions.

6.7. THERMAL PERFORMANCE

6.7.1 Moisture protection shall be considered by the Contractor. Protection from damage to flooring and wall finishes shall be taken into consideration when designing floor slabs and walls. This could be as simple as placing a vapor barrier under the floor slab, building wrap, or vapor barrier on the walls.

6.8. PLUMBING

6.8.1 CROSS CONNECTION CONTROL: All local site specific requirements for cross connection control/backflow prevention shall be followed. All facilities will be provided with an inlet water backflow prevention device, located at the 5' line of the building; additionally, potable water systems shall be protected from contamination by hydronic water and other industrial and mechanical systems (see fire protection codes and this RFP for backflow prevention for those systems) via a reduced pressure zone backflow preventer.
6.8.2 NATURAL GAS SUPPLY: FLW utility company, Omega delivers the 2 PSIG gas at the outlet of the last devise/fitting at meter/regulator set assembly. Interior gas piping should continue to be 2 PSIG and inline regulators provided to reduce down at the manufacture's inlet pressure recommendations. All interior regulators shall be vented to the outside IAW NFPA 54.

6.8.3 Domestic Water Piping: Ft Leonard Wood has a history of erosion corrosion due to water hardness among other factors. Piping leaks have developed in less than 10 years after occupancy. Domestic piping design and installation shall conform to the conservative side of the recommendations of the Copper Development Association, which can be found at HYPERLINK "www.copper.org"www.copper.org. Water pipe velocities shall not exceed 5 fps for domestic cold water, 4 fps for domestic hot water below 140 degrees F and 2 fps for any domestic hot water at or above 140 degrees F. Long radius fittings shall be provided. Protrusions into the flow stream shall be minimized. Tube ends shall be properly reamed. Domestic circulation/recirculation pumps shall be selected to both meet and not exceed the design flow, i.e. care, including test adjust and balance, shall be provided to ensure that the actual installation of these pumps due not exceed the velocity specified above. Balancing valves or auto flow control valves shall be provided on all domestic hot water recirculation piping.

6.8.4 EXTERIOR WATER PIPING FREEZE PROTECTION: Seasonally (not used in winter) utilized water supply piping shall detailed and installed for complete drain down and shall be provided with an interior or below grade isolation valve. Exposed water piping that is utilized year round shall be insulated and heat traced and protected with pipe jacketing to ensure that the piping will not freeze.
6.8.5 A floor drain must be provided in any Janitor's Closet.

6.8.6 Plastic pipe (Schedule 40 PVC) shall be used for drainage and venting under concrete slabs or inside buildings. Do not use cast iron.

6.9. SITE ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

6.9.1 Medium Voltage Service Distribution

The underground loop for the BCT III-South area will be installed by Laclede in conjunction with the B/COF civil/site contract. The DPW and B/COF Contractor will coordinate all pertinent project information with Laclede to obtain pricing. Additionally, the B/COF Contractor will be required to coordinate with the BNHQ Contractor early in the design process to identify any electrical load/transformer requirements, including facility design loads and the transformer location for the BNHQ facility.

6.9.1.1 Power Distribution: The power distribution is Privatized and maintained by Laclede Electric through contract with Ft. Leonard Wood DPW. Contract administrator shall be contacted during design through the Contracting Officer.

a. Laclede Electric shall provide:

1) Primary service including transformer and pad.

2) Secondary conduits from the secondary section to 1-2 feet from that pad. Size to match design provided.

3) Final connection of service conductors to transformer.

4) Metering and enclosure rated to meet the EPAC Regulations.

5) Final cost, for project, to DPW once Contractor's design is solid.

b. Ft Leonard Wood DPW shall provide:

1) Approval for location of transformer and pad.

2) Gas and Electric rates for determining HVAC design parameters. I.e. most cost effective operating system. See Appendices for information available at time of bid.

3) All payments to Laclede Electric.

4) Site design approval related to utilities.

5) Final cost statement, for project, to COE once Contractor's design is solid.

c. Contracting Officer shall provide:

1) All coordination between Contractor and DPW.

2) Payment to DPW for Electrical Utility cost, for project from project funds.

d. Contractor shall provide:

1) Utility breakdown of NFPA 70 connected loads for transformer sizing. Ie: Lighting, receptacle, general, cooling, heating, etc. This is required 1 year before delivery of the utility transformer to the site due to ordering lead times. See Appendix C for required submittal form.

2) Size of secondary conduits and conductors with load breakdown information.

3) Secondary conduits from the utility provided conduits to the facility service panel.

4) Secondary cables to transformer with 15 feet extra cable for termination by Laclede.

5) Proposed location of transformer for approval by DPW.

6.9.2 Underground 600V Distribution System

6.9.2.1 Contractor shall furnish and install an underground 600V class distribution system to provide power to all new facilities constructed by the requirements of this scope of work. The distribution system shall include but not be limited to 600V cable, manholes, pull boxes, duct bank, conduit, warning tape, and all accessories commonly used in 600V underground distribution. All distribution shall be routed underground from the low voltage side of pad mounted transformers through a duct bank, or direct buried conduit raceway system as required.

6.9.2.2 Provide exterior power, data, and control circuits as required for sump pumps, irrigation pumps, electrical and mechanical equipment, etc for this Contract.

6.9.2.3 Provide a green, insulated safety ground wire for all non-service feeders and branch circuits.

6.9.3 Conduits and Fittings

6.9.3.1 Exterior Conduit: All exterior power and communication service conduits shall be 4” or larger PVC. Conduits installed above grade shall be rigid galvanized steel (RGS). Fittings for steel conduit shall be steel threaded or compression type. Screw, clamp or other type fittings are not acceptable.

6.9.3.2 Road Crossings: Provide horizontally drilled (bored) cables with rigid galvanized steel (RGS) sleeve under roads. Roads may not be cut for utility installation without specific acceptance of the COE.

6.9.3.3 Buried Conduit: Provide all buried conduits and cables a minimum of 36” below finished grade or 24” below bottom of pavement. All buried cable shall be marked with warning tape installed 18” immediately below grade. Provide metal tracer mounted at conduits for GPS depth finding equipped with signal stations. Underground connections or splices are prohibited, except in boxes or manholes. Splices shall be in a self-draining, rodent-resistant box with a cover. Provide cover with appropriate labeling. Refer to FACILITY ELECTRICAL SYSTEMS for additional requirements.

6.9.4 Grounding: Refer to FACILITY ELECTRICAL SYSTEMS for additional requirements.

6.9.5 Luminaries and Accessories

6.9.6 Site Lighting

Provide exterior lighting for the BCT III-Complex in compliance with the recommendations of the Illumination Engineering Society of North America (IESNA). Exterior site and area lighting shall be metal halide HID type to meet Base standards. Exterior lighting shall include parking areas, hardstands, roadways, training areas, exercise areas, facility, and walkways. Design of lighting shall include 0.72 LLF maximum and 0.5 footcandle minimum values. Calculations for parking lot lighting shall be to obtain an IESNA Figure 22-21recommended footcandle and ratios. Provide calculations for NFPA 101 foot-candle requirements to public way for compliance review as well.
6.9.5.1 Exterior Luminaries: Provide exterior luminaries for the complete with lamps and ballasts. Ballasts for High-Intensity-Discharge (HID) shall be constant wattage autotransformers (CWA) or regulator, high power-factor type. Provide single-lamp ballasts, which shall have a minimum starting temperature of minus 20 degrees C. HID ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 10,000 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 deg. C. Fluorescent fixtures if used outside shall have a minimum starting temperature of minus 20 degrees C and footcandle shall be calculated using 0.36 LLF.

6.9.5.2 Poles: Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS-4 while supporting luminaries and all other appurtenances indicated. The effective projected areas of luminaries’ and appurtenances used in calculations shall be specific for the actual products provided on each pole.

a. Non-wooden poles shall have hand hole having a minimum clear opening of 2.5 by 5 inches. Stainless steel captive screws shall secure handhole cover.

b. Aluminum Poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3, 5) for cast alloys. Poles shall be seamless extruded or spun seamless type with minimum 0.188 inch wall thickness. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Tops of shafts shall be fitted with a cover. Base shall be anchor bolt mounted, made of cast 356-T6 aluminum alloy in accordance with ASTM B 108 and shall be machined to receive the lower end of shaft. Joint between shaft and base shall be welded. Base cover shall be cast 356-T6 aluminum alloy in accordance with ASTM B 108. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel. Aluminum poles and brackets for lightings shall have a dark anodic bronze finish to match fixtures and shall not be field painted. Manufacturer’s standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes. Brackets and Supports shall comply with IEEE C136.3, IEEE C136.13 and IEEE C136.21 as applicable. Pole brackets shall be not less than 1¼-inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaries’ provided, and brackets for use with one type of luminary shall be identical. Brackets for pole-mounted parking lights shall correctly position luminary no lower than mounting height indicated. Pole

Foundations Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with ASTM A 153/A 153M.

c. Provide ground rod at each pole location and bond equipment ground conductor to all metal parts.

6.9.6 Telecommunications Distribution (OSP): BCT III-South Complex will be connected to the Area Distribution Node using an existing 12-way underground duct bank routed along the west side of Iowa. The main communications room in the BNHQ will be the distribution point for the BCT III-South Complex. The other buildings will be served in a star configuration via underground ductsbanks from the BNHQ telecommunications room. Copper and fiber cables will be installed for telephone and high-speed data at the BNHQ. The B/COF Contractor shall coordinate connection points and facility requirements with the BNHQ Contractor.

6.9.6.1 Outside Plant Cabling: Services for outside plant cabling, telecommunications and data are being furnished to the site from manhole (MH 1012A or MH 1012B). Telecommunication system tie-in locations (telecommunication manholes) are identified on the drawings in Appendix J.

6.9.6.2 Installation: Provide the telephone and data communications services from the facility to include but not be limited to the installation of all exterior cables, splice kits, handholes, manholes, conduit, duct bank systems and connections.

6.9.6.3 Duct Banks: Provide communication duct banks as a minimum of a four-way configuration with 4” conduits along the street. From the last manhole along the street to the Main Facility on the range, provide a minimum of a two-way duct bank configuration with 4” conduits is required. One conduit shall be provided with four 1-1/4 inch MaxCell innerduct throughout. All conduits shall be installed in concrete encased ductbank. When new “handholes” are required to meet I3A or for constructability they shall be provide as 6’x4’x6’ minimum. From the main facility to secondary facilities, provide as indicated in the building plans.

6.9.6.4 Design: Design from the demarcation location to the facility is the responsibility of the Contractor. Coordination of communication system minimum standards as well as final design, connections, routing, existing conditions and construction requirements shall be coordinated with the Fort Leonard Wood Network Enterprise Technology Command (NETC) through The Corps of Engineers Field representative. See paragraph 6.10.3 for additional requirements.

6.9.6.5 Handholes: When a hand hole is allowed by Fort Leonard Wood NEC for consideration; design shall be submitted and approved by Fort Leonard Wood NEC. Minimum requirements shall be as follows. Hand holes may only be used as pull points for small diameter cables for building access. A hand hole shall not be used in place of a MH or in a main conduit system. Hand holes shall not be used for splicing cables without prior U.S. Government approval. Telecommunications hand holes shall not be shared with electrical installations. Hand Holes shall be reinforced concrete units provided with a lid that permits internal access to the housed components. The minimum hand hole size is 4 ft x 4 ft x 4 ft (1.2 m x 1.2 m x 1.2.m). Larger hand holes (i.e., 1.2 m x 1.8 m x 1.2 m) are acceptable. Hand holes installed where vehicle traffic may be present shall be load rated as H-20 and shall be equipped with round MH lids. Each new hand hole shall be equipped with a lid, pull irons, cable racks, and hooks designed for use in telecommunications systems. Cable hooks shall be placed to support the weight of the cable. All new hand holes shall be stenciled with a number designated by the NEC.

6.9.7 Cable TV (CATV) Distribution

6.9.7.1 The local cable television (CATV) company shall provide and install servie cabling throughout the project site and terminating in the main communications room of each facility. Coordinated site work and site/facility interfaces with the local cable company.

6.9.7.2 Provide 4 feet by 4 feet handhole a minimum of 10 feet from each facility for vendor interface and cable entry into the building. Provide a 4-inch conduit from the handhole to a wall mounted enclosure inside the facility. The local CATV company shall install the service coaxial CATV cables from the handhole through the 4-inch conduit to the wall mounted enclosure in the building’s main communications room. See Paragraph 6.10.4 for additional requirements.

6.10. FACILITY ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

6.10.1 IDS: The IDS used of FT Leonard Wood is the Avantar Alarm System and will be installed by the DOM alarm Tech, MR Tanner. Conduit needs to be ran for the alarm panel inside by the door, for BMS on the doors, for hand duress and foot duress on the bottom of the arms vault door. and for motion sensors on the ceiling or the arm vault. See paragraph 3.7.6 and Appendix C, for additional IDS requirements.

No additional requirements.

6.11. HEATING, VENTILATING, AND AIR CONDITIONING

6.11.1 Emission Control Requirements for Air Conditioning Units and Chillers: Refrigerants shall have an Ozone Depletion Potential (ODP) of less than or equal to 0.05. 6.11.2 Water Quality Analysis and Treatment: D/B Contractor shall coordinate with water treatment contractor to confirm water data and current water treatment methods to obtain the required quantity and types of chemicals to be initially introduced into the closed loop heating and chilled water systems if used. Treatment will be required for make-up water in HVAC equipment. Water Quality tests shall be performed by the Contractor. The Contractor shall analyze the hardness of the water and provide water softening, if necessary. All hydronic coils subject to freezing shall be protected with an Inhibited Propylene Glycol solution with phosphoric acid and dipotassium salt and blue dye to reach a plus 5 to minus 5 degrees Fahrenheit freeze protection. If glycol is provided, then water treatment shall be provided per the Appendix titled "Closed System Water Treatment with Glycol". If glycol is not provided, then water treatment shall be provided per the Appendix titled "Closed System Water Treatment without Glycol".
6.11.3 Screening for mechanical and electrical equipment should be used to block undesirable views. The Contractor shall design the screening to be compatible with the exterior of the adjacent facilities and to allow air flow. The design must be in accordance with applicable Anti-Terrorism/Force Protection guidelines.

6.11.4 UMCS: See Appendix titled "Mechanical Controls" for system Architecture, DDC Controls and Building Point of Contract (BPOC). Each building shall have a BPOC.

Integrate the control system to the installation's existing UMCS. The existing UMCS is a BIM Enterprise Network utilizing LONworks.

6.12. ENERGY CONSERVATION

6.12.1. General

No additional requirements.

6.12.2. Inclusion of Renewable Energy Features. The following renewable energy features have been determined lifecycle cost effective, are included in the project budget and shall be provided:

Refer to paragraphs 6.11.1 - 6.11.4 in the Implementation Guide.

6.13. FIRE PROTECTION

6.13.1 Design fire protection system, including fire suppression and fire alarm systems, per UFC 3-600-01, except as follows. Design mass notification per UFC 4-021-01. All design shall involve the Fort Leonard Wood Fire Department and require approval prior to construction. Provide compliance with the Fort Leonard Wood DESIGN SPECIFICATION FOR CONSTRUCTION OF FIRE DETECTION AND FIRE SUPPRESSION document attached in the appendices.

6.13.2 General

6.13.2.1 Provide a Knox box that is keyed to the Ft. Leonard Wood fire and emergency services account, at the nearest exit that permits access to the electrical room. Generally, on building with brick exterior finish, a recess mounted Knox Box shall be required. Knox Box #3275 Dark Bronze with tamper switches and #3290 recessed mounting kit. For building that need surface mounting, Knox Box #3266 Dark Bronze with tamper switches. FLW Fire & Emergency Services will furnish to contractor an approved application to order Knox Box.

6.13.2.2 Fire department vehicle access roads shall be designed for a 105-foot ladder truck, weighing 62000 LBS, with a 100-foot turning radius.

6.13.2.3 If Gates or chains are used on access points, then a residential knox box shall be provided by the Contractor at each location keyed to the Fire Department Account. This knox box does not require connection to the building fire alarm system.

6.13.2.4 Provide Fire Extinguishers and fire extinguisher cabinets. Provide 10 lb. ABC in the office areas and 20 lb. ABC for shop/repair area. Shop/repair area should have a fire extinguisher sign above location that is visible marking the location.

6.13.2.5 Provide a temporary building sign at each entrance to each building under construction EMS & Fire response. The sign shall be Brown background with white letters. The sign shall be visible from the road. The building numbers can be obtained from DPW.

6.13.2.6 Contractor shall provide fire flow test and results for each hydrant installed for this project. Contractor shall paint the bonnet brim to match the results of the fire flow test in compliance with NFPA 291.

6.13.2.7 As required by UFC 3 600-01 a Fire Protection Engineer should be involved in the Life Safety Plans. As part of this process the Fire Protection Engineer shall coordinate and receive approval from the Fort Leonard Wood Fire Department for the Public Way location(s). This is required for NFPA 101 verification of emergency illumination compliance.

6.13.2.8 Riser Location: Fire risers shall be installed in dedicated space or mechanical room with external access for fire department.

6.13.3 Sprinkler system design, shop drawings, product data, and hydraulic calculations shall be submitted as one complete package for government approval prior to construction. This is expected at Plan Review and may delay construction permits if not provided during this time.

6.13.4 Fire Alarm

6.13.4.1 Provide an addressable intelligent fire alarm (FA) and mass notification (MN) system. Common speakers will be used for FA alarm and MN messages. Clear strobes are required in a red housing for FA, and amber strobes in a white housing for MN. Speaker and strobes combined in one unit is acceptable.

6.13.4.2 Provide all Fire Alarm notification annunciations with:

A. Steady tone for 5 seconds, (Male voice) Message to say: "May I have your attention please! A fire emergency has been reported in the building. While this is being verified, please leave the building by the nearest exit."

B. Standard Fire Alarm tone for **5** minutes.

C. Repeat.

6.13.4.3 Provide the FACP in the electrical room if one is in the building. Placement of the FACP in the communication room or mechanical room is not permitted when an electrical room is used. Buildings that do not have electrical rooms shall utilize the Mechanical room incompliance with the Fort Leonard Wood DESIGN SPECIFICATION FOR CONSTRUCTION OF FIRE DETECTION AND FIRE SUPPRESSION document.

6.13.4.4 The FACP shall be keyed, with key code , the same as the Monaco transceiver to prevent local user access to the fire alarm control panel (FACP).

6.13.4.5 Provide an 80 character display annunciator, with message buffer, at the FACP. Also, provide a graphic display annunciator at the main building entry. The graphic display should be an architectural display of the building set (floor plan) properly orientated to the building layout. The graphic display shall have LED lights for each device that illuminate, representing the activated device in red, and a separate yellow LED for trouble alarms." The design of the graphic annunciator shall be reviewed and approved by the AHJ (Fort Leonard Wood Fire Department) in writing before it is manufactured.

6.13.4.6 All fire sprinkler valves, including the PIV, shall be supervised, at its location, by the fire alarm system. PIV circuit requires protector block at entry into the building.

6.13.4.7 Provide Fire Alarm notification with DRILL function for local user operation. Provide with interface to the Local User MN remote annunciator.

6.13.4.8 Wall mounted appliances are discouraged and not required by ABA. Ceiling mounted appliances are preferred.

6.13.4.9 Provide manual pull stations at each exit in compliance with NFPA 72 installation requirements. Additional stations shall be provided so that the travel distance, to a station, will not be in excess of 200 feet, measured horizontally on the same floor.

6.13.4.10 Provide the Fire Alarm transceiver as a Monaco BT-XF. The transceiver shall have at least 60 zones reporting, unless there are less than 56 devices in the building. If less than 56 devices, one zone shall report for each device plus 4 spare zones. Each zone is a relay in the fire alarm control panel with a pair of wires routed to the BT-XF. Sixty zones will have sixty sets of wires routed between the FACP and BT-XF, and 60 relay contactors in the FACP.

6.13.5 Mass Notification (MN)

6.13.5.1 Provide a, Wheelock ATI, UHF signal transceiver with FSK protocol to the Ft Leonard Wood master Wheelock Mass Notification system in building 3200. This unit may be located adjacent to the Fire Alarm transceiver. MN messages shall NOT be sent to the county 911 center. Separate MN and FA transceivers and antennas are required. This transceiver shall be fully interfaced with the Fire Alarm equipment to provide all the functions necessary for interface all local features. The automatic over-ride and return between buildings Fire Alarm System and MNS by the EOC shall not require action by the local user to reset the system. The EOC shall be able to transmit any message their equipment permits into the buildings through the system.

6.13.5.2 The Local Operator Console shall be provided adjacent to the graphic annunciator at the fire fighter entry point.

6.13.5.3 Local Operator Console (LOC) for the project shall be a Cooper Wheelock Safepath 4, or approved equal with the following features.

A. Located near the Fire Alarm annunciator.

B. Keyed access as directed by Ft Leonard Wood fire department.

C. Remote Microphone with push button interrupting the FA signal until finger pressure is released.

D. Eight individual mass notification pre-recorded messages selector push buttons and one separately located ON - OFF switch.

(1) Button 1. FIRE ALARM DRILL, See Fire Alarm description above.

(2) Button 2. BUILDING EMERGENCY, Steady tone for 5 seconds, (Male Voice) Message to say: "May I have your attention please! An emergency has been reported in the building. Emergency personnel are in route. While this is being verified, please leave the building by the nearest exit."

(3) Button 3. SHELTER-IN-PLACE, Alternating Steady tone for 5 seconds, (Male voice) Message to say: "Attention. Seek Shelter immediately. Close doors and windows. Shut off heating, ventilation and air-conditioning. Seek shelter immediately."

(4) Button 4. TEST, Steady tone for 5 seconds, (Female voice) Message to say: "This is a test of the Fort Leonard Wood Mass Notification System, repeat this is only a test."

(5) Buttons 5 thru 8 to be left blank for future use by EOC.

(6) ON - OFF switch - HVAC Emergency Cut-off switch wired for simulated Fire Alarm activation. Once turned ON again the HVAC system should go through standard ON start-up sequencing required by the DDC system. DDC Notification of the ON-OFF status is required. Switch may be a pushbutton style.

6.13.5.4 MNS is required inside and exterior of the facility. Exterior strobes are not required.

6.13.6 Submittals
6.13.6.1 Submittals during Plan review shall include code compliance information. Differing to later “shop drawings” as verification of compliance will only delay construction permits being released. The following information does not elevate the requirements of a complete submittal indicated elsewhere in this contract.

6.13.6.2 Life Safety/ Code Compliance sheets should be issued as F- series sheets and include all relevant information related to Building and Life Safety Codes.

6.13.6.3 Sprinkler design sheets should be issued as FX series sheets and include all relevant information related to installation. This includes sprinkler heads coordinated with the overall building reflected ceiling plan.

6.13.6.4 Fire Alarm sheets should be submitted as FA series sheets and need to show compliance with UFC 3 600-01 and UFC 4 021-01. Provide design in compliance with UFC 3 600-01 5-1 and UFC 4 021 2-6.2. This includes:

a. All Fire Alarm equipment placed and coordinated with other work.

b. All devices shown including connections to hoods and elevator requirements. Only provide devices that are required by code. UFC 3 600-01 specifically prohibits additional devices.

c. All appliances placed. Provide candela and decibel ratings for each appliance on the plans, not amp tap so calculated spacing can be verified properly. Avoid the use of wall mounted appliances. ADA does not prohibit ceiling mounted appliances, Fort Leonard Wood Fire Department prefers ceiling mounted appliances, and they provide better coverage. If wall mounted appliances are used provide furniture/equipment elevations with heights coordinated with the mounting of appliances. Do note, unlike NFPA, UFC 4 021-01 requires coverage everywhere in the building and immediately outside the building. The Main Corp of Engineers AHJ, local Corp of Engineers AHJ, and Ft Leonard Wood AHJ translates this to include MNS in private offices, storage space, mechanical spaces, etc.

d. Provide plans, diagrams, Matrix, etc. similar to examples given in NFPA. The MATRIX should include all Mass Notification features as well.

e. Strobes for MNS are required adjacent to each of the Fire Alarm Strobes. Same coverage, equivalent candela intensity after de-rating amber lens, except where fire alarm strobes are not in an area with a speaker, then only the MNS strobe is required. I.e. Small Offices.

6.14. SUSTAINABLE DESIGN

6.14.1. LEED Rating Tool Version. This project shall be executed using LEED-NC Version 3.

6.14.2. The minimum requirement for this project is to achieve LEED Silver level. Each non-exempt facility (building plus sitework) must achieve this level. In addition to any facilities indicated as exempt in paragraph 3, the following facilities are exempt from the minimum LEED achievement requirement: None..

6.14.3. Credit Validation: LEED registration, compiling of documentation at LEED OnLine and use of the LEED Letter Templates is required. Registration and payment of registration fees will be by the Contractor. Administration/team management of the online project will be by the Contractor. Validation of credits will be accomplished by the Government. LEED certification of the project by the Contractor is required. The Contractor will obtain LEED certification prior to project closeout. Application, payment of certification of fees and all coordination with USGBC during the certification process will be by the Contractor. GBCI interim review of design phase data is not required by the Government but is recommended. Government validation during project execution does not relieve or modify in any way the Contractor’s responsibility to satisfy all requirements for certification as defined by LEED and GBCI. Contractor is not responsible for design phase LEED documentation of any unaltered portion of the design that is accomplished by others. If the project includes unaltered complete design by others, during the certification process Contractor will coordinate all GBCI comments on LEED credits that fall outside Contractor's scope of responsibility with the Government for coordination with the Designer of Record, and Contractor will not be penalized if project fails to achieve certification at the minimum required level due to loss of credits that are the responsibility of others.

6.14.4. Commissioning: See Appendix M for Owner's Project Requirements document(s).

6.14.5. LEED Credits Coordination. The following information is provided relative to Sustainable Sites and other credits.

SS Credit 1 Site Selection:

Project site IS NOT considered prime farmland.

Project site is five feet or more above 100-year flood elevation.

Project site contains no habitat for threatened or endangered species.

No portion of project site lies within 100 feet of any water, wetlands or areas of special concern.

Project site WAS NOT previously used as public parkland.

SS Credit 2 Development Density & Community Connectivity.

Project site DOES NOT meets the criteria for this credit.

SS Credit 3 Brownfield Redevelopment.

Project site DOES NOT meets the criteria for this credit.

SS Credit 4.1 Public Transportation Access.

Project site DOES NOT meets the criteria for this credit.

EA Credit 6 Green Power.

35% of the project's electricity WILL NOT will be provided through an Installation renewable energy contract. Do not purchase Renewable Energy Credits (REC's) to earn this credit.

MR Credit 2 Construction Waste Management.

The Installation has an on-post recycling facility.

Regional Priority Credits (Version 3 only)

The project zip code is 65473.

6.14.6. LEED Credit Preferences, Guidance and Resources. See Appendix L LEED Project Credit Guidance for supplemental information relating to individual credits.

6.14.7. Not Used

6.14.8. Additional Information

6.14.8.1 Contractor shall enter all justifications, calculations, and required data into the USGBC website that will support certification should it be sought later by the Government.

6.15. ENVIRONMENTAL

6.15.1 Ground disturbance activities is expected to exceed 1 acre, therefore, the requirements for construction stormwater permitting will apply. Please refer to the Environmental Appendix for additional requirements for the installation. Also please refer to the Demarcation Matrix Appendix to determine which of this section applies to the work being performed by the BCOF contractor.

6.15.2 The area contains potential roost trees (dead or dying trees w/ sloughing bark) for the Indiana bat, a Federally endangered species. These trees may only be removed during the period of 01 November thru 31 March.

6.15.3 All facilities must have backflow preventer on service line plus possible cross contamination sources.

6.15.4 All petroleum, oil, lubricants, hazardous materials, and hazardous waste in 55-gallon containers or larger must have **secondary containment** capable of holding at least 110% of the capacity of the largest container.

6.15.5 The **Spill Control Plan** shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 112, 40 CFR 265, 40 CFR 302, 40 CFR 355, and/or regulated under State or Local laws and regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan shall include the name of the individual who will report any spills or hazardous substance releases, and the individual who will follow up with complete documentation. *This individual shall immediately notify the Contracting Officer, the local Fire Department (911), and the Fort Leonard Wood Environmental Office (573/596-0882).*

See Appendix E, Environmental Requirements.

6.16. PERMITS

No additional requirements.

6.17. DEMOLITION

Demolition associated with this contract includes roads, site utilities and all other elements which will require demolition as part of site preparation. A construction and demolition waste diversion rate of 50% minimum is required. The disposal of any type of waste is not permitted on the Installation. The disposal of all material shall be the responsibility of the Contractor.

6.18. ADDITIONAL FACILITIES

None.

End of Section 01 10 00.0006

SECTION 01 33 00.0006
SUBMITTAL PROCEDURES
(DESIGN-BUILD TASK ORDERS)

1.0 GENERAL

1.13. GOVERNMENT APPROVED OR CONCURRED WITH SUBMITTALS

1.14. INFORMATION ONLY SUBMITTALS

1.0 GENERAL

1.1.1. This section contains requirements specifically applicable to this task order. The requirements of Base ID/IQ contract Section 01 33 30 apply to this task order, except as otherwise specified herein.

1.13. GOVERNMENT APPROVED OR CONCURRED WITH SUBMITTALS

Upon completion of review of submittals requiring Government approval or concurrence, the Government will stamp and date the submittals as approved or concurred. The Government will retain three (3) copies of the submittal and return one (1) copy(ies) of the submittal.

1.14. INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. The Government will retain two (2) copies of information only submittals.

End of Section 01 33 00.0006

SECTION 01 33 16
DESIGN AFTER AWARD

ATTACHMENT G DESIGN SUBMITTAL DIRECTORY AND SUBDIRECTORY FILE ARRANGEMENT

1.0 GENERAL INFORMATION

1.1. INTRODUCTION

1.1.1. The information contained in this section applies to the design required after award. After award, the Contractor will develop the accepted proposal into the completed design, as described herein.

1.1.2. The Contractor may elect to fast track the design and construction that is, proceed with construction of parts of the sitework and facilities prior to completion of the overall design. To facilitate fast tracking, the Contractor may elect to divide the design into no more than ten (10) design packages per major facility type and no more than three (3) design packages for site and associated work. Designate how it will package the design, consistent with its overall plan for permitting (where applicable) and construction of the project. See Sections 01 33 00 SUBMITTAL PROCEDURES and 01 32 01.00 10 PROJECT SCHEDULE for requirements for identifying and scheduling the design packaging plan in the submittal register and project schedule. See also Sections 01 10 00 STATEMENT OF WORK and 01 57 20.00 10 ENVIRONMENTAL PROTECTION for any specified permit requirements. If early procurement of long-lead item construction materials or installed equipment, prior to completion of the associated design package, is necessary to facilitate the project schedule, also identify those long-lead items and how it will assure design integrity of the associated design package to meet the contract requirements (The Contract consists of the Solicitation requirements and the accepted proposal). Once the Government is satisfied that the long-lead items meet the contract requirements, the Contracting Officer will allow the Contractor to procure the items at its own risk.

1.1.3. The Contractor may proceed with the construction work included in a separate design package after the Government has reviewed the final (100%) design submission for that package, review comments have been addressed and resolved to the Government's satisfaction and the Contracting Officer (or the Administrative Contracting Officer) has agreed that the design package may be released for construction.

1.1.4. INTEGRATED DESIGN. To the maximum extent permitted for this project, use a collaborative, integrated design process for all stages of project delivery with comprehensive performance goals for siting, energy, water, materials and indoor environmental quality and ensures incorporation of these goals. Consider all stages of the building lifecycle, including deconstruction.

1.2. DESIGNER OF RECORD

Identify, for approval, the Designer of Record (“DOR”) that will be responsible for each area of design. One DOR may be responsible for more than one area. Listed, Professional Registered, DOR(s) shall account for all areas of design disciplines shall be accounted for by a listed. The DOR’s shall stamp, sign, and date each design drawing and other design deliverables under their responsible discipline at each design submittal stage (see contract clause Registration of Designers). If the deliverables are not ready for release for construction, identify them as "preliminary" or "not for release for construction" or by using some other appropriate designation. The DOR(s) shall also be responsible for maintaining the integrity of the design and for compliance with the contract requirements through construction and documentation of the as-built condition by coordination, review and approval of extensions of design, material, equipment and other construction submittals, review and approval or disapproval of requested deviations to the accepted design or to the contract, coordination with the Government of the above activities, and by performing other typical professional designer responsibilities.

2.0 PRODUCTS (Not Applicable)

3.0 EXECUTION

3.1. PRE-WORK ACTIVITIES & CONFERENCES

3.1.1. Design Quality Control Plan

Submit for Government acceptance, a Design Quality Control Plan in accordance with Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL before design may proceed.

3.1.2. Post Award Conference

3.1.2.1. The government will conduct a post award contract administration conference at the project site, as soon as possible after contract award. This will be coordinated with issuance of the contract notice to proceed (NTP). The Contractor and major sub-contractor representatives shall participate. All designers need not attend this first meeting. Government representatives will include COE project delivery team members, facility users, facility command representatives, and installation representatives. The Government will provide an agenda, meeting goals, meeting place, and meeting time to participants prior to the meeting.

3.1.2.2. The post award conference shall include determination and introduction of contact persons, their authorities, contract administration requirements, discussion of expected project progress processes, and coordination of subsequent meetings for quality control (see Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL), Partnering (see below and SCR: Partnering), and the initial design conference (see below).

3.1.2.3. The government will introduce COE project delivery team members, facility users, facility command representatives, and installation representatives. The DB Contractor shall introduce major subcontractors, and other needed staff. Expectations and duties of each person shall be defined for all participants. A meeting roster shall be developed and distributed by the government with complete contact information including name, office, project role, phone, mailing and physical address, and email address.

3.1.3. Partnering & Project Progress Processes

3.1.3.1. The initial Partnering conference may be scheduled and conducted at any time with or following the post award conference. The Government proposes to form a partnership with the DB Contractor to develop a cohesive building team. This partnership will involve the COE project delivery team members, facility users, facility command representatives, installation representatives, Designers of Record, major subcontractors, contractor quality control staff, and contractor construction management staff. This partnership will strive to develop a cooperative management team drawing on the strengths of each team member in an effort to achieve a quality project within budget and on schedule. This partnership will be bilateral in membership and participation will be totally voluntary. All costs, excluding labor and travel expenses, shall be shared equally between the Government and the Contractor. The Contractor and Government shall be responsible for their own labor and travel costs. Normally, partnering meetings will be held at or in the vicinity of the project installation.

3.1.3.2. As part of the partnering process, the Government and Contractor shall develop, establish, and agree to comprehensive design development processes including conduct of conferences, expectations of design development at conferences, fast-tracking, design acceptance, Structural Interior Design (SID)/ Furniture, Fixtures & Equipment (FF&E) design approval, project closeout, etc. The government will explain contract requirements and the DB Contractor shall review their proposed project schedule and suggest ways to streamline processes.

3.1.4. Initial Design Conference

The initial design conference may be scheduled and conducted at the project installation any time after the post award conference, although it is recommended that the partnering process be initiated with or before the initial design conference. Any design work conducted after award and prior to this conference should be limited to site and is discouraged for other items. All Designers of Record shall participate in the conference. The purpose of the meeting is to introduce everyone and to make sure any needs the contractor has are assigned and due dates established as well as who will get the information. See also Attachment F, BUILDING INFORMATION MODELING REQUIREMENTS for discussion concerning the BIM Implementation Plan demonstration at this meeting. The DB Contractor shall conduct the initial design conference.

3.1.5. Pre-Construction Conference

Before starting construction activities, the Contractor and Government will jointly conduct a pre-construction administrative conference to discuss any outstanding requirements and to review local installation requirements for start of construction. It is possible there will be multiple Pre-Construction Conferences based on the content of the design packages selected by the Contractor. The Government will provide minutes of this meeting to all participants.

3.2. STAGES OF DESIGN SUBMITTALS AND OVER THE SHOULDER PROGRESS REVIEWS

The stages of design submittals described below define Government expectations with respect to process and content. The Contractor shall determine how to best plan and execute the design and review process for this project, within the parameters listed below. As a minimum, the Government expects to see at least one interim design submittal, at least one final design submittal before construction of a design package may proceed and at least one Design Complete submittal that documents the accepted design. The Contractor may sub-divide the design into separate packages for each stage of design and may proceed with construction of a package after the Government accepts the final design for that package. See discussion on waivers to submission of one or more intermediate design packages where the parties partner during the design process. See also Attachment F, BUILDING INFORMATION MODELING REQUIREMENTS for discussion concerning BIM and the various stages of design submittals and over-the-shoulder progress reviews.

3.2.1. Site/Utilities

To facilitate fast-track design-construction activities the contractor may submit a final (100%) site and utility design as the first design submittal or it may elect to submit interim and final site and utility design submittals as explained below. Following review, resolution, and incorporation of all Government comments, and submittal of a satisfactory set of site/utility design documents, after completing all other pre-construction requirements in this contract and after the pre-construction meeting, the Government will allow the Contractor to proceed with site development activities, including demolition where applicable, within the parameters set forth in the accepted design submittal. For the first site and utility design submission, whether an interim or final, the submittal review, comment, and resolution times from this specification apply, except that the Contractor shall allow the Government a 14 calendar day review period, exclusive of mailing time. No on-site construction activities shall begin prior to written Government clearance to proceed.

3.2.2. Interim Design Submittals

The Contractor may submit either a single interim design for review, representing a complete package with all design disciplines, or split the interim design into smaller, individual design packages as it deems necessary for fast-track construction purposes. As required in Section 01 32 01.00 10 PROJECT SCHEDULE, the Contractor shall schedule its design and construction packaging plan to meet the contract completion period. This submission is the Government's primary opportunity to review the design for conformance to the solicitation and to the accepted contract proposal and to the Building Codes at a point where required revisions may be still made, while minimizing lost design effort to keep the design on track with the contract requirements. The requirements for the interim design review submittals and review conferences are described hereinafter. This is not necessarily a hold point for the design process; the Contractor may designate the interim design submittal(s) as a snapshot and proceed with design development at its own risk. See below for a waiver, where the parties establish an effective over-the-shoulder progress review procedure through the partnering process that would eliminate the need for or expedite a formal intermediate design review on one or more individual design packages.

3.2.3. Over-the-Shoulder Progress Reviews

To facilitate a streamlined design-build process, the Government and the Contractor may agree to one-on-one reviewer or small group reviews, electronically, on-line (if available within the Contractor's standard design practices) or at the Contractor's design offices or other agreed location, when practicable to the parties. The Government and Contractor will coordinate such reviews to minimize or eliminate disruptions to the design process. Any data required for these reviews shall normally be provided in electronic format, rather than in hard copy. If the Government and Contractor establish and implement an effective, mutually agreeable partnering procedure for regular (e.g., weekly) over-the shoulder review procedures that allow the Government reviewers the opportunity to keep fully informed of the progress, contents, design intent, design documentation, etc. of the design package, the Government will agree to waive or to expedite the formal intermediate design review period for that package. The Contractor shall still be required to submit the required intermediate design documentation, however the parties may agree to how that material will be provided, in lieu of a formal consolidated submission of the package. It should be noted that Government funding is extremely limited for non-local travel by design reviewers, so the maximum use of virtual teaming methods must be used. Some possible examples include electronic file sharing, interactive software with on-line or telephonic conferencing, televideo conferencing, etc. The Government must still perform its Code and Contract conformance reviews, so the Contractor is encouraged to partner with the reviewers to find ways to facilitate this process and to facilitate meeting or bettering the design-build schedule. The Contractor shall maintain a fully functional configuration management system as described herein to track design revisions, regardless of whether or not there is a need for a formal intermediate design review. The formal intermediate review procedures shall form the contractual basis for the official schedule, in the event that the partnering process determines that the formal intermediate review process to be best suited for efficient project execution. However, the Government pledges to support and promote the partnering process to work with the Contractor to find ways to better the design schedule.

3.2.4. Final Design Submissions

This submittal is required for each design package prior to Government acceptance of that design package for construction. The requirements for the final design submittal review conferences and the Government's acceptance for start of construction are described herein after.

3.2.5. Design Complete Submittals

After the final design submission and review conference for a design package, revise the design package to incorporate the comments generated and resolved in the final review conferences, perform and document a back-check review and submit the final, design complete documents, which shall represent released for construction documents. The requirements for the design complete submittals are described hereinafter.

3.2.6. Holiday Periods for Government Review or Actions

Do not schedule meetings, Government reviews or responses during the last two weeks of December or other designated Government Holidays (including Friday after Thanksgiving). Exclude such dates and periods from any durations specified herein for Government actions.

3.2.7. Late Submittals and Reviews

If the Contractor cannot meet its scheduled submittal date for a design package, it must revise the proposed submittal date and notify the government in writing, at least one (1) week prior to the submittal, in order to accommodate the Government reviewers' other scheduled activities. If a design submittal is over one (1) day late in accordance with the latest revised design schedule, or if notification of a proposed design schedule change is less than seven (7) days from the anticipated design submission receipt date, the Government review period may be extended up to seven (7) days due to reviewers' schedule conflicts. If the Government is late in meeting its review commitment and the delay increases the Contractor's cost or delays completion of the project, the Suspension of Work and Defaults clauses provide the respective remedy or relief for the delay.

3.3. DESIGN CONFIGURATION MANAGEMENT

3.3.1. Procedures

Develop and maintain effective, acceptable design configuration management (DCM) procedures to control and track all revisions to the design documents after the Interim Design Submission through submission of the As-Built documents. During the design process, this will facilitate and help streamline the design and review schedule. After the final design is accepted, this process provides control of and documents revisions to the accepted design (See Special Contract Requirement: Deviating From the Accepted Design). The system shall include appropriate authorities and concurrences to authorize revisions, including documentation as to why the revision must be made. The DCM data shall be available to the Government reviewers at all times. The Contractor may use its own internal system with interactive Government concurrences, where necessary or may use the Government's "DrChecks Design Review and Checking System" (see below and Attachment C).

3.3.2. Tracking Design Review Comments

Although the Contractor may use its own internal system for overall design configuration management, the Government and the Contractor shall use the DrChecks Design Review and Checking System to initiate, respond to, resolve and track Government design compliance review comments. This system may be useful for other data which needs to be interactive or otherwise available for shared use and retrieval. See Attachment C for details on how to establish an account and set-up the DrChecks system for use on the project.

3.3.3. Design and Code Checklists

Develop and complete various discipline-specific checklists to be used during the design and quality control of each submittal. Submit these completed checklists with each design submittal, as applicable, as part of the project documentation. See Section 01 45 04.00 10 Contractor Quality Control, Attachment D for a Sample Fire Protection and Life Safety Code review checklist and Attachment E for LEED SUBMITTALS.

3.4. INTERIM DESIGN REVIEWS AND CONFERENCES

3.4.1. General

At least one interim design submittal, review and review conference is required for each design package (except that, per paragraph 3.2.1, the Contractor may skip the interim design submission and proceed directly to final design on the sitework and utilities package). The DB Contractor may include additional interim design conferences or over-the-shoulder reviews, as needed, to assure continued government concurrence with the design work. Include the interim submittal review periods and conferences in the project schedule and indicate what part of the design work is at what percentage of completion. The required interim design conferences shall be held when interim design requirements are reached as described below. See also Paragraph: **Over-the-Shoulder Progress Reviews** for a waiver to the formal interim design review.

3.4.2. Procedures

After receipt of an Interim Design submission, allow the Government fourteen (14) calendar days after receipt of the submission to review and comment on the interim design submittal. For smaller design packages, especially those that involve only one or a few separate design disciplines, the parties may agree on a shorter review period or alternative review methods (e.g., over-the–shoulder or electronic file sharing), through the partnering process. For each interim design review submittal, the COR will furnish, to the Contractor, a single consolidated, validated listing of all comments from the various design sections and from other concerned agencies involved in the review process using the DrChecks Design Review and Checking System. The review will be for conformance with the technical requirements of the solicitation and the Contractor's RFP proposal. If the Contractor disagrees technically with any comment or comments and does not intend to comply with the comment, he/she must clearly outline, with ample justification, the reasons for noncompliance within five (5) days after receipt of these comments in order that the comment can be resolved. Furnish disposition of all comments, in writing, through DrChecks. The Contractor is cautioned that if it believes the action required by any comment exceeds the requirements of this contract, that it should take no action and notify the COR in writing immediately. The Interim Review conference will be held for each design submittal at the installation. Bring the personnel that developed the design submittal to the review conference. The conference will take place the week after the receipt of the comments by the Contractor. For smaller fast-track packages that involve only a few reviewers, the parties may agree to alternative conferencing methods, such as teleconferencing, or televideo, where available, as determined through Partnering.

3.4.3. Conference Documentation

3.4.3.1. In order to facilitate and accelerate the Government code and contract conformance reviews, identify, track resolution of and maintain all comments and action items generated during the design process and make this available to the designers and reviewers prior to the Interim and subsequent design reviews.

3.4.3.2. The DB Contractor shall prepare meeting minutes and enter final resolution of all comments into DrChecks. Copies of comments, annotated with comment action agreed on, will be made available to all parties before the conference adjourns. Unresolved problems will be resolved by immediate follow-on action at the end of conferences. Incorporate valid comments. The Government reserves the right to reject design document submittals if comments are significant. Participants shall determine if any comments are critical enough to require further design development prior to government concurrence. Participants shall also determine how to proceed in order to obtain government concurrence with the design work presented.

3.5. INTERIM DESIGN REQUIREMENTS

Interim design deliverables shall include drawings, specifications, and design analysis for the part of design that the Contractor considers ready for review.

3.5.1. Drawings

Include comments from any previous design conferences incorporated into the documents to provide an interim design for the “part” submitted.

3.5.2. Design Analyses

3.5.2.1. The designers of record shall prepare and present design analyses with calculations necessary to substantiate and support all design documents submitted. Address design substantiation required by the applicable codes and references and pay particular attention to the following listed items:

3.5.2.2. For parts including sitework, include site specific civil calculations.

3.5.2.3. For parts including structural work, include structural calculations.

(a) Identify all loads to be used for design.

(b) Describe the method of providing lateral stability for the structural system to meet seismic and wind load requirements. Include sufficient calculations to verify the adequacy of the method.

(c) Provide calculations for all principal roof, floor, and foundation members and bracing and secondary members.

(d) Provide complete seismic analyses for all building structural, mechanical, electrical, architectural, and building features as dictated by the seismic zone for which the facility is being constructed.

(e) Computer generated calculations must identify the program name, source, and version. Provide input data, including loads, loading diagrams, node diagrams, and adequate documentation to illustrate the design. The schematic models used for input must show, as a minimum, nodes/joints, element/members, materials/properties, and all loadings, induced settlements/deflections, etc., and a list of load combinations. Include an output listing for maximum/minimum stresses/forces and deflections for each element and the reactions for each loading case and combination.

(f) See also the Security (Anti-Terrorism) requirements below for members subject to Anti-Terrorist Force Protection (ATFP) and Progressive Collapse requirements.

(g) Fully coordinate and integrate the overall structural design between two different or interfacing construction types, such as modular and stick-built or multistory, stacked modular construction. Provide substantiation of structural, consolidation/settlement analysis, etc., as applicable, through the interfaces.

3.5.2.4. For Security (Anti-Terrorism): Provide a design narrative and calculations where applicable, demonstrating compliance with each of the 22 standards in UFC 4-010-01, which includes Design of Buildings to Resist Progressive Collapse (use the most recent version of UFC 4-023-03, regardless of references to any specific version in UFC 4-010-01). Where sufficient standoff distance is not being provided, show calculations for blast resistance of the structural system and building envelope. Show complete calculations for members subjected to ATFP loads, e.g., support members of glazed items (jambs, headers, sills) connections of windows to support members and connections of support members to the rest of the structure. For 3 story and higher buildings, provide calculations to demonstrate compliance with progressive collapse requirements.

3.5.2.5. For parts including architectural work, include building floor area analysis.

3.5.2.6. For parts including mechanical work, include HVAC analysis and calculations. Include complete design calculations for mechanical systems. Include computations for sizing equipment, compressed air systems, air duct design, and U-factors for ceilings, roofs and exterior walls and floors. Contractor shall employ commercially available energy analysis techniques to determine the energy performance of all passive systems and features. Use of hourly energy load computer simulation is required (see paragraph 3.5.5.2 for list of acceptable software). Based on the results of calculations, provide a complete list of the materials and equipment proposed with the manufacturer's published cataloged product installation specifications and roughing-in data.

3.5.2.7. For parts including life safety, include building code analysis and sprinkler and other suppression systems. Notwithstanding the requirements of the Codes, address the following:

(a) A registered fire protection engineer (FPE) must perform all fire protection analyses. Provide the fire protection engineer’s qualifications. See Section 01 10 00, paragraph 5 for qualifications.

(b) Provide all references used in the design including Government design documents and industry standards used to generate the fire protection analysis.

(c) Provide classification of each building in accordance with fire zone, building floor areas and height and number of stories.

(d) Provide discussion and description of required fire protection requirements including extinguishing equipment, detection equipment, alarm equipment and water supply. Alarm and detection equipment shall interface to requirements of Electronic Systems.

(e) Provide hydraulic calculations based on water flow test for each sprinkler system to insure that flow and pressure requirements can be met with current water supply. Include copies of Contractor's water flow testing done to certify the available water source.

3.5.2.8. For parts including plumbing systems:

(a) List all references used in the design.

(b) Provide justification and brief description of the types of plumbing fixtures, piping materials and equipment proposed for use.

(c) Detail calculations for systems such as sizing of domestic hot water heater and piping; natural gas piping; LP gas piping and tanks, fuel oil piping and tanks, etc., as applicable.

(d) When the geotechnical report indicates expansive soils are present, indicate in the first piping design submittal how piping systems will be protected against damage or backfall/backflow due to soil heave (from penetration of slab to the 5 foot building line).

3.5.2.9. For elevator systems:

(a) List all criteria codes, documents and design conditions used.

(b) List any required permits and registrations for construction of items of special mechanical systems and equipment.

3.5.2.10. For parts including electrical work, include lighting calculations to determine maintained foot-candle levels, electrical load analysis and calculations, electrical short circuit and protective device coordination analysis and calculations and arc fault calculations.

3.5.2.11. For parts including telecommunications voice/data (including SIPRNET, where applicable), include analysis for determining the number and placement of outlets

3.5.2.12. For Cathodic Protection Systems, provide the following stamped report by the licensed corrosion engineer or NACE specialist with the first design submission. The designer must be qualified to engage in the practice of corrosion control of buried or submerged metallic surfaces. He/she must be accredited or certified by the National Association of Corrosion Engineers (NACE) as a NACE Accredited Corrosion Specialist or a NACE certified Cathodic Protection Specialist, or must be a registered professional engineer with a minimum of five years experience in corrosion control and cathodic protection, Clearly describe structures, systems or components in soil or water to be protected. Describe methods proposed for protection of each.

3.5.3. Geotechnical Investigations and Reports:

3.5.3.1. The contractor’s licensed geotechnical engineer shall prepare a final geotechnical evaluation report, to be submitted along with the first foundation design submittal. Make this information available as early as possible during the over-the-shoulder progress review process. Summarize the subsurface conditions and provide recommendations for the design of appropriate utilities, foundations, floor slabs, retaining walls, embankments, and pavements. Include compaction requirements for fill and backfill under buildings, sidewalks, other structures and open areas. Recommend foundation systems to be used, allowable bearing pressures for footings, lateral load resistance capacities for foundation systems, elevations for footings, grade beams, slabs, etc. Provide an assessment of post-construction settlement potential including total and differential. Provide recommendations regarding lateral earth pressures (active, at-rest, passive) to be used in the design of retaining walls. Include the recommended spectral accelerations and Site Class for seismic design along with an evaluation of any seismic hazards and recommendations for mitigation, if required. Include calculations to support the recommendations for bearing capacity, settlement, and pavement sections. Include supporting documentation for all recommended design parameters such as Site Class, shear strength, earth pressure coefficients, friction factors, subgrade modulus, California Bearing Ratio (CBR), etc. Provide earthwork recommendations, expected frost penetration, expected groundwater levels, recommendations for dewatering and groundwater control and the possible presence of any surface or subsurface features that may affect the construction of the project such as sinkholes, boulders, shallow rock, old fill, old structures, soft areas, or unusual soil conditions. Include pH tests, salinity tests, resistivity measurements, etc., required to design corrosion control and grounding systems. Include the raw field data. Arrange a meeting with the Government subsequent to completion and evaluation of the site specific geotechnical exploration to outline any differences encountered that are inconsistent with the Government provided preliminary soils information. Clearly outline differences which require changes in the foundation type, or pavement and earthwork requirements from that possible and contemplated using the Government furnished preliminary soils investigation, which result in a change to the design or construction. Any equitable adjustment is subject to the provisions of the contract’s Differing Site Conditions Clause.

3.5.3.2. Vehicle Pavements: The Contractor’s geotechnical report shall contain flexible and rigid pavement designs, as applicable for the project, including design CBR and modulus of subgrade reaction and the required compaction effort for subgrades and pavement layers. Provide Information on the types of base course materials available in the area and design strengths.

3.5.3.3. The Contractor and the professional geotechnical engineer consultant shall certify in writing that the design of the project has been developed consistent with the Contractor’s final geotechnical report. The certification shall be stamped by the consulting professional geotechnical engineer and shall be submitted with the first design submission. If revisions are made to the initial design submission, a new certification shall be provided with the final design submission.

3.5.4. LEED Documentation:

Assign a LEED Accredited Professional, responsible to track LEED planning, performance and documentation for each LEED credit through construction closeout. Incorporate LEED credits in the plans, specifications and design analyses. Develop LEED supporting documentation as a separable portion of the Design Analysis and provide with each required design submittal. Include the LEED Project checklist for each non-exempt facility (one checklist may be provided for multiple facilities in accordance with the LEED-NC Application Guide for Multiple Buildings and On-Campus Building Projects and the LEED SUBMITTALS (Attachment E, herein) with each submittal. Final design submittal for each portion of the work must include all required design documentation relating to that portion of work (example - all site credit design documents with final site design). Submittal requirements are as indicated in Attachment E, LEED SUBMITTALS. Submit all documentation indicated on Attachment E as due at final design at final design submittal (for fast-track projects with multiple final design submittals, this shall be at the last scheduled final design submittal). All project documentation related to LEED shall conform to USGBC requirements for both content and format, including audit requirements and be separate from other design analyses. Maintain and update the LEED documentation throughout project progress to construction closeout and shall compile product data, receipts, calculations and other data necessary to substantiate and support all credits claimed. The Government may audit any or all individual credits. Audit documentation is not required to be submitted unless requested. These requirements apply to all projects. If the project requires the Contractor to obtain USGBC certification, the Contractor shall also be responsible for obtaining USGBC certification and shall provide written evidence of certification with the construction closeout LEED documentation submittal. Install the USGBC building plaque at the location indicated by the Government upon receipt. If Contractor obtains USGBC interim design review, submit the USGBC review to the Government within 30 days of receipt for information only.

3.5.4.1. LEED Documentation for Technology Solution Set. If the Solicitation provides a Prescriptive Technology Solution Set, use of the Technology Solution set has no effect on LEED documentation requirements. Provide all required LEED documentation, including energy analysis, in accordance with LEED requirements when using the Technology Solution Set.

3.5.5. Energy Conservation:

3.5.5.1. Refer to Section 01 10 00, Paragraph 5. Interim and Final Design submittals shall demonstrate that each building including the building envelope, HVAC systems, service water heating, power, and lighting systems meet the Mandatory Provisions and the Prescriptive Path requirements of ASHRAE 90.1. Use Compliance Documentation forms available from ASHRAE and included in the ASHRAE 90.1 User’s Manual for this purpose. The Architectural Section of the Design Analysis shall include completed forms titled “Building Envelope

Compliance Documentation Parts I and II". The Heating Ventilating and Air Conditioning (HVAC) Section of the Design Analysis shall include a completed form titled "HVAC Simplified Approach Option - Part I" if this approach is allowed by the Standard. Otherwise, the HVAC Section of the Design Analysis shall include completed forms titled "HVAC Mandatory Provisions - Part II" and "HVAC Prescriptive Requirements - Part III". The Plumbing Section of the Design Analysis shall include a completed form titled "Service Water Heating Compliance Documentation". The Electrical Section of the Design Analysis shall include an explanatory statement on how the requirements of ASHRAE 90.1-2004 Chapter 8 Power were met. The Electrical Section of the Design Analysis shall also include a completed form titled "Lighting Compliance Documentation".

3.5.5.2. Interim and Final Design submittals which address energy consuming systems, (heating, cooling, service hot water, lighting, power, etc.) must also include calculations in a separate Energy Conservation Section of the Design Analysis which demonstrate and document (a) the baseline energy consumption for the facility or facilities under contract, that would meet the requirements of ANSI/ASHRAE/IESNA Standard 90.1 and (b) the energy consumption of the facility or facilities under contract utilizing the materials and methods required by this construction contract. Use the USGBC Energy and Atmosphere (EA) Credit 1 compliance template / form or an equivalently detailed form for documenting compliance with the energy reduction requirements. This template / form is titled PERFORMANCE RATING METHOD and is available when the project is registered for LEED. The calculation methodology used for this documentation and analysis shall follow the guidelines set forth in Appendix G of ASHRAE 90.1, with two exceptions: a) receptacle and process loads may be omitted from the calculation; and b) the definition of the terms in the formula for Percentage Improvement found in paragraph G1.2 are modified as follows: Baseline Building Performance shall mean the annual energy consumption calculated for a building design intended for use as a baseline for rating above standard design meeting the minimum requirements of the energy standard, and Proposed Building Performance shall mean annual energy consumption calculated for the proposed building design intended for construction. This calculation shall address all energy consuming systems in a single integrated methodology. Include laboratory fume hoods and kitchen ventilation loads in the energy calculation. They are not considered process loads. Individual calculations for heating, cooling, power, lighting, power, etc. systems will not be acceptable. The following building simulation software is acceptable for use in calculating building energy consumption: Hourly Analysis Program (HAP) by Carrier Corp., TRACE 700 by Trane Corp., DOE-2 by US Department of Energy, EnergyPlus by DOD/DOE.

3.5.6. Specifications

Specifications may be any one of the major, well known master guide specification sources (use only one source) such as MASTERSPEC from the American Institute of Architects, SPECTEXT from Construction Specification Institute or Unified Facility Guide Specifications (UFGS using MASTERFORMAT 2004 numbering system), etc. (including specifications from these sources). Manufacturers' product specifications, utilizing CSI's Manu-Spec, three part format may be used in conjunction with the selected specifications. The designers of record shall edit and expand the appropriate Specifications to insure that all project design requirements, current code requirements, and regulatory requirements are met. Specifications shall clearly identify, where appropriate, specific products chosen to meet the contract requirements (i.e., manufacturers' brand names and model numbers or similar product information).

3.5.7. Building Rendering

Present and provide a draft color computer, artist, or hand drawn rendering with the conceptual design submittal of the building exterior. Perspective renderings shall include a slightly overhead view of the entire building to encompass elevations and the roof configuration of the building. After Government review and acceptance, provide a final rendering, including the following:

Three (3) 18" x 24" color prints, framed and matted behind glass with project title underneath the print.

One (1) Image file (high resolution) in JPG format on CD for those in the submittal distribution list.

3.5.8. Interim Building Design Contents

The following list represents what the Government considers should be included in the overall completed design for a facility or project. It is not intended to limit the contractor from providing different or additional information as needed to support the design presented, including the require design analyses discussed above. As the Contractor develops individual design packages and submits them for Interim review, include as much of the applicable information for an individual design package as is developed at the Interim design level for review purposes. These pieces shall be developed as the design progresses toward the design complete stage.

3.5.8.1. Lawn and Landscaping Irrigation System

3.5.8.2. Landscape, Planting and Turfing

3.5.8.3. Architectural

(a) Design Narrative

(b) Architectural Floor Plans, Typical Wall and Roof Sections, Elevations

(c) Finish schedule

(d) All required equipment

(e) Special graphics requirements

(f) Door and Window Schedules

(g) Hardware sets using BHMA designations

(h) Composite floor plan showing all pre-wired workstations

(i) Structural Interior Design (SID) package: See ATTACHMENT A for specific requirements

(j) Furniture, Fixtures & Equipment (FF&E) design package: See ATTACHMENT B for specific requirements

3.5.8.4. Structural Systems. Include:

(a) Drawings showing principal members for roof and floor framing plans as applicable

(b) Foundation plan showing main foundation elements where applicable

(c) Typical sections for roof, floor, and foundation conditions

3.5.8.5. Plumbing Systems

(a) Show locations and general arrangement of plumbing fixtures and major equipment

(b) Plan and isometric riser diagrams of all areas including hot water, cold water, waste and vent piping. Include natural gas (and meter as required), (natural gas and meter as required), (LP gas), (fuel oil) and other specialty systems as applicable.

(c) Include equipment and fixture connection schedules with descriptions, capacities, locations, connection sizes and other information as required

3.5.8.6. HVAC Systems

(a) Mechanical Floor Plans: The floor plans shall show all principle architectural features of the building which will affect the mechanical design. The floor plans shall also show the following:

(1) Room designations.

(2) Mechanical legend and applicable notes.

(3) Location and size of all ductwork and piping.

(4) Location and capacity of all terminal units (i.e., registers, diffusers, grilles, hydronic baseboards).

(5) Pre-Fabricated Paint Spray Booth (where applicable to project scope)

(6) Paint Preparation Area (where applicable to project scope)

(7) Exhaust fans and specialized exhaust systems.

(8) Thermostat location.

(9) Location of heating/cooling plant (i.e., boiler, chiller, cooling tower, etc).

(10) Location of all air handling equipment.

(11) Air balancing information.

(12) Flue size and location.

(13) Piping diagram for forced hot water system (if used).

(b) Equipment Schedule: Provide complete equipment schedules. Include:

(1) Capacity

(2) Electrical characteristics

(3) Efficiency (if applicable)

(4) Manufacturer's name

(5) Optional features to be provided

(6) Physical size

(7) Minimum maintenance clearances

(a) Details: Provide construction details, sections, elevations, etc., only where required for clarification of methods and materials of design.

(b) HVAC Controls: Submit complete HVAC controls equipment schedules, sequences of operation, wiring and logic diagrams, Input/Output Tables, equipment schedules, and all associated information. See the Statement of Work for additional specific requirements.

3.5.8.7. Fire Protection and Life Safety.

(a) Provide plan for each floor of each building that presents a compendium of the total fire protection features being incorporated into the design. Include the following types of information:

(1) The location and rating of any fire-resistive construction such as occupancy separations, area separations, exterior walls, shaft enclosures, corridors, stair enclosures, exit passageways, etc.

(2) The location and coverage of any fire detection systems

(3) The location and coverage of any fire suppression systems (sprinkler risers, standpipes, etc.)

(4) The location of any other major fire protection equipment

(5) Indicate any hazardous areas and their classification

(6) Schedule describing the internal systems with the following information: fire hazard and occupancy classifications, building construction type, GPM/square foot sprinkler density, area of operation and other as required

(b) Working plans and all other materials submitted shall meet NFPA 13 requirements, with respect to required minimum level of detail.

3.5.8.8. Elevators. Provide:

(a) Description of the proposed control system

(b) Description, approximate capacity and location of any special mechanical equipment for elevators.

3.5.8.9. Electrical Systems.

(a) Electrical Floor Plan(s): Show all principle architectural features of the building which will affect the electrical design. Show the following:

(1) Room designations.

(2) Electrical legend and applicable notes.

(3) Lighting fixtures, properly identified.

(4) Switches for control of lighting.

(5) Receptacles.

(6) Location and designation of panelboards. Clearly indicate type of mounting required (flush or surface) and reflect accordingly in specifications.

(7) Service entrance (conduit and main disconnect).

(8) Location, designation and rating of motors and/or equipment which requires electrical service. Show method of termination and/or connection to motors and/or equipment. Show necessary junction boxes, disconnects, controllers (approximate only), conduit stubs, and receptacles required to serve the motor and/or equipment.

(b) Building Riser Diagram(s) (from pad-mounted transformer to unit load center panelboard): Indicate the types and sizes of electrical equipment and wiring. Include grounding and metering requirements.

(c) Load Center Panelboard Schedule(s): Indicate the following information:

(1) Panelboard Characteristics (Panel Designation, Voltage, Phase, Wires, Main Breaker Rating and Mounting.

(2) Branch Circuit Designations.

(3) Load Designations.

(4) Circuit Breaker Characteristics. (Number of Poles, Trip Rating, AIC Rating)

(5) Branch Circuit Connected Loads (AMPS).

(6) Special Features

(d) Lighting Fixture Schedule(s): Indicate the following information:

(1) Fixture Designation.

(2) General Fixture Description.

(3) Number and Type of Lamp(s).

(4) Type of Mounting.

(5) Special Features.

(e) Details: Provide construction details, sections, elevations, etc. only where required for clarification of methods and materials of design.

3.5.8.10. Electronic Systems including the following responsibilities:

(a) Fire Detection and Alarm System. Design shall include layout drawings for all devices and a riser diagram showing the control panel, annunciator panel, all zones, radio transmitter and interfaces to other systems (HVAC, sprinkler, etc.)

(b) Fire Suppression System Control. Specify all components of the Fire Suppression (FS) System in the FS section of the specifications. Clearly describe how the system will operate and interact with other systems such as the fire alarm system. Include a riser diagram on the drawings showing principal components and interconnections with other systems. Include FS system components on drawing legend. Designate all components shown on floor plans “FS system components” (as opposed to “Fire Alarm components”). Show location of FS control panels, HVAC control devices, sensors, and 120V power panel connections on floor plans. Indicate zoning of areas by numbers (1, 2, 3) and detectors sub-zoned for cross zoning by letter designations (A and B). Differentiate between ceiling mounted and under floor detectors with distinct symbols and indicate sub-zone of each.

(c) Public Address System

(d) Special Grounding Systems. Completely reflect all design requirements in the specifications and drawings. Specifications shall require field tests (in the construction phase), witnessed by the Government, to determine the effectiveness of the grounding system. Include drawings showing existing construction, if any.

(e) Cathodic Protection.

(f) Intrusion Detection, Card Access System

(g) Central Control and Monitoring System

(h) Mass Notification System

(i) Electrical Power Distribution Systems

3.5.8.11. Separate detailed Telecommunications drawings for Information Systems including the following responsibilities:

(a) Telecommunications Cabling

(b) Supporting Infrastructure

(a) Outside Plant (OSP) Cabling - Campus or Site Plans - Exterior Pathways and Inter-Building Backbones

(a) Include a layout of the voice/data outlets (including voice only wall & pay phones) on telecommunication floor plan drawing, location of SIPRNET data outlets (where applicable), and a legend and symbol definition to indicate height above finished floor. Show size of conduit and cable type and size on Riser Diagram. Do not show conduit runs between backboard and outlets on the floor plans. Show underground distribution conduit and cable with sizing from point of presence to entrance facility of building.

(b) Layout of complete building per floor - Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways including Serving Zones Drawings - Drop Locations and Cable ID's

(c) Communication Equipment Rooms - Plan Views - Tech and AMEP/Elevations - Racks and Walls. Elevations with a detailed look at all telecomm rooms. Indicate technology layout (racks, ladder-racks, etc.), mechanical/electrical layout, rack elevation and backboard elevation. They may also be an enlargement of a congested area of T1 or T2 series drawing.

3.6. FINAL DESIGN REVIEWS AND CONFERENCES

A final design review and review conference will be held upon completion of final design at the project installation, or – where equipment is available - by video teleconference or a combination thereof, for any design package to receive Government acceptance to allow release of the design package for construction. For smaller separate design packages, the parties may agree on alternative reviews and conferences (e.g., conference calls and electronic file sharing, etc.) through the Partnering process. Include the final design conference in the project schedule and shall indicate what part of the design work is at 100% completion. The final design conference will be held after the Government has had seven (7) calendar days after receipt of the submission to review the final design package and supporting data. For smaller packages, especially those involving only one or a few design disciplines the parties may agree on a shorter period.

3.7. FINAL DESIGN REQUIREMENTS

Final design deliverables for a design package shall consist of 100% complete drawings, specifications, submittal register and design analyses for Government review and acceptance. The 100% design submission shall consist of drawings, specifications, updated design analyses and any permits required by the contract for each package submitted. In order to expedite the final design review, prior to the conference, ensure that the design configuration management data and all review comment resolutions are up-to-date. Include the 100% SID and 100% FF&E binders for government approval. The Contractor shall have performed independent technical reviews (ITR's) and back-checks of previous comment resolutions, as required by Section 01 45 04.00 10 CONTRACTOR QUALITY CONTROL, including providing documentation thereof.

3.7.1. Drawings

3.7.1.1. Submit drawings complete with all contract requirements incorporated into the documents to provide a 100% design for each package submitted.

3.7.1.2. Prepare all drawings with the Computer-Aided Design and Drafting (CADD)/Computer-Aided Design (CAD) system, organized and easily referenced electronically, presenting complete construction information.

3.7.1.3. Drawings shall be complete. The Contractor is encouraged to utilize graphics, views, notes, and details which make the drawings easier to review or to construct but is also encouraged to keep such materials to those that are necessary.

3.7.1.4. Provide detail drawings that illustrate conformance with the contract. Include room finish schedules, corresponding color/finish/special items schedules, and exterior finish schedules that agree with the submitted SID binders.

3.7.1.5. The design documents shall be in compliance with the latest version of the A/E/C CADD Standard, available at https://cadbim.usace.army.mil/CAD. Use the approved vertical Corps of Engineers title blocks and borders on all drawings with the appropriate firm name included within the title block area.

3.7.1.6. CAD System and Building Information Modeling (BIM) (NOTE: If this is a Single Award or Multiple Award, Indefinite Delivery/Indefinite Quantity Contract, this information will be provided for each task order.)

All CAD files shall be fully compatible with MicroStation V8 or higher. Save all design CAD files as MicroStation V8 or higher files. All submitted BIM Models and associated Facility Data shall be fully compatible with Bentley BIM file format and the USACE Bentley BIM v8 Workspace.

(a) CAD Data Final File Format: During the design development capture geo-referenced coordinates of all changes made to the existing site (facility footprint, utility line installations and alterations, roads, parking areas, etc) as a result of this contract. There is no mandatory methodology for how the geo-referenced coordinates will be captured, however, Engineering and Construction Bulletin No. 2006-15, Subject: Standardizing Computer Aided Design (CAD) and Geographic Information Systems (GIS) Deliverables for all Military Design and Construction Projects identifies the format for final as-built drawings and data sets to be delivered to the government. Close-out requirements at the as-built stage; require final geo-referenced GIS Database of the new facility along with all exterior modifications. The Government will incorporate this data set into the Installation's GIS Masterplan or Enterprise GIS System. See also, Section 01 78 02.00 10 Closeout Submittals.

(b) Electronic Drawing Files: In addition to the native CAD design files, provide separate electronic drawing files (in editable CAD format and Adobe Acrobat PDF version 7.0 or higher) for each project drawing.

(c) Each file (both CAD and PDF) shall represent one complete drawing from the drawing set, including the date, submittal phase, and border. Each drawing file shall be completely independent of any data in any other file, including fonts and shapes not included with the basic CAD software program utilized. Drawing files with external references or special fonts are not acceptable. All displayed graphic elements on all levels of the drawing files shall be part of the project drawing image. The drawing files shall not contain any graphic element that is not part of the drawing image.

(d) Deliver BIM Model and associated Facility Data files in their native format. At a minimum, BIM files shall address major architecture design elements, major structural components, mechanical systems and electrical/communication distribution and elements as defined in Attachment F. See Attachment F for additional BIM requirements.

(e) Drawing Index: Provide an index of drawings sheet in CAD as part of the drawing set, and an electronic list in Microsoft Excel of all drawings on the CD. Include the electronic file name, the sheet reference number, the sheet number, and the sheet title, containing the data for each drawing.

(f) Hard Copies: Plot submitted hard copy drawings directly from the "electronic drawing files" and copy for quantities and sizes indicated in the distribution list at the end of this specification section. The Designers of Record shall stamp, sign and date original hard copy sheets as Released For Construction, and provide copies for distribution from this set.

3.7.2. Design Analyses

3.7.2.1. The designers of record shall update, finalize and present design analyses with calculations necessary to substantiate and support all design documents submitted.

3.7.2.2. The responsible DOR shall stamp, sign and date the design analysis. Identify the software used where, applicable (name, version, vendor). Generally, provide design analyses, individually, in an original (file copy) and one copy for the assigned government reviewer.

3.7.2.3. All disciplines review the LEED design analysis in conjunction with their discipline-specific design analysis; include a copy of the separable LEED design analysis in all design analysis submittals.

3.7.2.4. Do not combine multi-disciplined volumes of design-analysis, unless multiple copies are provided to facilitate multiple reviewers (one copy per each separate design analysis included in a volume).

3.7.3. Specifications

Specifications shall be 100% complete and in final form.

3.7.4. Submittal Register

Prepare and update the Submittal Register and submit it with the 100% design specifications (see Specification Section 01 33 00, SUBMITTAL PROCEDURES) with each design package. Include the required submittals for each specification section in a design package in the submittal register.

3.7.5. Preparation of DD Form 1354 (Transfer of Real Property)

This form itemizes the types, quantities and costs of various equipment and systems that comprise the project, for the purpose of transferring the new construction project from the Corps Construction Division to the Installation's inventory of real property. The Government will furnish the DB Contractor's design manager a DD Form 1354 checklist to use to produce a draft Form 1354. Submit the completed checklist and prepared draft Form DD 1354 with the 100% design in the Design Analysis. The Corps will use these documents to complete the final DD 1354 upon completion of construction.

3.7.6. Acceptance and Release for Construction

3.7.6.1. At the conclusion of the Final Design Review (after resolutions to the comments have been agreed upon between DOR and Government reviewers), the Contracting Officer or the ACO will accept the Final Design Submission for the design package in writing and allow construction to start for that design package. The Government may withhold acceptance until all major corrections have been made or if the final design submission requires so many corrections, even though minor, that it isn't considered acceptably complete.

3.7.6.2. Government review and acceptance of design submittals is for contract conformance only and shall not relieve the Contractor from responsibility to fully adhere to the requirements of the contract, including the Contractor's accepted contract proposal, or limit the Contractor's responsibility of design as prescribed under Special Contract Requirement: "Responsibility of the Contractor for Design" or limit the Government's rights under the terms of the contract. The Government reserves the right to rescind inadvertent acceptance of design submittals containing contract deviations not separately and expressly identified in the submittal for Government consideration and approval.

3.8. DESIGN COMPLETE CONSTRUCTION DOCUMENT REQUIREMENTS

After the Final Design Submission and Review Conference and after Government acceptance of the Final Design submission, revise the design documents for the design package to incorporate the comments generated and resolved in the final review conference, perform and document a back-check review and submit the final, design complete documents. Label the final design complete documents "FOR CONSTRUCTION" or use similar language. In addition to the final drawings and specifications, the following deliverables are required for distribution and field use. The deliverable includes all documentation and supporting design analysis in final form, as well as the final review comments, disposition and the back-check. As part of the quality assurance process, the Government may perform a back-check of the released for construction documentation. Promptly correct any errors or omissions found during the Government back-check. The Government may withhold retainage from progress payments for work or materials associated with a final design package until this submittal has been received and the Government determines that it is complete.

3.9. SUBMITTAL DISTRIBUTION, MEDIA AND QUANTITIES

3.9.1. Submittal Distribution and Quantities

General: The documents which the Contractor shall submit to the Government for each submittal are listed and generally described in preceding paragraphs in this Section. Provide copies of each design submittal and design substantiation as follows (NOTE: If this is a Single Award or Multiple Award, Indefinite Delivery/Indefinite Quantity Contract, this information will be provided for each task order):

Activity and Address	Drawing Size (Full Size) **22 X 34** Full Sets/ *Partial Sets	Design Analyses & Specs Full Sets/ *Partial Sets	Drawing Size (Half Size) **11 X 17** Full Sets/ *Partial Sets	Non-BIM Data CD-ROM or DVD as Necessary (PDF& **.dgn**)	Furniture Submittal (FFE)	Structural Interior Design Submittal	BIM Data DVD (Per Attach F)
Commander, U.S.Army Engineer District **[Not Supplied - DistrictInfoGeneral : CONSTRUCTION_DISTRICT]**	1/1	5/2	5/2	4	1	1	1
Commander, U.S.Army Engineer District, Center of Standardization **Fort Worth District**	1/0	5/2	5/2	6	1	1	1
Installation	1/0	10/0	10/0	10	2	2	10
U.S.Army Corps of Engineers Construction Area Office	3/2	3/2	3/2	3	3	3	1
Information Systems Engineering Command (ISEC)	0/0	0/1	0/0	1	1 (Electronic only)	N/A	1
Other Offices	0/0	3/3	3/3	3	1	2	0

***NOTE: For partial sets of drawings, specifications and design analyses, see paragraph 3.9.3.3, below.**

****NOTE: When specified below in 3.9.2, furnish Installation copies of Drawings as paper copies, in lieu of the option to provide secure web-based submittals.**

3.9.2. Web based Design Submittals

Except for full or half-sized drawings for Installation personnel, as designated in the Table above, Web based design submittals will be acceptable as an alternative to the paper copies listed in the Table above, provided a single hard-copy PDF based record set is provided to the Contracting Officer for record purposes. Where the contract requires the Contractor to submit documents to permitting authorities, still provide those authorities paper copies (or in an alternate format where required by the authority). Web based design submittal information shall be provided with adequate security and availability to allow unlimited access those specifically authorized to Government reviewers while preventing unauthorized access or modification. File sizes must be of manageable size for reviewers to quickly download or open on their computers. As a minimum, drawings shall be full scale on American National Standards Institute (ANSI) D sheets (34" x 22"). In addition to the optional website, provide the

BIM data submission on DVD to each activity and address noted above in paragraph 3.9.1 for each BIM submission required in Attachment F.

3.9.3. Mailing of Design Submittals

3.9.3.1. Mail all design submittals to the Government during design and construction, using an overnight mailing service. The Government will furnish the Contractor addresses where each copy shall be mailed to after award of the contract (or individual task order if this is an indefinite delivery/indefinite quantity, task order contract). Mail the submittals to four (4) different addresses. Assemble drawing sheets, specs, design analyses, etc. into individual sets; do not combine duplicate pages from individual sets so that the government has to assemble a set.

3.9.3.2. Each design submittal shall have a transmittal letter accompanying it indicating the date, design percentage, type of submittal, list of items submitted, transmittal number and point of contact with telephone number.

3.9.3.3. Provide partial sets of drawings, specifications, design analyses, etc., as designated in the Table in paragraph 3.9.1, to those reviewers who only need to review their applicable portions of the design, such as the various utilities. The details of which office receives what portion of the design documentation will be worked out after award.

3.10. AS-BUILT DOCUMENTS

Provide as-built drawings and specifications in accordance with Section 01 78 02.00 10, CLOSEOUT SUBMITTALS. Update LEED design phase documentation during construction as needed to reflect construction changes and advancing project completion status (example - Commissioning Plan updates during construction phase) and include updated LEED documentation in construction closeout submittal.

ATTACHMENT A
STRUCTURAL INTERIOR DESIGN (SID) REQUIREMENTS

1.0 GENERAL INFORMATION

Structural Interior Design includes all building related elements and components generally part of the building itself, such as wall finishes, ceilings finishes, floor coverings, marker/bulletin boards, blinds, signage and built in casework. Develop the SID in conjunction with the furniture footprint.

2.0 STRUCURAL INTERIOR DESIGN (SID) REQUIREMENTS FOR THE INTERIM AND FINAL DESIGN SUBMITTALS

2.1. FORMAT AND SCHEDULE

Prepare and submit for approval an interior and exterior building finishes scheme for an interim design submittal. The DOR shall meet with and discuss the finish schemes with the appropriate Government officials prior to preparation of the schemes to be presented. Present original sets of the schemes to reviewers at an interim design conference.

At the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers, the Contractor may proceed to final design with the interior finishes scheme presented.

The SID information and samples are to be submitted in 8 ½” x 11” format using three ring binders with pockets on the inside of the cover. When there are numerous pages with thick samples, use more than one binder. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½”. Provide cover and spine inserts sheets identifying the document as “Structural Interior Design” package. Include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

Design submittal requirements include, but are not limited to:

2.1.1. Narrative of the Structural Interior Design Objectives

The SID shall include a narrative that discusses the building related finishes. Include topics that relate to base standards, life safety, sustainable design issues, aesthetics, durability and maintainability, discuss the development and features as they relate to the occupants requirements and the building design.

2.1.2. Interior Color Boards

Identify and key each item item on the color boards to the contract documents to provide a clear indication of how and where each item will be used. Arrange finish samples to the maximum extent possible by room type in order to illustrate room color coordination. Label all samples on the color boards with the manufacturer’s name, patterns and colors name and number. Key or code samples to match key code system used on contract drawings.

Material and finish samples shall indicate true pattern, color and texture. Provide photographs or colored photocopies of materials or fabrics to show large overall patterns in conjunction with actual samples to show the actual colors. Finish samples must be large enough to show a complete pattern or design where practical.

Color boards shall include but not be limited to original color samples of the following:

All walls finishes and ceiling finishes, including corner guards, acrylic wainscoting and wall guards/chair rail finishes

All tile information, including tile grout color and tile patterns.

- All flooring finishes, including patterns.
- All door, door frame finishes and door hardware finishes
- All signage, wall base, toilet partitions, locker finishes and operable/folding partitions and trim

- All millwork materials and finishes (cabinets, counter tops, etc.)
- All window frame finishes and window treatments (sills, blinds, etc.)

Color board samples shall reflect all actual finish textures, patterns and colors required as specified. Patterned samples shall be of sufficient size to adequately show pattern and its repeat if a repeat occurs.

2.1.3. Exterior Color Boards

Prepare exterior finishes color boards in similar format as the interior finishes color boards, for presentation to the reviewers during an interim design conference. Provide original color samples of all exterior finishes including but not limited to the following:

- All Roof Finishes
- All Brick and Cast Stone Samples
- All Exterior Insulation and Finish Samples
- All Glass Color Samples
- All Exterior Metals Finishes
- All Window & Door Frame Finishes
- All Specialty Item Finishes, including trim

Identify each item on the exterior finishes color boards and key to the building elevations to provide a clear indication of how and where each item will be used.

2.2. STRUCTURAL INTERIOR DESIGN DOCUMENTS

2.2.1. General

Structural interior design related drawings must indicate the placement of extents of SID material, finishes and colors and must be sufficiently detailed to define all interior work. The following is a list of minimum requirements:

2.2.2. Finish Color Schedule

Provide finish color schedule(s) in the contract documents. Provide a finish code, material type, manufacturer, series, and color designations. Key the finish code to the color board samples and drawings.

2.2.3. Interior Finish Plans

Indicate wall and floor patterns and color placement, material transitions and extents of interior finishes.

2.2.4. Furniture Footprint Plans

Provide furniture footprint plans showing the outline of all freestanding and systems furniture for coordination of all other disciplines.

2.2.5. Interior Signage

Include interior signage plans or schedules showing location and quantities of all interior signage. Key each interior sign to a quantitative list indicating size, quantity of each type and signage text.

2.2.6. Interior Elevations, Sections and Details

Indicate material, color and finish placement.

ATTACHMENT B
FURNITURE, FIXTURES & EQUIPMENT (FF&E) REQUIREMENTS

1.0 FF&E REQUIREMENTS FOR THE INTERIM AND FINAL DESIGN SUBMITTALS

1.1. FORMAT AND SCHEDULE

Prepare and submit for approval a comprehensive FF&E scheme for an interim design submittal. The Contractor's interior designer, not a furniture dealer, shall develop the design. FF&E is the selection, layout, specification and documentation of furniture includes but is not limited to workstations, seating, tables, storage and shelving, filing, trash receptacles, clocks, framed artwork, artificial plants, and other accessories. Contract documentation is required to facilitate pricing, procurement and installation. The FF&E package is based on the furniture footprint developed in the Structural Interior Design (SID) portion of the interior design. Develop the FF&E package concurrently with the building design to ensure that there is coordination between the electrical outlets, switches, J-boxes, communication outlets and connections, and lighting as appropriate. In addition, coordinate layout with other building features such as architectural elements, thermostats, location of TV's, GF/GI equipment (for example computers, printers, copiers, shredders, faxes), etc. Locate furniture in front of windows only if the top of the item falls below the window and unless otherwise noted, do not attach furniture including furniture systems to the building. If project has SIPRNET and/or NIPRNET, coordinate furniture layout with SIPRNET and NIPRNET separation requirements. Verify that access required by DOIM for SIPRNET box and conduit is provided. The DOR shall interview appropriate Government personnel to determine FF&E requirements for furniture and furnishings prior to preparation of the scheme to be presented. Determine FFE items and quantities by, but not limited to: (1) the number of personnel to occupy the building, (2) job functions and related furniture/office equipment to support the job function, (3) room functions, (4) rank and grade. Present original sets of the scheme to reviewers at an interim design conference upon completion of the interim architectural submittal or three months prior to the submittal of the final FF&E package (whichever comes first).

Design may proceed to final with the FF&E scheme presented at the conclusion of the interim phase, after resolutions to the comments have been agreed upon between DOR and Government reviewers.

Provide six copies of the electronic versions of all documents upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first), to ensure adequate time for furniture acquisition. Provide unbound, electronic drawings in CAD and BIM. Provide all files needed to v,/iew complete drawings. Submit all text documents in Microsoft Word or Excel..

Submit three copies of the final and complete FF&E information and samples in 8 ½" x 11" format using three ring binders with pockets on the inside of the cover upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first). Use more than one binder when there are numerous pages with thick samples. Large D-ring binders are preferred to O-ring binders. Use page protectors that are strong enough to keep pages from tearing out for upholstery and finish boards. Anchor large or heavy samples with mechanical fasteners, Velcro, or double-faced foam tape rather than rubber cement or glue. Fold out items must have a maximum spread of 25 ½". Provide cover and spine inserts sheets identifying the document as "Furniture, Fixtures & Equipment" package and include the project title and location, project number, Contractor/A/E name and phone number(s), submittal stage and date.

Provide electronic copies of all documents upon completion of the final architectural submittal or ten months prior to the contract completion date (whichever comes first), to ensure adequate time for furniture acquisition. Provide six compact disks with all drawings files needed to view the complete drawings unbound and in the latest version AutoCAD. Provide six additional compact disks of all text documents in Microsoft Word or Excel.

Design submittal requirements include, but are not limited to:

1.1.1. Narrative of Interior Design Objectives

Provide a narrative description of the furniture, to include functional, safety and ergonomic considerations, durability, sustainability, aesthetics, and compatibility with the building design.

1.1.2. Furniture Order Form

Prepare one Furnishings Order Form for each item specified in the design. This form identifies all information required to order each individual item. In addition to the project name and location, project number, and submittal phase, the order form must include:

(a) Furniture item illustration and code

(b) Furniture item name

(c) Job name, location, and date

(d) General Services Administration (GSA) FSC Group, part, and section

(e) Manufacturer, Product name and Product model number or National Stock Number (NSN)

(f) Finish name and number (code to finish samples)

(g) Fabric name and number, minimum Wyzenbeek Abrasion Test double rubs (code to fabric samples)

(h) Dimensions

(i) Item location by room number and room name

(j) Quantity per room

(k) Total quantity

(l) Special instructions for procurement ordering and/or installation (if applicable)

(m) Written Product Description: include a non-proprietary paragraph listing the salient features of the item to include but not limited to:

(1) required features and characteristics

(2) ergonomic requirements

(3) functional requirements

(4) testing requirements

(5) furniture style

(6) construction materials

(7) minimum warranty

The following is an example for “m” features and characteristics, ergonomic requirements and functional requirements:

Chair Description:

(1) Mid-Back Ergonomic Task Chair

(2) Pneumatic Gaslift; Five Star Base

(3) Mesh Back; Upholstered Seat

(4) Height and Width Adjustable Task Arms:

a. Arm Height: 6”- 11” (+-1/2”)

b. Arm Width: 2”– 4” adjustment

(5) Height Adjustable Lumbar Support

(6) Adjustable Seat Height 16”-21” (+- 1”)

(7) Sliding Seat Depth Adjustment 15”-18” (+-1”)

(8) Standard Hard Casters (for carpeted areas)

(9) Overall Measurements:

a. Overall width: 25” - 27”

b. Overall depth: 25”– 28”

(10) Must have a minimum of the following adjustments (In addition to the above):

a. 360 Degree Swivel

b. Knee-Tilt with Tilt Tension

c. Back angle

d. Forward Tilt

e. Forward Tilt and Upright Tilt Lock

For projects with systems furniture, also provide a written description of the following minimum requirements:

(1) Type furniture systems (panel, stacking panels, spine wall, desk based system, or a combination)

(2) Minimum noise reduction coefficient (NRC)

(3) Minimum sound transfer coefficient (STC)

(4) Minimum flame spread and smoke development

(5) UL testing for task lighting and electrical system

(6) Panel widths and heights and their locations (this may be done on the drawings)Worksurface types and sizes (this may be done on the drawings)

(7) Worksurface edge type

(8) Varying panel/cover finish materials and locations (locations may be shown on the drawings)

(9) Storage requirements

(10) Keyboard requirements

(11) Lock and keying requirements

(12) Accessory components (examples: tack boards, marker boards, paper management)

(13) Electrical and communication raceway requirement; type, capacity and location (base, beltline, below and/or above beltline)

(14) Locations of communication cables (base, beltline, below and/or above beltline, top channel)

(15) Types of electrical outlets

(16) Types of communication jacks; provided and installed by others

(17) Locations of electrical outlets and communication jacks (this may be done on the drawings)

(18) Type of cable (examples: Cat. 5, Cat. 6, fiber optic; UTP or STP, etc.) system needs to support; provided and installed by others

1.1.3. Alternate Manufacturer List

Provide a table consisting of major furniture items that lists the manufacturers products specified on the Order Form and two alternate manufacturers. Major furniture items include, but are not limited to, casegoods, furniture systems, seating, and tables. Organize matrix by item code and item name. Supply alternates that are available on GSA Schedule and meet the requirements of the Furniture Order Form. One of the two alternates must be from UNICOR if possible. Provide manufacturer name address, telephone number, product series and product name for each alternate manufacturer.

1.1.4. FF&E Procurement List

Provide a table that lists all FF&E furniture, mission unique equipment and building Contractor Furnished/Contractor Installed (CF/CI) items. Give each item a code and name and designate whether item will be procured as part of the FF&E furniture, mission unique equipment or the building construction contract. Use the item code to key all FF&E documents including location plans, color boards, data sheets, cost estimate, etc.

1.1.5. Points of Contact (POCs)

Provide a comprehensive list of POCs needed to implement the FF&E package. This would include but not be limited to appropriate project team members, using activity contacts, interior design representatives, construction contractors and installers involved in the project. In addition to name, address, phone, fax and email, include each contact's job function. Divide the FF&E package into different sections based on this listing, applies to order forms and cost estimates.

1.1.6. Color Boards

Provide color boards for all finishes and fabrics for all FF&E items. Finishes to be included but not limited to paint, laminate, wood finish, fabric, etc.

1.1.7. Itemized Furniture Cost Estimate

Provide an itemized cost estimate of furnishings keyed to the plans and specifications of products included in the package. This cost estimate should be based on GSA price schedules. The cost estimate must include separate line items for general contingency, installation, electrical hook-up for systems furniture or other furniture requiring hardwiring by a licensed electrician, freight charges and any other related costs. Installation and freight quotes from vendors should be use in lieu of a percentage allowance when available. Include a written statement that the pricing is based on GSA schedules. An estimate developed by a furniture dealership may be provided as support information for the estimate, but must be separate from the contractor provided estimate.

1.2. INTERIOR DESIGN DOCUMENTS

1.2.1. Overall Furniture and Area Plans

Provide floor Plans showing locations and quantities of all freestanding, and workstation furniture proposed for each floor of the building. Key each room to a large scale Furniture Placement Plan showing the furniture configuration, of all furniture. Provide enlarged area plans with a key plan identifying the area in which the building is located. Key all the items on the drawings by furniture item code. Do not provide manufacturer specific information such as product names and numbers on drawings, Drawings shall be non-proprietary. This is typical for FFE on all plans, including those mentioned below.

1.2.2. Workstation Plans

Show each typical workstation configuration in plan view, elevations or isometric view. Drawings shall illustrate panels and all major components for each typical workstation configuration. Identify workstations using the same numbering system as shown on the project drawings. Key components to a legend on each sheet which identifies and describes the components along with dimensions. Provide the plan, elevations and isometric of each typical workstation together on the same drawing sheet.

1.2.3. Panel Plans

Show panel locations and critical dimensions from finished face of walls, columns, panels including clearances and aisle widths. Key panel assemblies to a legend which shall include width, height, configuration of frames, panel fabric and finishes (if there are different selections existing within a project), powered or non-powered panel and wall mount locations.

1.2.4. Desk Plans

Provide typical free standing desk configurations in plan view, elevation or isometric view and identify components to clearly represent each desk configuration.

1.2.5. Reflected Ceiling Plans

Provide typical plans showing ceiling finishes and heights, lighting fixtures, heating ventilation and air conditioning supply and return, and sprinkler head placement for coordination of furniture.

1.2.6. Electrical and Telecommunication Plans

Show power provisions including type and locations of feeder components, activated outlets and other electrical componentsShow locations and quantities of outlets for workstations. Clearly identify different outlets, i.e. electrical, LAN and telecommunication receptacles indicating each type proposed. Show wiring configuration, (circuiting, switching, internal and external connections) and provide as applicable.

1.2.7. Artwork Placement Plans

Provide an Artwork Placement Plan to show location of artwork, assign an artwork item code to each piece of artwork. As an alternative, artwork can be located on the Furniture Plans. Provide a schedule that identifies each piece by room name and number. Provide installation instructions; include mounting height.

1.2.8. Window Drapery Plans

Provide Interior Window Drapery Plans. Key each drapery treatment to a schedule showing color, pattern, material, drapery size and type, draw direction, location and quantities.

1.3. FURNITURE SELECTION

1.3.1. Select furniture from the GSA Schedules. Specify furniture available open market when an item is not available on the GSA Schedules. Provide justification fort items not available on the GSA Schedules.

1.3.2. To the greatest extent possible when specifying furniture work within a manufacturer's family of furniture for selections, example: Steelcase, Turnstone, Brayton International, Metro, and Vecta are all Steelcase companies. Each alternate should also be specified from a manufacturer's family of furniture, example: first set of alternates would be specified from Knoll's family of furniture and the second from Herman Miller family of furniture. It may be necessary to make some selections from other than a manufacturer's family of furniture if costs are not reasonable for particular items, some items are not available or appropriate for the facility or the items are not on GSA Schedule. If this occurs, consider specifying product from an open line that is accessible by numerous dealerships. Select office furniture including case goods, tables, storage, seating, etc. that is compatible in style, finish and color. Select furniture that complies with ANSI/BIFMA and from manufacturer's standard product line as shown in the most recent published price list and/or amendment and not custom product.

1.4. CONSTRUCTION

1.4.1. Provide knee space at workstations and tables that is not obstructed by panels/legs that interfere with knee space of seated person and provide desks, storage and tables with leveling devices to compensate for uneven floors.

1.4.2. Provide worksurface tops constructed to prevent warpage. Provide user friendly features such as radius edges. Do not use sharp edges and exposed connections and ensure the underside of desks, tables and worksurfaces are completely and smoothly finished. Provide abutting worksurfaces that mate closely and are of equal heights when used in side-by-side configurations in order to provide a continuous and level worksurface.

1.4.3. Drawers shall stay securely closed when in the closed position and protect wires from damage during drawer operation. Include a safety catch to prevent accidental removal when fully open

1.4.4. Unless otherwise noted, specify lockable desks and workstations and storage of steel construction. Use tempered glass glazing when glazing is required.

1.5. FINISHES AND UPHOLSTERY

1.5.1. Specify neutral colors for casegoods, furniture systems, storage and tables. Specify desk worksurfaces and table tops that are not too light or too dark in color and have a pattern to help hide soiling. Accent colors are allowed in break and lounge areas. Keep placement of furniture systems panel fabric accent colors to a minimum. All finishes shall be cleanable with ordinary household cleaning solutions.

1.5.2. Use manufacturer's standard fabrics; including textile manufacturers fabrics that have been graded into the furniture manufactures fabric grades and are available through their GSA Schedule. Customers Own Material

(COM) can be used in headquarter buildings in command suites with executive furniture. Coordinate specific locations with Corps of Engineers Interior Designer.

1.5.3. Specify seating upholstery that meets Wyzenbeek Abrasion Test, 55,000 minimum rubs. Specify a soil retardant finish for woven fabrics if Crypton or vinyl upholstery is not provided for seating in dining areas. Use manufacturer's standard fabrics. This includes textile manufacturers fabrics that have been graded into the furniture manufactures fabric grades and are available through their GSA Schedule. Specify upholstery and finish colors and patterns that help hide soiling. Specify finishes that can be cleaned with ordinary household cleaning solutions.

1.6. ACCESSORIES

1.6.1. Specify all accessories required for completely finished furniture installation. Provide filing cabinets and storage for office supplies. Provide tack surfaces at workstations with overhead storage. Provide tackable surfaces at workstations with overhead storage.

1.6.2. Not Used.

1.6.3. Workstations are to be equipped with stable keyboard trays that have height adjustability, tilting capability, including negative tilt, have a mouse pad at same height as the keyboard tray that can accommodate both left and right handed users, and retractable under worksurface.

1.7. MISSION UNIQUE EQUIPMENT

Funding for FF&E furniture items and mission unique equipment (MUE) items are from two different sources. Separate the designs and procurement documentation for FFE items and MUE. MUE includes, but is not limited to, items such as industrial shelving, workbenches, appliances, fitness equipment, IT equipment and supporting carts. The User will purchase and install mission unique equipment items, unless otherwise noted. Identify locations of known MUE items such as industrial shelving, workbenches, appliances, etc. for space planning purposes.

1.8. SUSTAINABILITY

1.8.1. For all designs provided regardless of facility type, make every effort to implement all aspects of sustainability to the greatest extent possible for all the selections made in the FF&E package. This includes but is not limited to the selection of products that consider: **Material Chemistry and Safety of Inputs** (What chemicals are used in the construction of the selections?); **Recyclability** (Do the selections contain recycled content?); **Disassembly** (Can the selections be disassembled at the end of their useful life to recycle their materials?).

1.8.2. Make selections to the greatest extent possible of products that possess current McDonough Braungart Design Chemistry (MBDC) certification or other "third-party" certified Cradle to Cradle program, Forest Stewardship Council (FSC) certification, GREENGAURD certification or similar "third-party" certified products consisting of low-emitting materials.

1.9. FURNITURE SYSTEMS

1.9.1. General.

Where appropriate, design furniture systems in open office areas. Coordinate style and color of furniture systems with other storage, seating, etc. in open office areas. Minimize the number of workstation typicals and the parts and pieces required for the design to assist in future reconfiguration and inventorying.

1.9.2. Connector Systems.

Specify a connector system that allows removal of a single panel or spine wall within a typical workstation configuration without requiring disassembly of the workstation or removal of adjacent panels. Specify connector system with tight connections and continuous visual seals. When Acoustical panels are used, provide connector system with continuous acoustical seals. Specify concealed clips, screws, and other construction elements, where possible.

1.9.3. Panels and Spine Walls

Specify panels and spine walls with hinged or removable covers that permit easy access to the raceway when required but are securely mounted and cannot be accidentally dislodged under normal conditions. Panels shall be capable of structurally supporting more than 1 fully loaded component per panel per side. Raceways are to be an integral part of the panel and must be able to support lay-in cabling and have a large capacity for electrical and IT. Do not thread cables through the frame.

1.9.4. Electrical And Information/Technology (IT)

Design furniture with electrical systems that meets requirements of UL 1286 when powered panels are required and UL approved task lights that meet requirements of NFPA 70. Dependent on user requirements and Section 01 10 00, paragraph 3 requirements, it is recommended that workstation electrical and IT wiring entry come from the building walls to eliminate the use of power poles and access at the floor. Design electrical and IT systems that are easily accessed in the spine wall and panels without having to move return panels and components. Electrical and IT management will be easily accessible by removable wall covers which can be removed while workstation components are still attached. Specify connector system that has continuation of electrical and IT wiring within workstations and workstation to workstation.

1.9.5. Pedestals

Specify pedestals that are interchangeable from left to right, and right to left, and retain pedestal locking system capability.

1.10. EXECUTIVE FURNITURE

1.10.1. Design for executive furniture in command areas, coordinate specific locations with Corps of Engineers Interior Designer. Use upgraded furniture, upholsteries and finishes in command suites. This includes but is not limited to wood casegoods, seating and tables. Select executive furniture casegoods from a single manufacturer and style line, to include workstations, credenzas, filing, and storage, etc.

1.10.2. Specify furniture with wood veneer finish (except worksurfaces) with mitered solid wood edge of same wood type. Provide worksurface plastic laminate that closely matches adjacent wood veneer. Other executive office furniture such as seating, tables, executive conference room furniture, etc. shall be compatible in style, finish and color with executive furniture casegoods.

1.11. SEATING

1.11.1. General

Specify appropriate chair casters and glides for the floor finish where the seating is located. Universal casters that are appropriate for both hard surface flooring and carpet are preferred. All seating shall support up to a minimum of 250 lbs.

1.11.2. Desk and Guest Seating

Select ergonomic desk chairs with casters, non-upholstered adjustable arms, waterfall front, swivel, tilt, variable back lock, adjustable back height or adjustable lumbar support, pneumatic seat height adjustment, and padded, contoured upholstered seat and back. Desk and guest chair backs may be other than upholstered such as mesh fabric if it is ergonomically designed, forms to back and is comfortable. Depending on scale of desk chair provide seat pan forward and back adjustment to increase or decrease depth of seat pan. All desk chairs shall have an adjustable seat height range of 4 1/2", range to include 16 1/2-20". Select guest chairs that are compatible in style, finish and color with the desk chairs.

1.11.3. Conference Room Seating

At tables, select ergonomic conference seating with casters, non-upholstered arms, waterfall front, swivel, tilt, pneumatic seat height adjustment, and padded, contoured seat and back, unless otherwise noted. Select arm height and/or design that allows seating to be moved up closely to the table top. Conference chair backs may be other than upholstered such as mesh fabric if it is ergonomically designed, forms to back and is comfortable. Perimeter conference chairs shall be compatible in style, finish and color with conference seating at the tables.

1.11.4. Lounge, Waiting and Reception Area Seating

Select seating with arms and cushioned, upholstered seat and back. In heavy use areas, arms shall be easily cleaned such as non-upholstered arms or upholstered arms with wood arm caps unless otherwise noted.

1.11.5. Break Room Seating

Select stackable seating that is easily cleaned. Seating shall be appropriate for table and counter heights as applicable with non-upholstered arms if arms are required. Chairs shall have metal legs and composite materials for seats.

1.11.6. Lounge, Waiting and Reception Furniture.

Design for end and coffee tables with plastic laminate tops that are compatible in style finish and color with the seating.

1.12. FILING AND STORAGE.

Select storage and shelving units that meet customer’s functional load requirements for stored items. Specify counterweights for filing cabinets when required by the manufacturer for stability. File drawers shall allow only one drawer to be opened at a time. Provide heavy duty storage and shelving if information is not available.

1.13. TRAINING TABLES.

Don’t use plastic laminate self edge. Training tables shall be reconfigurable, moveable and storable; lighter weight folding with dollies or castered as necessary. Specify dollies if required.

1.14. FURNITURE WARRANTIES.

Specify manufacturer's performance guarantees or warranties that include parts, labor and transportation as follows:

Furniture System, unless otherwise noted – 10 year minimum
Furniture System Task Lights – 2 year minimum, excluding bulbs
Furniture System Fabric – 3 year minimum
Desks - 10 year minimum
Seating, unless otherwise noted - 10 year minimum
Seating Mechanisms and Pneumatic Cylinders - 10 years
Fabric - 3 years minimum
Filing and Storage - 10 year minimum
Tables, unless otherwise noted - 10 year minimum
Table Mechanisms – 5 year
Table Ganging Device - 1 year
Items not listed above - 1 year minimum

ATTACHMENT C
TRACKING COMMENTS IN DRCHECKS

1.0 General

The Government and DB Contractor shall set up the project in Dr Checks. Throughout the design process, the parties shall enter, track, and back-check comments using the DrChecks system. Government reviewers enter design review comments into DrChecks. Designers of Record shall annotate comments timely and specifically to indicate exactly what action will be taken or why the action is not required. Comments considered critical by the conference participants shall be flagged as such.

2.0 DrChecks Review Comments

The Contractor and the Government shall monitor DrChecks to assure all comments are annotated and agreed to by the designers and reviewers prior to the next submittal. The DrChecks comments and responses shall be printed and included in the design analysis for record.

2.1. Conference participants (reviewers) will expect coordination between Design Analysis calculations and the submitted design. Reviewers will also focus on the design submittal's satisfaction of the contract requirements.

2.2. The Designers of Record shall answer each comment in DrChecks with a formal response prior to the next submittal, clearly indicating what action will be taken and what drawing/spec will change. Designers of Record are encouraged to directly contact reviewers to discuss and agree to the formal comment responses rather than relying only on DrChecks and review meetings to discuss comments. With the next design conference, reviewers will back-check answers to the comments against the submittal, in addition to reviewing additional design work.

2.3. Comments that, in the DB Contractor's opinion, require effort outside the scope of the contract shall be clearly indicated as such in DrChecks. The DB Contractor shall not proceed with work outside the contract until a modification to the contract is properly executed, if one is necessary.

3.0 DrChecks Initial Account Set-Up

To initialize an office's use of DrChecks, choose a contact person within the office to call the DrChecks Help Desk at 800-428-HELP, M-F, 8AM-5PM, Central time. This POC will be given an office password to distribute to others in the office. Individuals can then go to the hyperlink at http://www.projnet.org and register as a first time user. Upon registration, each user will be given a personal password to the DrChecks system.

3.1. Once the office and individuals are registered, the COE's project manager or lead reviewer will assign the individuals and/or offices to the specific project for review. At this point, persons assigned can make comments, annotate comments, and close comments, depending on their particular assignment.

4.0 DrChecks Reviewer Role

The Contractor is the technical reviewer and the Government is the compliance reviewer of the DB designers design documents. Each reviewer enters their own comments into the Dr Checks system. To enter comments:

4.1. Log into DrChecks.

4.2. Click on the appropriate project.

4.3. Click on the appropriate review conference. An Add comment screen will appear.

4.4. Select or fill out the appropriate sections (particularly comment discipline and type of document for sorting) of the comment form and enter the comment in the space provided.

4.5. Click the Add Comment button. The comment will be added to the database and a fresh screen will appear for the next comment you have.

4.6. Once comments are all entered, exit DrChecks by choosing “My Account” and then Logout.

5.0 DrChecks Comment Evaluation

The role of the designers of record is to evaluate and respond to the comments entered by the Government reviewers and by the DB Contractor. To respond to comments:

5.1. Log into DrChecks.

5.2. Click on the appropriate project.

5.3. Under “Evaluate” click on the number under “Pending”.

5.4. Locate the comments that require your evaluation. (Note: If you know the comment number you can use the Quick Pick window on your home page in DrChecks; enter the number and click on go.)

5.5. Select the appropriate evaluation (concur, non-concur, for information only, or check and resolve) and add the response.

5.6. Click on the Add button. The evaluation will be added to the database and a fresh screen will appear with the next comment.

5.7. Once evaluations are all entered, exit DrChecks by choosing “My Account” and then Logout.

6.0 DrChecks Back-check

At the following design conference, participants will back-check comment annotations against newly presented documents to verify that the designers' responses are acceptable and completed. The Contractor and Government reviewers shall either enter additional back-check comments, as necessary or close those that are resolved as a result of the design conferences:

6.1. Log into DrChecks.

6.2. Click on the appropriate project.

6.3. Under “My Backcheck” click on the number under “Pending”.

6.4. If you agree with the designer’s response select “Close Comment” and add a closing response if desired.

6.5. If you do not agree with the designer’s response or the submittal does not reflect the response given, select “Issue Open”, enter additional information.

6.6. Click on the Add button. The back-check will be added to the database and a fresh screen will appear with the next comment.

6.7. Once back-checks are all entered, exit DrChecks by choosing “My Account” and then Logout. The design is completed and final when there are no pending comments to be evaluated and there are no pending or open comments under back-check.

ATTACHMENT D
SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW

Instructions: Use the information outlined in this document to provide the minimum requirement for development of Fire Protection and Life Safety Code submittals for all building projects. Additional and supplemental information may be used to further develop the code review. Insert N/A after criteria, which may be “not applicable”.

1.0 SAMPLE FIRE PROTECTION AND LIFE SAFETY CODE REVIEW

1.1. Project Name (insert name and location)

1.2. Applicable Codes and Standards

1.2.1. Unified Facilities Criteria (UFC): 3-600-01, Design: Fire Protection Engineering For Facilities

1.2.2. International Building Code (IBC) for fire resistance requirements, allowable floor area, building height limitations and building separation distance requirements, except as modified by UFC 3-600-01.

1.2.3. National Fire Protection Association (NFPA) 101 Life Safety Code (latest edition), for building egress and life safety and applicable criteria in UFC 3-600-01.

1.2.4. ADA and ABA Accessibllity Guidelines. For Buildings and Facilities See Section 01 10 00, Paragraph 3 for facility specific criteria.

1.3. Occupancy Classification
IBC chapters 3 and 4

1.4. Construction Type
IBC chapter 6

1.5. Area Limitations
IBC chapter 5, table 503

1.6. Allowable Floor Areas
IBC section 503, 505

1.7. Allowable area increases
IBC section 506, 507

1.8. Maximum Height of Buildings
IBC section 504

1.9. Fire-resistive substitution

1.10. Occupancy Separations
IBC table 302.3.2

1.11. Fire Resistive Requirements

1.11.1. Exterior Walls - [_____] hour rating, IBC table 601, 602

1.11.2. Interior Bearing walls - [_____] hour rating

1.11.3. Structural frame - [_____] hour rating

1.11.4. Permanent partitions - [_____] hour rating

1.11.5. Shaft enclosures - [_____] hour rating

1.11.6. Floors & Floor-Ceilings - [_____] hour rating

1.11.7. Roofs and Roof Ceilings - [_____] hour rating

1.12. Automatic Sprinklers and others used to determine the need for automatic Extinguishing Equipment, Extinguishing Systems, Foam Systems, Standpipe

1.12.1. UFC 3-600-01, chapters 4 and 6 systems, wet chemical systems, etc. State which systems are required and to what criteria they will be designed.

1.12.2. UFC 3-600-01, Appendix B Occupancy Classification. Note the classification for each room. This may be accomplished by classifying the entire building and noting exceptions for rooms that differ (E.g. The entire building is Light Hazard except boiler room and storage rooms which are [_____], etc.)

1.12.3. UFC 3-600-01, Chapter 3 Sprinkler Design Density, Sprinkler Design Area, Water Demand for Hose Streams (supply pressure and source requirements).

1.12.4. UFC 3-600-01, Chapter 4 Coverage per sprinkler head. Extended coverage sprinkler heads are not permitted.

1.12.5. Available Water Supply. Provide the results of the water flow tests showing the available water supply static pressure and residual pressure at flow. Based on this data and the estimated flow and pressure required for the sprinkler system, determine the need for a fire pump.

1.12.6. NFPA 13, Para. 8.16.4.6.1. Provide backflow preventer valves as required by the local municipality, authority, or water purveyor. Provide a test valve located downstream of the backflow preventer for flow testing the backflow preventer at full system demand flow. Route the discharge to an appropriate location outside the building.

1.13. Kitchen Cooking Exhaust Equipment

Describe when kitchen cooking exhaust equipment is provided for the project. Type of extinguishing systems for the equipment should be provided. per NFPA 96. Show all interlocks with manual release switches, fuel shutoff valves, electrical shunt trips, exhaust fans, and building alarms.

1.14. Portable Fire Extinguishers, fire classification and travel distance. per NFPA 10

1.15. Enclosure Protection and Penetration Requirements. - Opening Protectives and Through Penetrations

1.15.1. IBC Section712, 715 and Table 715.3. Mechanical rooms, exit stairways, storage rooms, janitor [_____] hour rating. IBC Table 302.1.1

1.15.2. Fire Blocks, Draft Stops, Through Penetrations and Opening Protectives

1.16. Fire Dampers. Describe where fire dampers and smoke dampers are to be used (IBC Section 716 and NFPA 90A}. State whether isolation smoke dampers are required at the air handler.

1.17. Detection Alarm and Communication. UFC 3-600-01, (Chapter 5); NFPA 101 para. 3.4 (chapters 12-42); NFPA 72

1.18. Mass Notification. Describe building/facility mass notification system (UFC 4-021-01) type and type of base-wide mass notification/communication system. State whether the visible notification appliances will be combined with the fire alarm system or kept separate. (Note: Navy has taken position to combine visible notification appliances with fire alarm).

1.19. Interior Finishes (classification). NFPA 101.10.2.3 and NFPA 101.7.1.4

1.20. Means of Egress

1.20.1. Separation of Means of Egress, NFPA 101 chapters 7 and 12-42; NFPA101.7.1.3

1.20.2. Occupant Load, NFPA101.7.3.1 and chapters 12-42.

1.20.3. Egress Capacity (stairs, corridors, ramps and doors) NFPA101.7.3.3

1.20.4. Number of Means of Egress, NFPA101.7.4 and chapters 12-42.

1.20.5. Dead end limits and Common Path of Travel, NFPA 101.7.5.1.6 and chapters 12-42.

1.20.6. Accessible Means of Egress (for accessible buildings), NFPA101.7.5.4

1.20.7. Measurement of Travel Distance to Exits, NFPA101.7.6 and chapters 12-42.

1.20.8. Discharge from Exits, NFPA101.7.7.2

1.20.9. Illumination of Means of Egress, NFPA101.7.8

1.20.10. Emergency Lighting, NFPA101.7.9

1.20.11. Marking of Means of Egress, NFPA101.7.10

1.21. Elevators, UFC 3-600-01, Chapter 6; IBC and ASME A17.1 - 2000,(Safety Code for Elevators and Escalators)

1.22. Accessibility Requirements, ADA and ABA Accessibility Guidelines for Buildings and Facilities

1.23. Certification of Fire Protection and Life Safety Code Requirements. (Note: Edit the Fire team membership if necessary). Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features for this project in accordance with the attached completed form(s).

1.24. Designer of Record. Certification of Fire protection and Life Safety Code Requirements. (Note: Edit the Fire team members if necessary). Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features of this project.

Fire Protection Engineer of Record:

____

Signature and Stamp

Date

OR

Architect of Record:

____

Signature and Stamp

Date

Mechanical Engineer of Record:

____

Signature and Stamp

Date

Electrical Engineer of Record:

Signature/Date

ATTACHMENT E
LEED SUBMITTALS

LEED Credit Paragraph	Contractor Check Here if Credit is Claimed	LEED-NC v3 Submittals (OCT09)		Provide for Credit Audit Only		Date Submitted (to be filled in by Contractor)	Government Reviewer's Use
PAR		FEATURE	DUE AT		REQUIRED DOCUMENTATION	DATE	REV
GENERAL							
	GENERAL - All calculations shall be in accordance with LEED 2009 Reference Guide.						
	GENERAL: Obtain excel version of this spreadsheet at http://en.sas.usace.army.mil/enWeb, "Engineering Criteria".						
	GENERAL - For all credits, narrative/comments may be added to describe special circumstances or considerations regarding the project's credit approach.						
	GENERAL - Include all required LEED drawings indicated below in contract drawings with applicable discipline drawings, labeled For Reference Only.						
	NOTE: Each submittal indicated with "**" differs from LEED certified project submittals by either having a different due date or being an added submittal not required by GBCI.						
	NOTE: Projects seeking LEED certification need only submit to GBCI whatever documentation is acceptable to GBCI (for example, licensed professional certifications). This checklist identifies what must be submitted to the Government for internal review purposes. Government review of LEED documentation in no way supercedes or modifies the requirements and rulings of of GBCI for purposes of compliance with project requirement to obtain LEED certifiaction.						
	GENERAL - Audit documentation may include but is not limited to what is indicated in this table.						
			Closeout		List of all Final Design submittals revised after final design to reflect actual closeout conditions. Revised Final Design submittals. - OR - Statement confirming that no changes have been made since final design that effect final design submittal documents.		Proj Engr (PE)
CATEGORY 1 - SUSTAINABLE SITES							
SSPR1		Construction Activity Pollution Prevention (PREREQUISITE)	**Final Design		List of drawings and specifications that address the erosion control, particulate/dust control and sedimentation control measures to be implemented.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			**Final Design		Narrative that indicates which compliance path was used (NPDES or Local standards) and describes the measures to be implemented on the project. If a local standard was followed, provide specific information to demonstrate that the local standard is equal to or more stringent than the NPDES program.		CIV
SS1		Site Selection	Final Design		Statement confirming that project does not meet any of the prohibited criteria.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design	X	LEED Site plan drawing that shows all proposed development, line depicting boundary of all bodies of water and/or wetlands within 100 feet of project boundary and a line depicting 5' elevation above 100 year flood line that falls within project boundary. Not required if neither condition applies.		CIV
SS2		Development Density & Community Connectivity	Final Design		Option 1: LEED Site vicinity plan showing project site and surrounding development. Show density boundary or note drawing scale.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design		Option 1: Table indicating, for project site and all surrounding sites within density radius (keyed to site vicinity plan), site area and building area. Project development density calculation. Density radius calculation. Development density calculation within density radius.		CIV
			Final Design		Option 2: LEED Site vicinity plan showing project site, the 1/2 mile community radius, pedestrian walkways and the locations of the residential development(s) and Basic Services surrounding the project site.		CIV
			Final Design		Option 2: List (including business name and type) of all Basic Services facilities within the 1/2 mile radius, keyed to site vicinity plan.		CIV
SS3		Brownfield Redevelopment	Final Design		Narrative describing contamination and the remediation activities included in project. Include statement indicating how site was determined to be a brownfield.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS4.1		Alternative Transportation: Public Transportation Access	Final Design		Statement indicating which option for compliance applies. State whether public transportation is existing or proposed and, if proposed, cite source of this information.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design		Option 1: LEED Site vicinity plan showing project site, mass transit stops and pedestrian path to them with path distance noted.		CIV
			Final Design		Option 2: LEED Site vicinity plan showing project site, bus stops and pedestrian path to them with path distance noted.		CIV
SS4.2		Alternative Transportation: Bicycle Storage & Changing Rooms	Final Design		FTE calculation. Bicycle storage spaces calculation. Shower/changing facilities calculation.		CIV
			Final Design		List of drawings that show the location(s) of bicycle storage areas. Statement indicating distance from building entrance.		CIV
			Final Design		List of drawings that show the location(s) of shower/changing facilities and, if located outside the buiding, statement indicating distance from building entrance.		ARC

LEED-NC v3 Submittals (OCT09)

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SS4.3		Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	Final Design		Statement indicating which option for compliance applies. FTE calculation. Statement indicating total parking capacity of site.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design		Option 1: Low-emission & fuel-efficient vehicle calculation.		CIV
			Final Design		Option 1: List of drawings and specification references that show location and number of preferred parking spaces for low-emission & fuel-efficient vehicles and signage.		CIV
			Final Design		Option 1: Statement indicating quantity, make, model and manufacturer of low-emission & fuel-efficient vehicles to be provided. Statement confirming vehicles are zero-emission or indicating ACEEE vehicle scores.		CIV
			Final Design		Option 2: Low-emission & fuel-efficient vehicle parking calculation.		CIV
			Final Design		Option 2: List of drawings and specification references that show location and number of preferred parking spaces and signage.		CIV
			Final Design		Option 3: Low-emission & fuel-efficient vehicle refueling station calculation.		CIV
			Final Design		Option 3: List of drawings and specifications indicating location and number of refueling stations, fuel type and fueling capacity for each station for an 8-hour period.		CIV
			Closeout	X	Option 3: Construction product submittals indicating what was provided and confirming compliance with respect to fuel type and fueling capacity for each station for an 8-hour period.		CIV
SS4.4		Alternative Transportation: Parking Capacity	Final Design		Statement indicating which option for compliance applies.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design		Option 1: Preferred parking calculation including number of spaces required, total provided, preferred spaces provided and percentage.		CIV
			Final Design		Option 2: FTE calculation. Preferred parking calculation including number of spaces provided, preferred spaces provided and percentage.		CIV
			Final Design		Options 1 and 2: List of drawings and specification references that show location and number of preferred parking spaces and signage.		CIV
			Final Design		Option 3: Narrative indicating number of spaces required and provided and describing infrastructure and support programs with description of project features to support them.		CIV
SS5.1		Site Development: Protect or Restore Habitat	**Final Design		Option 1: List of drawing and specification references that convey site disturbance limits.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			**Final Design		Option 2: LEED site plan drawing that delineates boundaries of each preserved and restored habitat area with area (sf) noted for each.		CIV
			**Final Design		Option 2: Percentage calculation of restored/preserved habitat to total site area. List of drawings and specification references that convey restoration planting requirements.		CIV
SS5.2		Site Development: Maximize Open Space	Final Design		Option 2: LEED site plan drawing delineating boundary of vegetated open space adjacent to building with areas of building footprint and designated open space noted.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS6.1		Stormwater Design: Quantity Control	Final Design		Statement indicating which option for compliance applies.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design		Option 1: Indicate pre-development and post-development runoff rate(cfs) and runoff quantity (cf) -OR - Narrative describing site conditions, measures and controls to be implemented to prevent excessive stream velocities and erosion.		CIV
			Final Design		Option 2: Indicate pre-development and post-development runoff rate(cfs) and runoff quantity (cf). Indicate percent reduction in each.		CIV
SS6.2		Stormwater Design: Quality Control	Final Design		For non-structural controls, list all BMPs used and, for each, describe the function of the BMP and indicate the percent annual rainfall treated. List all structural controls and, for each, describe the pollutant removal and indicate the percent annual rainfall treated.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
SS7.1		Heat Island Effect: Non-Roof	**Final Design		LEED site plan drawing indicating locations and quantities of each paving type, including areas of shaded pavement. Percentage calculation indicating percentage of reflective/shaded/open grid area.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV

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SS7.2		Heat Island Effect: Roof	Final Design		Option 1: Percentage calculation indicating percentage of SRI compliant roof area. List of drawings and specification references that convey SRI requirements and roof slopes.		ARC
			Final Design		Option 1: List of specified roof materials indicating, for each, type, manufacturer, product name and identification if known, SRI value and roof slope.		ARC
			**Closeout		Option 1: List of installed roof materials indicating, for each, manufacturer, product name and identification, SRI value and roof slope.		PE
			Closeout	X	Option 1: Manufacturer published product data or certification confirming SRI		PE
			Final Design		Option 2: Percentage calculation indicating percentage of vegetated roof area.		ARC
			Final Design		Option 3: Combined reflective and green roof calculation.		ARC
			Final Design		Option 3: List of specified roof materials indicating, for each, type, manufacturer, product name and identification if known, SRI value and roof slope.		ARC
			**Closeout		Option 3: List of installed roof materials indicating, for each, manufacturer, product name and identification, SRI value and roof slope.		PE
			Closeout	X	Option 3: Manufacturer published product data or certification confirming SRI		PE
SS8		Light Pollution Reduction	Final Design		Interior Lighting: List of drawings and specification references that convey interior lighting requirements (location and type of all installed interior lighting, location of non-opaque exterior envelope surfaces, allowing confirmation that maximum candela value from interiorfixtures does not intersect non-opaque building envelope surfaces). - OR - List of drawings and specification references that show automatic lighting controls compliance with credit requirement.		ELEC
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		ELEC
			Final Design		Exterior Lighting: List of drawings and specification references that convey exterior lighting requirements (location and type of all site lighting and building façade/landscape lighting).		ELEC
			Final Design		Exterior Site Lighting Power Density (LPD): Tabulation for exterior site lighting indicating, for each location identification or description, units of measure, area or distance of the location, actual LPD using units consistent with ASHRAE 90.1, and the ASHRAE allowable LPD for that type of location. Percentage calculation of actual versus allowable LPD for all site lighting.		ELEC
			Final Design		Exterior Building Facade/Landscape Lighting Power Density (LPD): Tabulation for exterior building facade/landscape lighting indicating, for each location identification or description, units of measure, area or distance of the location, actual LPD using units consistent with ASHRAE 90.1, and the ASHRAE allowable LPD for that type of location. Percentage calculation of actual versus allowable LPD for all building facade/landscape lighting.		ELEC
			Final Design		Exterior Lighting IESNA Zone: Indicate which IESNA zone is applicable to the project.		ELEC
			Final Design		Exterior Lighting Site Lumen table indicating, for each fixture type, quantity installed, initial lamp lumens per luminaire, initial lamp lumens above 90 degrees from Nadir, total lamp lumens and total lamp lumens above 90 degrees. Percentage of site lamp lumens above 90 degrees from nadir to total lamp lumens.		ELEC
			Final Design		Exterior Lighting Narrative describing analysis used for addressing requirements for light trespass at site boundary and beyond.		ELEC
CATEGORY 2 – WATER EFFICIENCY							
WEPR1		Water Use Reduction: 20% Reduction	Final Design		Statement confirming which occupancy breakdown applies (default or special). For special occupancy breakdown, indicate source and explanation for ratio.		MEC
			Final Design		Occupancy calculation including male/female numbers for FTEs, visitors, students, customers, residential and other type occupants/users		MEC
			Final Design		Statement indicating percent of male restrooms with urinals. Statement indicating annual days of operation.		MEC

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			Final Design		Baseline flush fixture calculation spreadsheet indicating, for each fixture type, gender, flush rate, daily uses per person for each occupant type identified in occupancy calculation and annual baseline flush fixture water usage.		MEC
			Final Design		Design case flush fixture calculation spreadsheet indicating, for each fixture type, gender, fixture manufacturer, fixture model number, flush rate, percent of occupants using this fixture type, daily uses per person for each occupant type identified in occupancy calculation and annual design case flush fixture water usage.		MEC
			Closeout	X	Manufacturer published product data or certification confirming fixture water usage.		PE
WE1.1		Water Efficient Landscaping: Reduce by 50%	Final Design		Statement indicating which option for compliance applies.		CIV
			**Final Design		Delineation and labeling of "LEED Project site boundary" on site plan.		CIV
			Final Design		Calculation indicating, for baseline and design case, total water applied, total potable water applied, total non-potable water applied. Design case percent potable water reduction. If nonpotable water is used, indicate source of nonpotable water.		CIV
			Final Design		List of landscape plan drawings.		CIV
			Final Design		Narrative describing landscaping and irrigation design strategies, including water use calculation methodology used to determine savings and, if non-potable water is used, specific information about source and available quantity.		CIV
WE1.2		Water Efficient Landscaping: No Potable Water Use or No Irrigation	Same as WE1.1		Same as WE1.1		CIV
WE2		Innovative Wastewater Technologies	Final Design		Statement confirming which option for compliance applies.		MEC
			Final Design		Statement confirming which occupancy breakdown applies (default or special). For special occupancy breakdown, indicate source and explanation for ratio.		MEC
			Final Design		Occupancy calculation including male/female numbers for FTEs, visitors, students, customers, residential and other type occupants/users		MEC
			Final Design		Statement indicating percent of male restrooms with urinals. Statement indicating annual days of operation.		MEC
			Final Design		Baseline flush fixture calculation spreadsheet indicating, for each fixture type, gender, flush rate, daily uses per person for each occupant type identified in occupancy calculation and annual baseline flush fixture water usage.		MEC
			Final Design		Design case flush fixture calculation spreadsheet indicating, for each fixture type, gender, fixture manufacturer, fixture model number, flush rate, percent of occupants using this fixture type, daily uses per person for each occupant type identified in occupancy calculation and annual design case flush fixture water usage.		MEC
			Final Design		Option 1: If onsite non-potable water is used, identify source(s), indicate annual quantity from each source and indicate total annual quantity from all onsite non-potable water sources.		MEC
			Final Design		Option 1: Summary calculation indicating baseline annual water consumption, design case annual water consumption, non-potable annual water consumption and total percentage annual water savings.		MEC
			Final Design		Option 2: Statement confirming on-site treatment of all generated wastewater to tertiary standards and all treated wastewater is either infiltrated or used on-site.		MEC
			Final Design		Option 2: List of drawing and specification references that convey design of on-site wastewater treatment features.		CIV
			Final Design		Option 2: On-site water treatment quantity calculation indicating all on-site wastewater source(s), annual quantity treated, annual quantity infiltrated and annual quantity re-used on site from each source and totals for annual quantity treated, annual quantity infiltrated and annual quantity re-used on site from all sources.		CIV
			Final Design		Option 2: Wastewater summary calculation indicating design case annual flush fixture water usage, annual on-site water treatment and percentage sewage convyance reduction.		MEC
			Final Design		Narrative describing project strategy for reduction of potable water use for sewage conveyance, including specific information on reclaimed water usage and treated wastewater usage.		MEC
WE3		Water Use Reduction: 30% - 40% Reduction	Same as WEPR1		Same as WEPR1		MEC
CATEGORY 3 – ENERGY AND ATMOSPHERE							

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EAPR1		Fundamental Commissioning of the Building Energy Systems (PREREQUISITE)	**Final Design		**Owner's Project Requirements document		ALL
			**Final Design		**Basis of Design document for commissioned systems		MEC, ELEC
			**Final Design		**Commissioning Plan		MEC, ELEC
			Closeout		Statement confirming all commissioning requirements have been incorporated into construction documents.		PE
			Closeout		Commissioning Report		PE
EAPR2		Minimum Energy Performance (PREREQUISITE)	Final Design		Statement listing the mandatory provisions of ASHRAE 90.1 that project meets relative to compliance with this prerequisite and indicating which compliance path was used.		MEC ELEC ARC
			Final Design		Statement indicating which compliance path option applies.		MEC
			Final Design		Option 1: Statement confirming simulation software capabilities and confirming assumptions and methodology.		MEC
			Final Design		Option 1: General information including simulation program, principal heating source, percent new construction and renovation, weather file, climate zone and Energy Star Target Finder score.		MEC
			Final Design		Option 1: Space summary listing, for each building use, the conditioned area, unconditioned area and total area and include total area for each category		MEC
			Final Design		Option 1: List of all simulation output advisory message data and show difference between baseline and proposed design		MEC
			Final Design		Option 1: Comparison summary for energy model inputs including description of baseline and design case energy model inputs, showing both by element type		MEC
			Final Design		Option 1: Energy type summary lising, for each energy type, utility rate description, units of energy and units of demand		MEC
			Final Design		Option 1: Statement indicating whether project uses on-site renewable energy. If yes, list all sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost		MEC
			Final Design		Option 1: If analysis includes exceptional calculation methods, statement describing how exceptional calculation measure cost savings is determined		MEC
			Final Design		Option 1: If analysis includes exceptional calculation methods, for each exceptional calculation method indicate energy types and, for each energy type, annual energy savings, annual cost savings, and brief descriptive narrative		MEC
			Final Design		Option 1: Baseline performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand for all four orientations. For each orientation indicate total annual energy use for each orientation and total annual process energy use.		MEC
			Final Design		Option 1: Baseline energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design		Option 1: Proposed Design performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand, baseline annual and peak energy demand and percent savings. Indicate total annual energy use and total annual process energy use for both proposed design and baseline and percent savings.		MEC
			Final Design		Option 1: Proposed Design energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design		Option 1: Energy cost and consumption by energy type report indicating, for each energy type, proposed design and baseline annual use and annual cost, percent savings annual use and annual cost. Indicate for renewable energy annual energy generated and annual cost. Indicate exceptional calculations annual energy savings and annual cost savings. Indicate building total annual energy use, annual energy cost for proposed design and baseline and indicate percent savings annual energy use and annual energy cost.		MEC

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			Final Design		Option 1: Compliance summaries from energy simulation software. If software does not produce compliance summaries provide output summaries and example input summaries for baseline and proposed design supporting data in the tables. Output summaries must include simulated energy consumption by end use and total energy use and cost by energy type. Example input summaries should represent most common systems and must include occupancy, use pattern, assumed envelope component sizes and descriptive features and assumed mechanical equipment types and descriptive features		MEC
			Final Design		Option 1: Energy rate tariff from project energy providers (only if not using LEED Reference Guide default rates)		MEC
EAPR3		Fundamental Refrigerant Management (PREREQUISITE)	Final Design		Statement indicating which option for compliance applies.		MEC
			Final Design		Option 2: Narrative describing phase out plan, including specific information on phase out dates and refrigerant quantities.		MEC
EA1		Optimize Energy Performance	Final Design		Statement indicating which compliance path option applies.		MEC
			Final Design		Option 1: Statement confirming simulation software capabilities and confirming assumptions and methodology.		MEC
			Final Design		Option 1: General information including simulation program, principal heating source, percent new construction and renovation, weather file, climate zone and Energy Star Target Finder score.		MEC
			Final Design		Option 1: Space summary listing, for each building use, the conditioned area, unconditioned area and total area and include total area for each category		MEC
			Final Design		Option 1: List of all simulation output advisory message data and show difference between baseline and proposed design		MEC
			Final Design		Option 1: Comparison summary for energy model inputs including description of baseline and design case energy model inputs, showing both by element type		MEC
			Final Design		Option 1: Energy type summary lising, for each energy type, utility rate description, units of energy and units of demand		MEC
			Final Design		Option 1: Statement indicating whether project uses on-site renewable energy. If yes, list all sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost		MEC
			Final Design		Option 1: If analysis includes exceptional calculation methods, statement describing how exceptional calculation measure cost savings is determined		MEC
			Final Design		Option 1: If analysis includes exceptional calculation methods, for each exceptional calculation method indicate energy types and, for each energy type, annual energy savings, annual cost savings, and brief descriptive narrative		MEC
			Final Design		Option 1: Baseline performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand for all four orientations. For each orientation indicate total annual energy use for each orientation and total annual process energy use.		MEC
			Final Design		Option 1: Baseline energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design		Option 1: Proposed Design performance rating compliance report table indicating, for each energy end use, whether it is a process load, energy type, annual and peak energy demand, baseline annual and peak energy demand and percent savings. Indicate total annual energy use and total annual process energy use for both proposed design and baseline and percent savings.		MEC
			Final Design		Option 1: Proposed Design energy cost table indicating, for each energy type, annual cost for all four orientations and building total energy cost.		MEC
			Final Design		Option 1: Energy cost and consumption by energy type report indicating, for each energy type, proposed design and baseline annual use and annual cost, percent savings annual use and annual cost. Indicate for renewable energy annual energy generated and annual cost. Indicate exceptional calculations annual energy savings and annual cost savings. Indicate building total annual energy use, annual energy cost for proposed design and baseline and indicate percent savings annual energy use and annual energy cost.		MEC

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			Final Design		Option 1: Compliance summaries from energy simulation software. If software does not produce compliance summaries provide output summaries and example input summaries for baseline and proposed design supporting data in the tables. Output summaries must include simulated energy consumption by end use and total energy use and cost by energy type. Example input summaries should represent most common systems and must include occupancy, use pattern, assumed envelope component sizes and descriptive features and assumed mechanical equipment types and descriptive features		MEC
			Final Design		Option 1: Energy rate tariff from project energy providers (only if not using LEED Reference Guide default rates)		MEC
EA2.1		On-Site Renewable Energy	Final Design		Statement indicating which compliance path option applies.		ELEC
			Final Design		List all on-site renewable energy sources and indicate, for each source, backup energy type, annual energy generated, rated capacity and renewable energy cost. Indicate total annual energy use (all sources), total annual energy cost (all sources) and percent renewable energy cost.		ELEC MEC
			Final Design		Option 1: Indicate, for renewable energy,proposed design total annual energy generated and annual cost.		ELEC MEC
			Final Design		Option 2: Indicate CBECS building type and building gross area. Provide the following CBECS data: median annual electrical intensity, median annual non-electrical fuel intensity, average electric energy cost, average non-electric fuel cost, annual electric energy use and cost, annual non-electric fuel use and cost.		ELEC MEC
			Final Design		Option 2: Narrative describing renewable systems and explaining calculation method used to estimate annual energy generated, including factors influencing performance.		ELEC MEC
EA2.2		On-Site Renewable Energy	Same as EA2.1		Same as EA2.1		ELEC MEC
EA2.3		On-Site Renewable Energy	Same as EA2.1		Same as EA2.1		ELEC MEC
EA3		Enhanced Commissioning	**Final Design		**Owner's Project Requirements document (OPR)		ALL
			**Final Design		**Basis of Design document for commissioned systems (BOD)		ELEC MEC
			**Final Design		**Commissioning Plan		ELEC MEC
			Closeout		Statement confirming all commissioning requirements have been incorporated into construction documents.		PE
			Closeout		**Commissioning Report		PE
			**Final Design		Statement by CxA confirming Commissioning Design Review		
			Closeout		Statement by CxA confirming review of Contractor submittals for compliance with OPR and BOD		PE
			Closeout		**Systems Manual		PE
			Closeout		Statement by CxA confirming completion of O&M staff and occupant training		PE
			Closeout		**Scope of work for post-occupancy review of building operation, including plan for resolution of outstanding issues		PE
			**Predesign		Statement confirming CxA qualifications and contractual relationships relative to work on this project, demonstrating that CxA is an independent third party.		MEC
EA4		Enhanced Refrigerant Management	Final Design		Refrigerant impact calculation table with all building data and calculation values as shown in LEED 2009 Reference Guide Example Calculations		MEC
			Final Design		Narrative describing any special circumstances or explanatory remarks		
			Closeout	X	Cut sheets highlighting refrigerant data for all HVAC components.		PE
EA5		Measurement & Verification	Closeout		Statement indicating which compliance path option applies.		PE
			Closeout		Measurement and Verification Plan including Corrective Action Plan		PE
			Closeout		**Scope of work for post-occupancy implementation of M&V plan including corrective action plan.		PE
EA6		Green Power	Closeout		Statement indicating which compliance path option applies.		PE
			Closeout		Option 1: Indicate proposed design total annual electric energy usage		PE
			Closeout		Option 2: Indicate actual total annual electric energy usage		PE
			Closeout		Option 3: Calculation indicating building type, total gross area, median electrical intensity and annual electric energy use		PE

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			Closeout		Green power provider summary table indicating, for each purchase type, provider name, annual quantity green power purchased and contract term. Indicate total annual green power use and indicate percent green power		PE
			Closeout		Narrative describing how Green Power or Green Tags are purchased		PE
CATEGORY 4 – MATERIALS AND RESOURCES							
MRPR1		Storage & Collection of Recyclables (PREREQUISITE)	Final Design		Statement confirming that recycling area will accommodate recycling of plastic, metal, paper, cardboard and glass. Narrative indicating any other materials addressed and coordination with pickup.		ARC
MR1.1		Building Reuse: Maintain 55% of Existing Walls, Floors & Roof	**Final Design		If project includes a building addition, confirm that area of building addition does not exceed 2x the area of the existing building.		ARC
			**Final Design		Spreadsheet listing, for each building structural/envelope element, the existing area and reused area. Total percent reused.		ARC
MR1.2		Building Reuse: Maintain 75% of Existing Walls, Floors & Roof	Same as MR1.1		Same as MR1.1		ARC
MR1.3		Building Reuse: Maintain 95% of Existing Walls, Floors & Roof	Same as MR1.1		Same as MR1.1		ARC
MR1.4		Building Reuse: Maintain 50% of Interior Non-Structural Elements	**Final Design		If project includes a building addition, confirm that area of building addition does not exceed 2x the area of the existing building.		ARC
			**Final Design		Spreadsheet listing, for each building interior non-structural element, the existing area and reused area. Total percent reused.		ARC
MR2.1		Construction Waste Management: Divert 50% From Disposal	**Preconstruction		Waste Management Plan		PE
			**Construction Quarterly and Closeout		Spreadsheet calculations indicating material description, disposal/diversion location (or recycling hauler), weight, total waste generated, total waste diverted, diversion percentage		PE
			**Construction Quarterly and Closeout		Receipts/tickets for all items on spreadsheet		PE
MR2.2		Construction Waste Management: Divert 75% From Disposal	Same as MR2.1		Same as MR2.1		PE
MR3.1		Materials Reuse: 5%	Closeout		Statement indicating total materials value and whether default or actual.		PE
			Closeout		Spreadsheet calculations indicating, for each reused/salvaged material, material description, source or vendor, cost. Total reused/salvaged materials percentage.		PE
MR3.2		Materials Reuse: 10%	Same as MR3.1		Same as MR3.1		PE
MR4.1		Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	Closeout		Statement indicating total materials value and whether default or actual.		PE
			Closeout		Spreadsheet calculations indicating, for each recycled content material, material name/description, manufacturer, cost, post-consumer recycled content percent, pre-consumer recycled content percent, source of recycled content data. Total post-consumer content materials cost, total pre-consumer content materials cost, total combined recycled content materials cost, recycled content materials percentage.		PE
			Final Design or NLT Preconstruction		**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE
			Closeout	X	Manufacturer published product data or certification, confirming recycled content percentages in spreadsheet		PE
MR4.2		Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	Same as MR4.1		Same as MR4.1		PE
MR5.1		Regional Materials:10% Extracted, Processed & Manufactured Regionally	Closeout		Statement indicating total materials value and whether default or actual.		PE
			Closeout		Spreadsheet calculations indicating, for each regional material, material name/description, manufacturer, cost, percent compliant, harvest distance, manufacture distance, source of manufacture and harvest location data. Total regional materials cost, regional materials percentage.		PE
			Preconstruction		**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE
			Closeout	X	Manufacturer published product data or certification confirming regional material percentages in spreadsheet		PE

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MR5.2		Regional Materials:20% Extracted, Processed & Manufactured Regionally	Same as MR5.1		Same as MR5.1		PE
MR6		Rapidly Renewable Materials	Closeout		Statement indicating total materials value and whether default or actual.		PE
			Closeout		Spreadsheet calculations indicating, for each rapidly renewable material, material name/description, manufacturer, cost, rapidly renewable content percent, rapidly renewable product value. Total rapidly renewable product value, rapidly renewable materials percentage.		PE
			Final Design		**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		ARC
			Closeout	X	Manufacturer published product data or certification confirming rapidly renewable material percentages in spreadsheet		PE
MR7		Certified Wood	Closeout		Statement indicating total materials value and whether default or actual.		PE
			Closeout		Spreadsheet calculations indicating, for each certified wood material, material name/description, vendor, cost, wood component percent, certified wood percent of wood component, FSC chain of custody certificate number. Total certified wood product value, certified wood materials percentage.		PE
			Final Design or NLT Preconstruction		**Purchasing Plan consisting of spreadsheet indicated above, filled in with estimated quantities to show strategy for achieving goal.		PE
			Closeout	X	Vendor invoices, FSC chain of custody certificates and anufacturer published product data or certification confirming all certified wood materials percentages in spreadsheet.		PE
INDOOR ENVIRONMENTAL QUALITY							
EQPR1		Minimum IAQ Performance (PREREQUISITE)	Final Design		Statement indicating which option for compliance applies, stating applicable criteria/requirement, and confirming that project has been designed to meet the applicable requirements.		MEC
			Final Design		Narrative describing the project's ventilation design, including specifics about fresh air intake volumes and special considerations.		MEC
EQPR2		Environmental Tobacco Smoke (ETS) Control (PREREQUISITE)	Final Design		Statement indicating which option for compliance applies, stating applicable criteria/requirement, and confirming that project has been designed to meet the applicable requirements.		ARC
			Final Design		List of drawing and specification references that convey conformance to applicable requirements (signage, exhaust system, room separation details, etc).		ARC
EQ1		Outdoor Air Delivery Monitoring	Final Design		Statement indicating which option for compliance applies and confirming that project has been designed to meet the applicable requirements.		MEC
			Final Design		List of drawing and specification references that convey conformance to applicable requirements.		MEC
			Final Design		Narrative describing the project's ventilation design and CO2 monitoring system, including specifics about monitors, operational parameters and setpoints.		MEC
			Closeout	X	Cut sheets for CO2 monitoring system.		PE
EQ2		Increased Ventilation	Final Design		Statement indicating which option for compliance applies and confirming that project has been designed to meet the applicable requirements.		MEC
			Final Design		Narrative describing the project's ventilation design, including specifics about zone fresh air intake volumes and demonstrating compliance.		MEC
			Final Design		Option 2: Narrative describing design method used for determining natural ventilation design, including calculation methodology/model results and demonstrating compliance.		MEC
			Final Design		List of drawing and specification references that convey conformance to applicable requirements.		MEC
EQ3.1		Construction IAQ Management Plan: During Construction	**Preconstruction		Construction IAQ Management Plan		PE
			Closeout		Statement confirming whether air handling units were operated during construction		PE
			Closeout		Dated jobsite photos showing examples of IAQ management plan practices being implemented. Label photos to indicate which practice they demonstrate. Minimum one photo of each practice at each building.		PE

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			Closeout		Spreadsheet indicating, for each filter installed during construction, the manufacturer, model number, MERV rating, location installed, and if it was replaced immediately prior to occupancy.		PE
EQ3.2		Construction IAQ Management Plan: Before Occupancy	**Preconstruction		Construction IAQ Management Plan		PE
			Closeout		Statement indicating which option for compliance applies and confirming that required activities have occurred that meet the applicable requirements.		PE
			Closeout		Option 1a: Narrative describing the project's flushout process, including specifics about temperature, airflow and duration, special considerations (if any) and demonstrating compliance.		PE
			Closeout		Option 1b: Narrative describing the project's pre-occupancy and post-occupancy flushout processes, including specifics about temperature, airflow and duration, special considerations (if any) and demonstrating compliance.		PE
			Closeout		Option 2: Narrative describing the project's IAQ testing process, including specifics about contaminants tested for, locations, remaining work at time of test, retest parameters and special considerations (if any).		PE
			Closeout		Option 2: IAQ testing report demonstrating compliance.		PE
EQ4.1		Low Emitting Materials: Adhesives & Sealants	Closeout		Spreadsheet indicating, for each applicable indoor adhesive, sealant and sealant primer used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data.		PE
			Closeout		Spreadsheet indicating, for each applicable indoor aerosol adhesive, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data - OR - Statement confirming no indoor aerosol adhesives were used for the project.		PE
			Closeout	X	Manufacturer published product data or certification confirming material VOCs in spreadsheet		PE
EQ4.2		Low Emitting Materials: Paints & Coatings	Closeout		Spreadsheet indicating, for each applicable indoor paint and coating used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data.		PE
			Closeout		Spreadsheet indicating, for each applicable indoor anti-corrosive/anti-rust paint and coating used, the manufacturer, product name/model number, VOC content, LEED VOC limit, and source of VOC data - OR - Statement confirming no indoor anti-corrosive/anti-rust paints were used for the project .		PE
			Closeout	X	Manufacturer published product data or certification confirming material VOCs in spreadsheet		PE
EQ4.3		Low Emitting Materials: Flooring Systems	Closeout		Spreadsheet indicating, for each indoor flooring system used, the manufacturer, product name/model number, if it meets LEED requirement (yes/no) and source of LEED compliance data.		PE
			Closeout		Spreadsheet indicating, for each indoor carpet cushion used, the manufacturer, product name/model number, if it meets LEED requirement (yes/no) and source of LEED compliance data - OR - Statement confirming no indoor carpet cushion was used for the project.		PE
			Closeout	X	Manufacturer published product data or certification confirming material compliance label in spreadsheet		PE
EQ4.4		Low Emitting Materials: Composite Wood & Agrifiber Products	Closeout		Spreadsheet indicating, for each indoor composite wood and agrifiber product used, the manufacturer, product name/model number, if it contains added urea formaldehyde (yes/no) and source of LEED compliance data.		PE
			Closeout	X	Manufacturer published product data or certification confirming material urea formaldehyde in spreadsheet		PE
EQ5		Indoor Chemical & Pollutant Source Control	Closeout		Spreadsheet indicating, for each permanent entryway system used, the manufacturer, product name/model number and description of system.		PE
			Final Design		List of drawing and specification references that convey locations and installation methods for entryway systems.		ARC
			Final Design		Spreadsheet indicating, for each chemical use area, the room number, room name, description of room separation features (walls, floor/ceilings, openings) and pressure differential from surrounding spaces with doors closed - OR - Statement confirming that project includes no chemical use areas and that no hazardous cleaning materials are needed for building maintenance.		ARC MEC
			Final Design		If project includes chemical use areas: List of drawing and specification references that convey locations of chemical use areas, room separation features and exhaust system.		ARC MEC

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			Final Design		If project includes places where water and chemical concentrate mixing occurs: List of drawing and specification references that convey provisions for containment of hazardous liquid wastes OR - Statement confirming that project includes no places where water and chemical concentrate mixing occurs.		ARC MEC
			Closeout		If project includes chemical use areas: Spreadsheet indicating, for AHUs/mechanical ventilation equipment serving occupied areas, the manufacturer, model number, MERV rating, location installed, and if it was replaced immediately prior to occupancy (yes/no) - OR - Statement confirming that project does not use mechanical equipment for ventilation of occupied areas.		PE
EQ6.1		Controllability of Systems: Lighting	Final Design		Calculation indicating total number of individual workstations, number of workstations with individual lighting controls and the percentage of workstations with individual lighting controls.		ELEC
			Final Design		For each shared multi-occupant space, provide a brief description of lighting controls.		ELEC
			Final Design		Narrative describing lighting control strategy, including type and location of individual controls and type and location of controls in shared multi-occupant spaces.		ELEC
EQ6.2		Controllability of Systems: Thermal Comfort	Final Design		Calculation indicating total number of individual workstations, number of workstations with individual thermal comfort controls and the percentage of workstations with individual thermal comfort controls.		MEC
			Final Design		For each shared multi-occupant space, provide a brief description of thermal comfort controls.		MEC
			Final Design		Narrative describing thermal comfort control strategy, including type and location of individual and shared multi-occupant controls.		MEC
EQ7.1		Thermal Comfort: Design	Final Design		Design criteria spreadsheet indicating, for spring, summer, fall and winter, maximum indoor space design temperature, minimum indoor space design temperature and maximum indoor space design humidity.		MEC
			Final Design		Narrative describing method used to establish thermal comfort control conditions and how systems design addresses the design criteria, including compliance with the referenced standard.		MEC
EQ7.2		Thermal Comfort: Verification	Final Design		Narrative describing the scope of work for the thermal comfort survey, including corrective action plan development		MEC
			Final Design		List of drawing and specification references that convey permanent monitoring system.		MEC
EQ8.1		Daylight & Views: Daylight 75% of Spaces	Final Design		Option 2: Table indicating all regularly occupied spaces with space area and space area with compliant daylight zone. Sum of regularly occupied areas and regularly occupied areas withcompliant daylight zone. Percentage calculation of areas withcompliant daylight zone to total regularly occupied areas.		ARC
			Final Design		Option 1: Simulation model method, software and output data		ELEC
			Final Design		Option 1: Table indicating all regularly occupied spaces with space area, space area with minimum 25 footcandles daylighting illumination, and method of providing glare control. Sum of regularly occupied areas and regularly occupied areas with 25 fc daylighting. Percentage calculation of areas with 25 fc daylighting to total regularly occupied areas.		ELEC
			Final Design		For all occupied spaces excluded from the calculation, provide narrative indicating reasons for excluding the space.		ARC
			Final Design		List of drawing and specification references that convey exterior glazed opening head and sill heights, glazing performance properties and glare control/sunlight redirection devices.		ARC
			Closeout	X	Manufacturer published product data or certification confirming glazing Tvis in spreadsheet		PE
EQ8.2		Daylight & Views: Views for 90% of Spaces	Final Design		Table indicating all regularly occupied spaces with space area and space area with access to views. Sum of regularly occupied areas and regularly occupied areas with access to views. Percentage calculation of areas with views to total regularly occupied areas.		ARC
			Final Design		For all occupied spaces excluded from the calculation, provide narrative indicating reasons for excluding the space.		ARC
			Final Design		LEED Floor plan drawings showing line of sight diagramming of views areas in each regularly occupied space. List of drawing/specification references that convey exterior glazed opening head and sill heights.		ARC
INNOVATION & DESIGN PROCESS							

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IDc1.1		Innovation in Design	Final Design		Narrative decribing intent, requirement for credit, project approach to the credit. List of drawings and specification references that convey implementation of credit. All other documentation that validates claimed credit.		
IDc1.2		Innovation in Design	Final Design				
IDc1.3		Innovation in Design	Final Design				
IDc1.4		Innovation in Design	Final Design				
IDc2		LEED Accredited Professional	Final Design		Narrative indicating name of LEED AP, company name of LEED AP, description of LEED AP's role and responsiblilities in the project.		ARC

ATTACHMENT F
Version 02-03-2010

BUILDING INFORMATION MODELING REQUIREMENTS

1.0 Section 1 - Submittal Format

1.1. Design Deliverables. Develop all designs using Building Information Modeling (BIM) and Computer Aided Design (CAD) software. Design submittal drawings shall be 22 X 34 size, suitable for half-size scaled reproduction.

2.0 Section 2 – Design Requirements

2.1. BIM Model and Facility Data. Contractor shall use BIM application(s) and software(s) to develop project designs. “Facility Data” is defined as associated intelligent attribute data. The “Model” is defined as 3D graphics that includes Facility Data and output as described in the paragraph ‘Output’ below. Contractors will use the Model to produce accurate Construction Documents. For each Center of Standardization (CoS) facility type included in this project, all BIM Models and associated Facility Data shall be submitted in Bentley Systems BIM Bentley V8 XM with associated USACE Bentley BIM Workspace (which includes specific standard BIM libraries and definitions). This Workspace can be downloaded from the CAD/BIM Technology Center. [Where available, the workspace will be specific to this CoS Facility Standard Design. The Contractor will be provided a baseline multi-discipline BIM Project Model for the CoS Facility Standard Design type, where such a model exists (for the purposes of site adaptation).] The USACE Bentley BIM Workspace is dependent on specific versions of the Bentley BIM suite of products and only the versions of the software that are listed in the Contractor instructions included with the USACE BIM Workspace are permitted to be used.

2.1.1. Reference. Refer to ERDC TR-06-10, “U.S. Army Corps of Engineers Building Information Modeling Road Map” from the CAD/BIM Technology Center website for more information on the USACE BIM implementation goals.

2.2. Drawings. Deliver CAD files used for the creation of the Construction Documents Drawings per requirements in Section 01 33 16, the criteria of the USACE [Not Supplied - DistrictInfoGeneral : ISSUING_DISTRICT] District, and as noted herein. Specification of a CAD file format for these Drawings does not limit which BIM application(s) or software(s) may be used for project development and execution.

2.2.1. IFC Support. The Contractor’s selected BIM application(s) and software(s) must support the IFC (Industry Foundation Class - see www.iai-tech.org). Submit any deviations from or additions to the IFC property sets for any new spaces, systems, and equipment for Government approval.

2.2.2. Submittal Requirements. BIM submittals shall be fully interoperable, compatible, and editable with the Bentley BIM tools. Use the specified version of the USACE Bentley BIM Workspace and conform to the requirements of **Sections 3 and 4 below**.

2.2.3. BIM Project Execution Plan.

2.2.3.1. Develop a BIM Project Execution Plan (“Plan” or “PxP”) documenting the BIM and analysis technologies selected for the Project Model (integrated with the AEC CAD Standard) from concept development through As-Builts as a design, production, coordination, construction, and documentation tool and the collaborative process by which it shall be executed. See Section 7 for additional guidance on developing the Plan.

2.2.4. BIM Requirements..

2.2.4.1. Facility Data. Develop the Facility Data consisting of a set of intelligent elements for the Model (e.g., doors, air handlers, electrical panels). This Facility Data shall include all material definitions and attributes that are necessary for the Project facility design and construction. Additional data in support of Section 6 Contractor Electives is encouraged.

2.2.4.2. Model Content. The Model and Facility Data shall include, at a minimum, the requirements of Section 4 below.

2.2.4.3. Model Granularity. Models may vary in level of detail for individual elements within a model, but at a minimum must include all features that would be included on a quarter inch (1/4" = 1'0") scaled drawing (e.g. at least 1/16th, 1/8th and 1/4th), or appropriately scaled civil drawings.

2.2.4.4. Output. Submitted CAD drawings (e.g., plans, elevations, sections, schedules, details, etc.) shall be derived (commonly known as extractions, views or sheets) and maintained from the submitted Model and Facility Data.

2.3. Quality Control. Implement quality control (QC) parameters for the Model, including:

2.3.1. Model Standards Checks. QC validation used to ensure that the Project Facility Data set has no undefined, incorrectly defined or duplicated elements. Report non-compliant elements and corrective action plan to correct non-compliant elements. Provide the government with detailed justification and request government approval for any non-compliant element which the contractor proposes to be allowed to remain in the Model.

2.3.2. CAD Standards Checks. QC checking performed to ensure that the fonts, dimensions, line styles, levels and other construction document formatting issues are followed per the A/E/C CADD Standard.

2.3.3. Other Parameters. Develop such other QC parameters as Contractor deems appropriate for the Project and provide to the Government for concurrence.

2.4. Design and Construction Reviews. Perform design and construction reviews at each submittal stage under Section 3 to test the Model, including:

2.4.1. Visual Checks. Checking to ensure the design intent has been followed and that there are no unintended elements in the Model.

2.4.2. Interference Management Checks. Locate conflicting spatial data in the Model where two elements are occupying the same space. Log hard interferences (e.g., mechanical vs. structural or mechanical vs. mechanical overlaps in the same location) and soft interferences, (e.g., conflicts regarding equipment clearance, service access, fireproofing, insulation) in a written report and resolve.

2.4.3. IFC Coordination View. Provide an IFC Coordination View in IFC Express format for all deliverables. Provide exported property set data for all IFC supported named building elements.

2.4.4. Other Parameters. Develop such other Review parameters as the Contractor deems appropriate for the Project and provide to the Government for concurrence..

3.0 Section 3 – Design Stage Submittal Requirements

3.1. General Submittal Requirements.

3.1.1. Provide submittals in compliance with BIM Project Execution Plan deliverables at stages as described hereinafter.

3.1.2. At each Stage in Paragraphs 3.3 through 3.6, provide a Contractor-certified written report confirming that consistency checks as identified in Paragraphs 2.3 and 2.4 have been completed. This report shall be discussed as part of the review process and shall address cross-discipline interferences, if any.

3.1.3. At each Stage in Paragraphs 3.3 through 3.6, provide the Government with:

- The Model, Facility Data, Workspace and CAD Data files in native Bentley BIM/CAD.

- A 3-D interactive review format of the Model in Bentley Navigator, Autodesk Navisworks, Adobe 3D PDF 7.0 (or later), Google Earth KMZ or other format per Plan requirements. The file format for reviews can change between submittals.

- A list of all submitted files. The list should include a description, directory, and file name for each file submitted. For all CAD sheets, include the sheet title and sheet number. Identify files that have been produced from the submitted Model and Facility Data.

3.2. Initial Design Conference Submittal.

3.2.1. Submit a digital copy of the Plan where, in addition to Paragraph 3.1.4, the USACE Geographic District BIM Manager will coordinate with the USACE CoS BIM Manager to confirm acceptability of the Plan or advise as to additional processes or activities necessary to be incorporated.

3.2.2. Within thirty (30) days after the approval of the Plan, conduct a demonstration to review the Plan for clarification, and to verify the functionality of Model technology workflow and processes. If modifications are required, the Contractor shall complete the modifications and resubmit the Plan and perform subsequent demonstration for Government acceptance. There will be no payment for design or construction until the Plan is acceptable to the Government. The Government may also withhold payment for design and construction for unacceptable performance in executing the approved Plan.

3.3. Interim Design Submittals.

3.3.1. BIM and CAD Data. The Model shall include the requirements identified in Paragraph 2.2.4 as applicable to the Interim Design package(s).

3.4. Final Design Submissions and Design Complete Submittals.

3.4.1. BIM and CAD Data. The Model shall include the requirements identified in Paragraph 2.2.4. Acceptance according to Paragraph 3.1.4 is required before commencement of construction, as described in Paragraph 3.7.6 of Section 01 33 16.

3.5. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model, including interference management and design change tracking information.

3.6. Final As-Builts BIM and CAD Data Submittal. Submit the final Model, Facility Data, and CAD files reflecting as-built conditions for Government Approval, as specified in Section 01 78 02.00 10, PROJECT CLOSEOUT.

4.0 Section 4 – BIM Model Minimum Requirements and Output

4.1. General Provisions. The deliverable Model shall be developed to include the systems described below as they would be built and the processes of installing them, and to reflect final as-built conditions. The deliverable model at the interim design stage and at the final design stage (“released for construction”) shall be developed to include as many of the systems described below as are necessary and appropriate at that design stage.

4.2. Architectural/Interior Design. The Architectural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing. Additional minimum Model requirements include:

4.2.1. Spaces. The Model shall include spaces defining accurate net square footage and net volume, and holding data for the room finish schedule for including room names and numbers. Include Programmatic Information provided by the Government or validated program to verify design space against programmed space, using this information to validate area quantities.

4.2.2. Walls and Curtain Walls. Each wall shall be depicted to the exact height, length, width and ratings (thermal, acoustic, fire) to properly reflect wall types. The Model shall include all walls, both interior and exterior, and the necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.

4.2.3. Doors, Windows and Louvers. Doors, windows and louvers shall be depicted to represent their actual size, type and location. Doors and windows shall be modeled with the necessary intelligence to produce accurate window and door schedules.

4.2.4. Roof. The Model shall include the roof configuration, drainage system, penetrations, specialties, and the necessary intelligence to produce accurate plans, building sections and generic wall sections where roof design elements are depicted.

4.2.5. Floors. The floor slab shall be developed in the structural Model and then referenced by the architectural Model for each floor of the Project building.

4.2.6. Ceilings. All heights and other dimensions of ceilings, including soffits, ceiling materials, or other special conditions shall be depicted in the Model with the necessary intelligence to produce accurate plans, building sections and generic wall sections where ceiling design elements are depicted.

4.2.7. Vertical Circulation. All continuous vertical components (i.e., non-structural shafts, architectural stairs, handrails and guardrails) shall be accurately depicted and shall include the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.

4.2.8. Architectural Specialties and Woodwork. All architectural specialties (i.e., toilet room accessories, toilet partitions, grab bars, lockers, and display cases) and woodwork (i.e., cabinetry and counters) shall be accurately depicted with the necessary intelligence to produce accurate plans, elevations and sections in which such design elements are referenced.

4.2.9. Signage. The Model shall include all signage and the necessary intelligence to produce accurate plans and schedules.

4.2.10. Schedules. Provide door, window, hardware sets using BHMA designations, flooring, wall finish, and signage schedules from the Model, indicating the type, materials and finishes used in the design.

4.3. Furniture. The furniture systems Model may vary in level of detail for individual elements within a Model, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing, and have necessary intelligence to produce accurate plans. Representation of furniture elements is to be 2D. Contractor may provide a minimal number of 3D representations as examples. Examples of furniture include, but are not limited to, desks, furniture systems, seating, tables, and office storage.

4.3.1. Furniture Coordination. Furniture that makes use of electrical, data or other features shall include the necessary intelligence to produce coordinated documents and data.

4.4. Equipment. The Model may vary in level of detail for individual elements within a Model. Equipment shall be depicted to meet layout requirements with the necessary intelligence to produce accurate plans and minimum schedules depicting their configuration. Examples of equipment include but are not limited to copiers, printers, refrigerators, ice machines and microwaves.

4.4.1. Schedules. Provide furniture and equipment schedules from the model indicating the materials, finishes, mechanical, and electrical requirements.

4.5. Structural. The structural systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing. Additional minimum Model requirements include:

4.5.1. Foundations. All necessary foundation and/or footing elements, with necessary intelligence to produce accurate plans and elevations

4.5.2. Floor Slabs. Structural floor slabs shall be depicted, including all necessary recesses, curbs, pads, closure pours, and major penetrations accurately depicted.

4.5.3. Structural Steel. All steel columns, primary and secondary framing members, and steel bracing for the roof and floor systems (including decks), including all necessary intelligence to produce accurate structural steel framing plans and related building/wall sections.

4.5.4. Cast-in-Place Concrete. All walls, columns, and beams, including necessary intelligence to produce accurate plans and building/wall sections depicting cast-in-place concrete elements.

4.5.5. Expansion/Contraction Joints. Joints shall be accurately depicted.

4.5.6. Stairs. The structural Model shall include all necessary openings and framing members for stair systems, including necessary intelligence to produce accurate plans and building/wall sections depicting stair design elements.

4.5.7. Shafts and Pits. The structural Model shall include all necessary shafts, pits, and openings, including necessary intelligence to produce accurate plans and building/wall sections depicting these design elements.

4.6. Mechanical. The mechanical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing. Small diameter (less than 1-1/2” NPS) field-routed piping is not required in the model. Additional minimum Model requirements include:

4.6.1. HVAC. All necessary heating, ventilating, air-conditioning and specialty equipment, including air distribution ducts for supply, return, and ventilation and exhaust ducts, including control system, registers, diffusers, grills and hydronic baseboards with necessary intelligence to produce accurate plans, elevations, building/wall sections and schedules.

4.6.1.1. Mechanical Piping. All necessary piping and fixture layouts, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, and schedules.

4.6.2. Plumbing. All necessary plumbing piping and fixture layouts, floor and area drains, and related equipment, including necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules.

4.6.3. Equipment Clearances. All HVAC and Plumbing equipment clearances shall be modeled for use in interference management and maintenance access requirements.

4.6.4. Elevator Equipment. The Model shall include the necessary equipment and control system, including necessary intelligence to produce accurate plans, sections and elevations depicting these design elements.

4.7. Electrical/Telecommunications. The electrical systems Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4”=1’0”) scaled drawing. Small diameter (less than 1-1/2”Ø) field-routed conduit is not required in the model. Additional minimum Model requirements include:

4.7.1. Interior Electrical Power and Lighting. All necessary interior electrical components (i.e., lighting, receptacles, special and general purpose power receptacles, lighting fixtures, panelboards, cable trays and control systems), including necessary intelligence to produce accurate plans, details and schedules. Lighting and power built into furniture/equipment shall be modeled.

4.7.2. Special Electrical Systems. All necessary special electrical components (i.e., security, Mass Notification, Public Address, nurse call and other special occupancies, and control systems), including necessary intelligence to produce accurate plans, details and schedules.

4.7.3. Grounding Systems. Grounding Systems. All necessary grounding components (i.e., lightning protection systems, static grounding systems, communications grounding systems, bonding), including necessary intelligence to produce accurate plans, details and schedules.

4.7.4. Communications. All existing and new communications service controls and connections, both above ground and underground with necessary intelligence to produce accurate plans, details and schedules. Cable tray routing shall be modeled without detail of cable contents.

4.7.5. Exterior Building Lighting. All necessary exterior lighting with necessary intelligence to produce accurate plans, elevations and schedules. The exterior building lighting Model shall include all necessary lighting, relevant existing and proposed support utility lines and equipment required with necessary intelligence to produce accurate plans, details and schedules.

4.7.6. Equipment Clearances. The model shall incorporate and define all electrical and communications working spaces, clearances, and required access

4.8. Fire Protection. The fire protection system Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a quarter inch (1/4"=1'0") scaled drawing. Additional minimum Model requirements include:

4.8.1. Fire Protection System. All relevant fire protection components (i.e., branch piping, sprinkler heads, fittings, drains, pumps, tanks, sensors, control panels) with necessary intelligence to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All fire protection piping shall be modeled.

4.8.2. Fire Alarms. Fire alarm/mass notification devices and detection system shall be indicated with necessary intelligence to produce accurate plans depicting them.

4.9. Civil. The civil Model may vary in level of detail for individual elements, but at a minimum must include all features that would be included on a one inch (1"=100') scaled drawing. Additional minimum Model requirements include:

4.9.1. Terrain (DTM). All relevant site conditions and proposed grading, including necessary intelligence to produce accurate Project site topographical plans and cross sections.

4.9.2. Drainage. All existing and new drainage piping, including upgrades thereto, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.9.3. Storm Water and Sanitary Sewers. All existing and new sewer structures and piping, including upgrades thereto, on the Project site with necessary connections to mains or other distribution points as appropriate, including necessary intelligence to produce accurate plans and profiles for the Project site.

4.9.4. Utilities. All necessary new utilities connections from the Project building(s) to the existing or newly-created utilities, and all existing above ground and underground utility conduits, including necessary intelligence to produce accurate plans and site-sections.

4.9.5. Roads and Parking. All necessary roadways and parking lots or parking structures, including necessary intelligence to produce accurate plans, profiles and cross-sections.

5.0 Section 5 - Ownership and Rights in Data

5.1. Ownership. The Government has ownership of and rights at the date of Closeout Submittal to all CAD files, BIM Model, and Facility Data developed for the Project in accordance with FAR Part 27, clauses incorporated in Section 00 72 00, Contract Clauses and Special Contract Requirement 1.14 GOVERNMENT RE-USE OF DESIGN (Section 00 73 00). The Government may make use of this data following any deliverable.

6.0 Section 6 – Contractor Electives

6.1. Applicable Criteria. If the Contractor elected to include one or more of the following features as an elective in its accepted contract proposal for additional credit during the source selection, as described in the proposal submission requirements and evaluation criteria, the following criteria are requirements, as applicable to those elective feature(s).

6.2. COBIE Compliance. The Model and Facility Data for the Project shall fulfill Construction Operations Building Information Exchange (COBIE) requirements as defined by the Whole Building Design Guide organization, including all requirements for the indexing and submission of Portable Document Format (PDF) and other appropriate file formats that would otherwise be printed and submitted in compliance with Project operations and maintenance handover requirements.

6.3. Project Scheduling using the Model. In the BIM Execution Plan and during the Preliminary BIM Execution Plan Review, provide an overview of the use of BIM in the development and support of the project construction schedule.

6.3.1. Submittal Requirements. During the Submittal stages, the Contractor shall deliver the construction schedule with information derived from the Model.

6.3.1.1. Construction Submittals – Over-The-Shoulder Progress Reviews. Periodic quality control meetings or construction progress review meetings shall include quality control reviews on the implementation and use of the Model for project scheduling.

6.4. Cost Estimating. In the BIM Execution Plan and during the Preliminary BIM Execution Plan Review, provide an overview of the use of BIM in the development and support of cost estimating requirements, or other applications such as cost analysis and estimate validation.

6.4.1. Submittal Requirements. During the Submittal stages, the Contractor shall deliver cost estimating information derived from the Model.

6.4.2. Project completion. At project completion, the Contractor shall provide an MII (Micro Computer Aided Cost Estimating System Generation II) Cost Estimate which follows the USACE Cost Engineering Military Work Breakdown System (WBS), a modified Uniformat, to at least the sub-systems level and uses quantity information supplied directly from BIM output to the maximum extent possible, though other "Gap" quantity information will be included as necessary for a complete and accurate cost estimate.

6.4.2.1. Sub system level extracted quantities from the BIM for use within the estimate shall be provided according to how detailed line items or tasks should be installed/built so that accurate costs can be developed and/or reflected. Therefore, when developing a BIM, the designer shall be cognizant of what tasks need to be separated appropriately at the beginning stages of model development, such as tasks done on the first floor versus the same task on higher floors that will be more labor intensive and therefore need to have a separate quantity and be priced differently. Tasks and their extracted quantities from the BIM shall be broken done by their location (proximity in the structure) as well as the complexity of its installation.

6.4.2.2. At all design stages it shall be understood that BIM output as described in this document will not generate all quantities that are necessary in order to develop a complete and accurate cost estimate of the project based on the design. An example of this would be plumbing that is less than 1.5" diameter and therefore not expected to be modeled due to granularity; this information is commonly referred to as The Gap. Quantities from The Gap and their associated costs shall be included in the final project actual cost estimates as well.

6.5. Other Analyses and Reports. Structural, energy and efficiency, EPACT 2005 & EISA 2007, lighting design, daylighting, electrical power, psychrometric processing, shading, programming, LEED, fire protection, code compliance, Life Cycle Cost, acoustic, plumbing.

7.0 Section 7 – BIM Project Execution Plan Template

7.1. Contractors will utilize the latest version of the USACE BIM PROJECT EXECUTION PLAN (USACE PxP) Template to develop an acceptable Plan. The template can be downloaded from the CAD/BIM Technology Center website.

ATTACHMENT G
DESIGN SUBMITTAL DIRECTORY AND SUBDIRECTORY FILE ARRANGEMENT

Organize electronic design submittal files in a subdirectory/file structure in accordance with the following table. The Contractor may suggest a slightly different structure, subject to the discretion of the government.

Design Submittal Directory and Subdirectory File Arrangement.

Directory	Sub-Directory	Sub-Directory or Files	Files
Submittal/Package Name	Narratives	PDF file or files with updated design narrative for each applicable design discipline	
	Drawings	PDF (subdirectory)	Single PDF file with all applicable drawing sheets - bookmarked by sheet number and name
		BIM (subdirectory) See Attachment F.	BIM project folder (with files) per the USACE Workspace. Include an Excel drawing index file with each drawing sheet listed by sheet #, name and corresponding dgn file name (Final Design & Design Complete only)
	Design Analysis & Calculations	Individual PDF files containing design analysis and calculations for each discipline applicable to the submittal	
		PDF file with Fire Protection and Life Safety Code Review checklist	
	LEED	PDF file with updated Leed Check List	
		PDF file or files with LEED Templates for each point with applicable documentation included in each file.	
		LEED SUBMITTALS	
	Energy Analysis	PDF with baseline energy consumption analysis	
		PDF with actual building energy consumption analysis	
	Specifications	Single PDF file with table of contents and all applicable specifications sections.	
		Submittal Register (Final Design & Design Complete submittal only)	
	Design Quality Control	PDF file or files with DQC checklist(s) and/or statements	
	Building Rendering(s)	PDF file of rendering for each building type included in contract (Final Design & Design Complete).	

SECTION 01 45 04.00 10
CONTRACTOR QUALITY CONTROL

1.0 GENERAL

1.1. REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Refer to the latest edition, as of the date of the contract solicitation.

- ASTM INTERNATIONAL (ASTM)
- ASTM D 3740 Minimum Requirements for Agencies

  Engaged in the Testing and/or Inspection
  of Soil and Rock as Used in Engineering
  Design and Construction
- ASTM E 329 Agencies Engaged in the Testing

  and/or Inspection of Materials Used in
  Construction
- U.S. ARMY CORPS OF ENGINEERS (USACE)

  ER 1110-1-12 Quality Management

1.2. PAYMENT

There will be no separate payment for providing and maintaining an effective Quality Control program. Include all costs associated therewith in the applicable unit prices or lump-sum prices contained in the Contract Line Item Schedule.

2.0 PRODUCTS (Not Applicable)

3.0 EXECUTION

3.1. GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product, which complies with the contract requirements. The system shall cover all design and construction operations, both onsite and offsite, and shall be keyed to the proposed design and construction sequence. The site project superintendent is responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

3.2. QUALITY CONTROL PLAN

Furnish for Government review, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Design and construction may begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. The Government will not permit work outside of the features of work included in an accepted interim plan to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started. Where the applicable Code issued by the International Code Council calls for an inspection by the Building Official, the Contractor shall include the inspections in the Quality Control Plan and shall perform the inspections. The Designer of Record shall develop a program for any special inspections required by the applicable International Codes and the Contractor shall perform these inspections, using qualified inspectors. Include the special inspection plan in the QC Plan.

3.2.1. Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect/engineers (AE), fabricators, suppliers, and purchasing agents:

3.2.1.1. A description of the quality control organization. Include a chart showing lines of authority and an acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. A CQC System Manager shall report to the project superintendent or someone higher in the contractor's organization.

3.2.1.2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function. Also include those responsible for performing and documenting the inspections required by the International Codes and the special inspection program developed by the designer of record.

3.2.1.3. A copy of the letter to the CQC System Manager, signed by an authorized official of the firm, which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Furnish copies of these letters.

3.2.1.4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents subcontractors, designers of record, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

3.2.1.5. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. Use only Government approved Laboratory facilities.

3.2.1.6. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

3.2.1.7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

3.2.1.8. Reporting procedures, including proposed reporting formats.

3.2.1.9. A list of the definable features of work. A definable feature of work is a task, which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.1.10. A list of all inspections required by the International Codes and the special inspection program required by the code and this contract.

3.2.2. Additional Requirements for Design Quality Control (DQC) Plan

The following additional requirements apply to the Design Quality Control (DQC) plan:

3.2.2.1. The Contractor's QCP Plan shall provide and maintain a Design Quality Control (DQC) Plan as an effective quality control program which will assure that all services required by this design-build contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, competent, independent reviewers identified in the DQC Plan shall review all documents. Use personnel who were not involved in the design effort to produce the design to perform the independent technical review (ITR). The ITR is intended as a quality control check of the design. Include, at least, but not necessarily limited to, a review of the contract requirements (the accepted contract or task order proposal and amended RFP), the basis of design, design calculations, the design configuration management documentation and check the design documents for errors, omissions, and for coordination and design integration. The ITR team is not required to examine, compare or comment concerning alternate design solutions but should concentrate on ensuring that the design meets the contract requirements. Correct errors and deficiencies in the design documents prior to submitting them to the Government.

3.2.2.2. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit these completed checklists at each design phase as part of the project documentation.

3.2.2.3. A Design Quality Control Manager, who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated, shall implement the DQC Plan This individual shall be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. Notify the Government, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

3.2.3. Acceptance of Plan

Government acceptance of the Contractor's plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4. Notification of Changes

After acceptance of the CQC Plan, notify the Government in writing of any proposed change. Proposed changes are subject to Government acceptance.

3.3. COORDINATION MEETING

After the Postaward Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, the Contractor and the Government shall meet and discuss the Contractor's quality control system. Submit the CQC Plan for review a minimum of 7 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. The Government will prepare minutes of the meeting for signature by both parties. . The minutes shall become a part of the contract file. There may be occasions when either party will call for subsequent conferences to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4. QUALITY CONTROL ORGANIZATION

3.4.1. Personnel Requirements

The requirements for the CQC organization are a CQC System Manager, a Design Quality Manager, and sufficient number of additional qualified personnel to ensure contract compliance. The CQC organization shall also include personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly furnish complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2. CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System

Manager shall be a graduate engineer, graduate architect, or a BA/BS graduate of an ACCE accredited construction management college program. The CQC system Manager may alternately be an engineering technician with at least 2 years of college and an ICC certification as a Commercial Building Inspector (Residential Building Inspector certification will be required for Military Family Housing projects). In addition, the CQC system manager shall have a minimum of 5 years construction experience on construction similar to this contract. The CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. Assign the CQC System Manager no other duties (except may also serve as Safety and Health Officer, if qualified and if allowed by Section 00 73 00). Identify an alternate for the CQC System Manager in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager but the alternate may have other duties in addition to serving in a temporary capacity as the acting QC manager.

3.4.3. CQC Personnel

3.4.3.1. In addition to CQC personnel specified elsewhere in the contract provide specialized CQC personnel to assist the CQC System Manager in accordance with paragraph titled Area Qualifications.

3.4.3.2. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; **are not intended to be full time, but must be physically present at the construction site during work on their areas of responsibility**; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan. **One person may cover more than one area, provided that they are qualified to perform QC activities for the designated areas below and provided that they have adequate time to perform their duties:**

3.4.4. Experience Matrix

3.4.4.1. Area Qualifications

3.4.4.1.1. Civil - Graduate Civil Engineer or (BA/BS) graduate in construction management with 4 years experience in the type of work being performed on this project or engineering technician with 5 yrs related experience.

3.4.4.1.2. Mechanical - Graduate Mechanical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or engineering technician with an ICC certification as a Commercial Mechanical Inspector with 5 yrs related experience.

3.4.4.1.3. Electrical - Graduate Electrical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or engineering technician with an ICC certification as a Commercial Electrical Inspector with 5 yrs related experience.

3.4.4.1.4. Structural - Graduate Structural Engineer or (BA/BS) graduate in construction management with 4 yrs related experience or person with an ICC certification as a Reinforced Concrete Special Inspector and Structural Steel and Bolting Special Inspector (as applicable to the type of construction involved) with 5 yrs related experience.

3.4.4.1.5. Plumbing - Graduate Mechanical Engineer or (BA/BS) graduate in construction management with 4 yrs related experience, or person with an ICC certification as a Commercial Plumbing Inspector with 5 yrs related experience.

3.4.4.1.6. Concrete, Pavements and Soils Materials Technician (present while performing tests) with 2 yrs experience for the appropriate area

3.4.4.1.7. Testing, Adjusting and Balancing Specialist must be a member (TAB) Personnel of AABC or an experienced technician of the firm certified by the NEBB (present while testing, adjusting, balancing).

3.4.4.1.8. Design Quality Control Manager Registered Architect or Professional Engineer (not required on the construction site)

3.4.4.1.9. Registered Fire Protection Engineer with 4 years related experience or engineering technician with 5 yrs related experience (but see requirements for Fire Protection Engineer of Record to witness final testing in Section 01 10 00, paragraph 5.10, Fire Protection).

3.4.4.1.10. QC personnel assigned to the installation of the telecommunication system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification. In lieu of BICSI certification, QC personnel shall have a minimum of 5 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. QC personnel shall witness and certify the testing of telecommunications cabling and equipment.

3.4.5. Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management for Contractors". This course is periodically offered at Fort Leonard Wood COE District Office, Fort Leonard Wood, MO. Inquire of the District or Division sponsoring the course for fees and other expenses involved, if any, for attendance at this course.

3.4.6. Organizational Changes

When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5. SUBMITTALS AND DELIVERABLES

Make submittals as specified in Section 01 33 00 ***SUBMITTAL PROCEDURES***. The CQC organization shall certify that all submittals and deliverables are in compliance with the contract requirements.

3.6. CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The CQC organization shall conduct at least three phases of control for each definable feature of the construction work as follows:

3.6.1. Preparatory Phase

Perform this phase prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

3.6.1.1. A review of each paragraph of applicable specifications, reference codes, and standards. Make a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field at the preparatory inspection. Maintain these copies in the field, available for use by Government personnel until final acceptance of the work.

3.6.1.2. A review of the contract drawings.

3.6.1.3. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

3.6.1.4. Review of provisions that have been made to provide required control inspection and testing.

3.6.1.5. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

3.6.1.6. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

3.6.1.7. A review of the appropriate activity hazard analysis to assure safety requirements are met.

3.6.1.8. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

3.6.1.9. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

3.6.1.10. Discussion of the initial control phase.

3.6.1.11. Notify the Government at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2. Initial Phase

Accomplish this phase at the beginning of a definable feature of work. Include the following actions:

3.6.2.1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

3.6.2.2. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

3.6.2.3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

3.6.2.4. Resolve all differences.

3.6.2.5. Check safety to include compliance with and upgrading of the Accident Prevention plan and activity hazard analysis. Review the activity analysis with each worker.

3.6.2.6. Notify the Government at least 24 hours in advance of beginning the initial phase. The CQC System Manager shall prepare and attach to the daily CQC report separate minutes of this phase. Indicate exact location of initial phase for future reference and comparison with follow-up phases.

3.6.2.7. Repeat the initial phase any time acceptable specified quality standards are not being met.

3.6.3. Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Conduct final follow-up checks and correct deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work.

3.6.4. Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7. TESTS

3.7.1. Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements and project design documents. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory, or establish an approved testing laboratory at the project site. The Contractor may elect to use a laboratory certified and accredited by the Concrete and cement Reference Laboratory (CCRL) or by AASHTO Materials Reference Laboratory (AMRL) for testing procedures that those organizations certify. The Contractor shall perform the following activities and record and provide the following data:

3.7.1.1. Verify that testing procedures comply with contract requirements and project design documents.

3.7.1.2. Verify that facilities and testing equipment are available and comply with testing standards.

3.7.1.3. Check test instrument calibration data against certified standards.

3.7.1.4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

3.7.1.5. Include results of all tests taken, both passing and failing tests, recorded on the CQC report for the date taken. Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2. Testing Laboratories

3.7.2.1. Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2. Capability Recheck

If the selected laboratory fails the capability check, the Government will assess the Contractor a charge of $1,375 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3. Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4. Furnishing or Transportation of Samples for Government Quality Assurance Testing

The Contractor is responsible for costs incidental to the transportation of samples or materials. Deliver samples of materials for test verification and acceptance testing by the Government to the Corps of Engineers Laboratory, f.o.b., at the following address:

- For delivery by mail:

  Area Office designated Government contact

  Not Applicable

  Not Applicable

  Not Applicable
- For other deliveries:

  Area Office designated Government contact

Not Applicable

Not Applicable

Not Applicable

The area or resident office will coordinate, exact delivery location, and dates for each specific test.

3.8. COMPLETION INSPECTION

3.8.1. Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the SPECIAL CONTRACT REQUIREMENTS Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. Prepare a punch list of items which do not conform to the approved drawings and specifications and include in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2. Pre-Final Inspection

As soon as practicable after the notification above, the Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. Accomplish these inspections and any deficiency corrections required by this paragraph within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3. Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall attend the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups and major commands may also attend. The Government will formally schedule the final acceptance inspection based upon results of the Pre-Final inspection. Provide notice to the Government at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9. DOCUMENTATION

3.9.1. Maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers using government-provided software, QCS (see Section 01 45 01.10). The report includes, as a minimum, the following information:

3.9.1.1. Contractor/subcontractor and their area of responsibility.

3.9.1.2. Operating plant/equipment with hours worked, idle, or down for repair.

3.9.1.3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

3.9.1.4. Test and/or control activities performed with results and references to specifications/drawings requirements. Identify the applicable control phase (Preparatory, Initial, Follow-up). List deficiencies noted, along with corrective action.

3.9.1.5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

3.9.1.6. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

3.9.1.7. Offsite surveillance activities, including actions taken.

3.9.1.8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

3.9.1.9. Instructions given/received and conflicts in plans and/or specifications.

3.9.1.10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identity of the ITR team, the ITR review comments, responses and the record of resolution of the comments.

3.9.2. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. Furnish the original and one copy of these records in report form to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, submit one report for every 7 days of no work and on the last day of a no work period. Account for all calendar days throughout the life of the contract. The first report following a day of no work shall be for that day only. The CQC System Manager shall sign and date reports. The report shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel. The Contractor may submit these forms electronically, in lieu of hard copy.

3.10. NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

End of Section 01 45 04.00 10

SECTION 01 50 02.0006
TEMPORARY CONSTRUCTION FACILITIES

1.0 OVERVIEW

1.1. GENERAL REQUIREMENTS

1.1.1. This section contains requirements specifically applicable to this task order. The requirements of Base ID/IQ contract Section 01 50 02 apply to this task order, except as otherwise specified herein.

1.3. BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.3.1. Bulletin Board (As Specified in Base contract)

1.3.2. Project and Safety Signs (Added to Stress standardization of signs, in the event that the Base ID/IQ Section 01 50 02 does not contain this information)

Erect a project sign and a site safety sign with informational details as provided by the Government at the Post award conference, within 15 days prior to any work activity on project site. Update the safety sign data daily, with light colored metallic or non-metallic numerals. Remove the signs from the site upon completion of the project. Engineer Pamphlet EP 310-1-6a contains the standardized layout and construction details for the signs. It can be found through a GOOGLE Search or try http://www.usace.army.mil/publications/eng-pamphlets/ep310-1-6a/s-16.pdf.

1.6. GOVERNMENT FIELD OFFICE

1.6.1. Resident Engineer's Office

Provide the Government Resident Engineer with an office, approximately 600 square feet in floor area, co-located on the project site with the Contractor’s office and providing space heat, air conditioning, electric light and power, power and communications outlets and toilet facilities consisting of at leastone lavatory and at least one water closet complete with connections to water and sewer mains, except that where no water and sewer service is available for connection, provide a unisex portable toilet with hand sanitizing feature, maintained by the Contractor in lieu of toilet facilities connected to water and sewer mains . Provide a mail slot in the door or a lockable mail box mounted on the surface of the door. Provide outlets for 4 government phones and same number of LAN connections for Government computers. Coordinate with the Resident Engineer for locations. Provide a conference room with space large enough for 8 personnel to hold meetings. Provide a minimum of two outlets per government work station and at least one outlet per 10 feet of wall space for other government equipment. Provide at least twice weekly janitorial service. Remove the office facilities upon completion of the work and restore those areas. Connect and disconnect utilities in accordance with local codes and to the satisfaction of the Contracting Officer.

1.6.2. Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. Securely anchor the trailer to the ground at all four corners to guard against movement during high winds, per EM 385-1-1.

End of Section 01 50 02.0006

APPENDIX A

Geotechnical Information

Geotechnical Engineering Report

Basic Combat Training Complex 3 South, Phase 1 & 2
Fort Leonard Wood, Missouri

May 26, 2010
Project No. B5105007

Prepared for:
Tompkins Architects
Lee's Summit, Missouri

Prepared by:
Terracon Consultants, Inc.
Springfield, Missouri

Terracon

May 26, 2010

Tompkins Architects
612 Northwest Kay Drive
Lee's Summit, Missouri 64063

Attn: Mr. James Tompkins, AIA
P: [816] 525-9833

Re: Geotechnical Engineering Report
Basic Combat Training Complex 3 South, Phase 1 & 2 (BCT3)
Fort Leonard Wood, Missouri
Terracon Project Number: B5105007

Dear Mr. Tompkins:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number PB510104g dated January 19, 2010. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

FOR Eric M. Hollabaugh, E.I.
Staff Professional

Ty G. Alexander, P.E.
Senior Associate
PE-2009002087

STATE OF MISSOURI
TY G
ALEXANDER
NUMBER
PE-2009002087
5/26/10
PROFESSIONAL ENGINEER

Eric H. Lidholm, P.E.
Senior Principle

Enclosures
cc: 3 – Client
1 – Client (PDF)
1 – File

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EXECUTIVE SUMMARY

A geotechnical exploration has been performed for phase 1 and 2 of the proposed Basic Combat Training Complex 3 South (BCT3) project. Borings were performed at the locations of each of the proposed structures to be located southwest of the intersection of South Dakota Avenue and Iowa Avenue in Fort Leonard Wood, Missouri, as shown on the Site Location Map (Exhibit A-1) in Appendix A. Forty-seven (47) borings, designated B-1 through B-47, were performed to depths of approximately 8.8 to 30 feet below the existing ground surface in the proposed building and pavement areas.

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project. The following geotechnical considerations were identified:

- Existing uncontrolled fill was encountered to depths of approximately 1 to 9 feet in some of the borings within the proposed building and pavement locations. In our opinion, the existing uncontrolled fill is not suitable to support new foundations, floor slabs or pavements. We recommend existing uncontrolled fill be removed where present below building and pavement areas. In our opinion, materials that comprise the existing uncontrolled fill may be used to construct compacted structural fill sections, if tested and approved.

- The proposed structures may be supported on shallow footings bearing on suitable native clay or newly placed compacted structural fill.

- If the site is properly prepared and any necessary subgrade repairs are made, total and differential settlement should be within anticipated client/owner specifications.

- The native on-site soils appear suitable for use as compacted structural fill; however, if they do not meet the low plasticity fill criteria, they should not be utilized within 24 inches of the finished grade beneath at-grade building areas.

- The near-surface native soils and existing uncontrolled fill are active and prone to significant volume change with variations in moisture content. For this reason, we recommend a 24-inch thick low volume change zone be constructed beneath grade-supported floor slabs. Construction of this low volume change zone may require overexcavation in some areas.

- The 2009 International Building Code (IBC), Table 1613.5.2 seismic site classification for this site is D.

- Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that the Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2
FORT LEONARD WOOD, MISSOURI

Project No. B5105007
May 26, 2010

1.0 INTRODUCTION

A geotechnical engineering report has been completed for phases 1 and 2 of the proposed Basic Combat Training Complex 3 South (BCT3) project. Borings were performed at the locations of each of the proposed structures. The BCT3 project site will be located southwest of the intersection of South Dakota Avenue and Iowa Avenue in Fort Leonard Wood, Missouri, as shown on the Site Location Map (Exhibit A-1) in Appendix A. Forty-seven (47) borings, designated B-1 through B-47, were performed to depths of approximately 8.8 to 30 feet below the existing ground surface within the proposed building and pavement areas. Logs of the borings along with a site location map, geologic map, and boring location diagram are included in Appendix A of this report.

The purposes of this Geotechnical Engineering Report are to describe our understanding of the project, present data and provide professional opinions and geotechnical engineering recommendations relative to:

- subsurface soil and bedrock conditions
- groundwater conditions
- earthwork
- pavement design
- foundation design and construction
- floor slab design and construction
- seismic considerations
- settlement considerations

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	See Appendix A, Exhibit A-3: Boring Location Diagram

ITEM	DESCRIPTION
Structures	The project will include the following structures: ■ Barracks/Company Operations Facilities (BCOF) – A total of five (5) three-story structures with plan footprints of approximately 22,000 square feet. ■ Battalion Headquarters (BNHQ) – A single-story structure with a plan footprint of approximately 24,500 square feet. ■ Dining Facility (DFAC) – A single-story structure (assumed) with a plan footprint of approximately 37,000 square feet. ■ Running track with physical training (PT) pits ■ Lawn Equipment Building (LEB) ■ Associated paved parking and drive areas ■ Stormwater detention basins
Building construction	Masonry with light gage studs and structural steel. Slab-on-grade floor (main floor) and slab-on-deck floors (upper levels). (assumed)
Finished floor elevation (FFE)	Not provided
Maximum loads	BCOF: Columns: 210 kips Walls: 4 klf (assumed) Slabs: 150 psf max (assumed) BNHQ & DFAC: Columns: 45 kips Walls: 4klf (assumed) Slabs: 150 psf max (assumed)
Maximum allowable settlement	Columns: 1 inch (assumed) Walls: ¾ inch over 40 feet (assumed)
Grading	Not provided. Cuts and fills are assumed to be on the order of 5 feet or less.
Cut and fill slopes	Assumed to be no steeper than 3H:1V (Horizontal to Vertical).
Free-standing retaining walls	None anticipated
Below grade areas	None anticipated

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	Southwest of the intersection of South Dakota Avenue and Iowa Avenue in Fort Leonard Wood, Missouri
Existing improvements	The proposed structure locations are partially developed with a gravel-surface motor-pool area (TA-2), paved roadways and drive areas, gravel-surface parking areas, and grassed lawn areas.

ITEM	DESCRIPTION
Current ground cover	Asphaltic concrete cement pavement, gravel-surface parking areas, grassed lawn areas, and tall grasses with scattered trees
Existing topography	The site is generally located near the crest of a hill, sloping downward in all directions.

3.0 SUBSURFACE CONDITIONS

3.1 Geology

Based on the 2003 Geologic Map of Missouri, Missouri Department of Natural Resources, the uppermost bedrock strata below the site consists primarily of the Roubidoux (Or) and the underlying Gasconade (Og) formations. The Roubidoux formation is described as being comprised primarily of sandstone, sandy dolomite, dolomite, chert, sandy chert, and cherty dolomite. The Gasconade formation is described as being comprised primarily of coarsely-crystalline, cherty dolomite.

Solution features, including caves and sinkholes, are commonly present in these formations. Numerous sinkholes are known to exist throughout Fort Leonard Wood, and several are present within ½ mile of the project site.

It is difficult to predict future sinkhole activity. Sinkholes and caves in this area are in various stages of development and can appear at any time. Site grading and drainage may alter site conditions and could possibly cause sinkholes in areas that have no history of this activity.

3.2 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/ Density
1	1 to 9 (Borings B-1, B-2, B-7, B-11, B-12, B-13, B-14, B-15, B-38, B-39)	Existing uncontrolled fill [1] generally comprised of lean to fat clay and fat clay containing varying amounts of sand, gravel, cobbles, boulders, and asphalt rubble	See boring logs for details

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/ Density
2	2½ to 29 21 borings terminated within Stratum 2	Native fat clay, gravely fat clay, and clayey gravel containing varying amounts of sand, gravel, cobbles, and possible boulders	Medium stiff to hard
3	Not determined; 26 borings terminated within Stratum 3	Sandstone containing varying amounts of clay and chert	Moderately to severely weathered

1. Uncontrolled fill is material that was placed without moisture and density control. This material is typically variable in composition, consistency, density, and moisture.

The soil types encountered in the upper portions of the borings generally consisted of clayey gravel, lean clay, and fat clay which was of moderate to high plasticity, and had the following measured liquid limits, plastic limits, and plastic indices:

Sample Location	Depth (feet)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
Boring B-3	1.5 – 3.0	53	15	38
Boring B-5	3.5 – 5.0	42	19	23
Boring B-7	1.5 – 3.0	75	20	55
Boring B-10	3.5 – 5.0	82	26	56
Boring B-11	3.5 – 5.0	93	30	63
Boring B-15	1.5 – 3.0	94	29	65
Boring B-17	1.5 – 3.0	40	18	22
Boring B-20	1.5 – 3.0	56	24	32
Boring B-21	1.5 – 3.0	74	26	48
Boring B-23	3.5 – 5.0	76	26	50
Boring B-26	3.5 – 5.0	98	31	67
Boring B-31	3.5 – 5.0	31	14	17
Boring B-33	1.5 – 3.0	32	17	15
Boring B-36	1.5 – 3.0	78	22	56
Boring B-39	1.5 – 3.0	36	18	18
Boring B-41	1.5 – 3.0	86	27	59
Boring B-42	1.5 – 3.0	43	16	27
Boring B-47	1.5 – 3.0	86	29	57

Conditions encountered at each boring location are indicated on the individual boring logs in Appendix A. Stratification boundaries on the boring logs represent the approximate location of changes in soil and rock types; in-situ, the transition between materials may be gradual.

3.3 Groundwater

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Groundwater was observed at the following depths in the borings:

Location	Depth to groundwater while drilling (feet) [1]	Depth to groundwater (or drill fluid) immediately after drilling (feet)	Depth to groundwater (or drill fluid) 24 hours after drilling (feet)
Boring B-1	None	7½	N/A [2]
Boring B-2	None	8	None
Boring B-3	None	7½	N/A [2]
Boring B-4	None	7	15
Boring B-5	None	6	16
Boring B-7	None	1½	8
Boring B-8	None	5	7
Boring B-9	None	6	9
Boring B-10	None	4½	16
Boring B-11	None	6	8
Boring B-12	None	5	9
Boring B-13	None	7	11
Boring B-14	None	7	22
Boring B-15	None	6	18
Boring B-16	None	5½	28
Boring B-20	None	5	8
Boring B-21	None	4½	11
Boring B-22	None	1	1
Boring B-23	None	7	14
Boring B-24	None	3	6
Boring B-25	None	6	13
Boring B-26	None	6	8
Boring B-29	None	3	6
Boring B-30	None	1	1
Boring B-31 [1]	None	None	18
Boring B-40	None	3	N/A [2]

1. All borings included in this table, except Boring B-31, were advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally occurring groundwater levels could not be obtained with drilling fluids in these boreholes.
2. Delayed water level not obtained. Boring was backfilled immediately after drilling completion for safety reasons.

Groundwater was not observed in the remaining borings during drilling, immediately following drilling, or 24 hours following drilling completion.

Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Sandy and gravelly zones were observed in the native soils encountered in the borings performed for this project. These sandy and gravelly zones can store and transmit water of variable quality and quantity. These sandy and gravelly zones may be encountered during foundation or utility excavation.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. In addition, perched water can develop over low permeability soil or rock strata. Therefore, groundwater levels during construction or at other times in the life of the structures may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Existing uncontrolled fill material, and material which could be possible uncontrolled fill, were encountered in several of the borings performed for this project to depths of approximately 1 to 9 feet below existing grade. The limited data suggest the existing uncontrolled fill is variable in density, moisture, and consistency, indicating it was not placed with strict moisture and density control. The existing uncontrolled fill was generally comprised of lean to fat clay and fat clay containing varying amounts of sand, gravel, cobbles, boulders, and asphalt rubble. Conditions can also vary between boring locations.

The lateral and vertical extent of the existing uncontrolled fill is not known; existing uncontrolled fill could be present in unexplored areas and to greater depths than indicated by our borings. In addition, the extent of existing uncontrolled fill may not be determined, even during construction. Support of the planned structures on or above existing uncontrolled fill involves significant risk. Foundations and floor slabs supported on or above the existing uncontrolled fill that should not be expected perform predictably. Further, the composition and amount of existing uncontrolled fill could vary significantly across the site.

In our opinion, the existing uncontrolled fill should be removed where present below, and for a lateral distance of 10 feet beyond, all buildings and pavement areas. Consideration can be given to leaving existing uncontrolled fill in place beneath PT-pits, sidewalks, and landscape areas provided the subgrade soils meet the criteria in, and are prepared in accordance with, the recommendations outlined in section **4.2 Earthwork**.

In addition to the presence of existing uncontrolled fill material, we anticipate that underground utilities may be present within various portions of the project site. We recommend, if these utilities are to remain in place, that their location be identified and their backfill be tested by a representative of Terracon at the time of construction. If these utilities are to be relocated, the resulting trenches should be overexcavated, backfilled properly and tested in accordance with the recommendations in section **4.2 Earthwork**.

The fat clay soils present at the site are active and prone to volume change with variations in moisture content. For this reason we recommend a low volume change zone be constructed beneath all grade-supported floor slabs. The procedures for using a low volume change zone as recommended in this report may not eliminate all future subgrade volume change and resultant shallow foundation and floor slab movements. However, the procedures outlined should significantly reduce the potential for subgrade volume change. Additional reductions in floor slab movements could be achieved by using a thicker low volume change zone. Details regarding this low volume change zone are provided in section **4.4 Floor Slab**. In addition, any new structural fill placed in the upper 24 inches beneath building areas should meet the requirements for the Low Volume Change Material defined in section **4.2 Earthwork**.

This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and at least minor cracking in the structure could still occur. The severity of cracking and other cosmetic damage such as uneven floor slabs will probably increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and cosmetic distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

We recommend that the exposed subgrade be thoroughly evaluated after stripping of any topsoil and existing fill and creation of all cut areas, but prior to the start of fill operations. We recommend that Terracon be retained to evaluate the bearing material for the foundations and floor slab subgrade soils. Subsurface conditions, as identified by the field and laboratory testing programs, have been reviewed and evaluated with respect to the proposed building plans known to us at this time.

4.2 Earthwork

4.2.1 Site Preparation

Prior to placing any fill, all vegetation, topsoil, existing uncontrolled fill material, and any otherwise unsuitable material should be removed from the construction areas. Wet or dry material that is otherwise suitable should be removed unless it can be moisture conditioned and compacted in place. After stripping and grubbing, the subgrade should be proof-rolled where possible to aid in locating loose or soft areas. Proof-rolling the subgrade to find loose or soft areas can be performed with a loaded tandem-axle dump truck. Soft, dry, and low-density soil should be removed if it cannot be satisfactorily compacted in place prior to placing fill. Compacted structural fill should be placed in accordance with the recommendations outlined in section **4.3.2 Compaction Requirements**.

Where fill is placed on existing slopes steeper than 5H:1V, benches should be cut into the existing slopes prior to fill placement. The benches should have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate the compaction equipment. This benching will help provide a positive bond between the fill and natural soils and reduce the possibility of developing a slope failure surface along the fill/natural soil interface. Furthermore, we recommend that fill slopes be over filled and then cut back to develop an adequately compacted slope face.

4.2.2 Material Requirements

Compacted structural fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Lean clay	CL (LL<40)	All locations and elevations
Lean to fat clay	CL/CH (40<LL<50)	> 24 inches below building finished grade unless tested and meets low volume change material criteria
Fat clay [2]	CH (LL>50)	> 24 inches below building finished grade
Well graded granular	GW [3]	All locations and elevations
Low Volume Change (LVC) Material	CL with (LL<40) or (LL<50 & PI<22), SC, GC, or GW [3]	All locations and elevations
On-site soils	CH, GC, CL	The on-site soil appears suitable for use as fill. On-site soils should not be placed within 24 inches below building finished grade within the proposed structures unless they are tested and meet low volume change material criteria.

1. Compacted structural fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Terracon for evaluation.

2. Delineation of moderate to highly plastic clays should be performed in the field by a qualified geotechnical engineer or their representative, and could require additional laboratory testing. If the lean to fat clay or fat clay contains greater than 35% granular material retained on a ¾ inch sieve, it may be used in the 2 feet immediately beneath finished grade.
3. Similar to MoDOT Type 5 crushed limestone aggregate. If frost heave is not a concern, then MoDOT Type 1 crushed limestone aggregate, limestone screenings or granular material such as sand, gravel or crushed stone containing at least 18% low plasticity fines may also be used.

4.2.3 Compaction Requirements

ITEM	DESCRIPTION
Fill Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping-jack or plate compactor) is used
Compaction Requirements [1]	95% of the material's maximum standard Proctor dry density (ASTM D 698)
Moisture Content – Cohesive Soil	Within the range of optimum moisture content to 4% above optimum moisture content as determined by the standard Proctor test at the time of placement and compaction
Moisture Content – Granular Material [2]	Workable moisture levels

1. We recommend that compacted structural fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved. As stated within ASTM D 698, this procedure is intended for soils with 30% or less material larger than ¾-inch by weight. Accordingly, we recommend full-time proof roll observation be performed instead of moisture/density testing for materials containing more than 30% aggregate retained on the ¾" sieve.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

4.2.4 Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. If utility trenches are backfilled with relatively clean granular material, they should be capped with at least 18 inches of cohesive fill in non-pavement areas to reduce the infiltration and conveyance of surface water through the trench backfill.

Utility trenches can allow water to infiltrate and/or migrate below buildings. All utility trenches that penetrate beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building. We recommend constructing an effective clay "trench plug" that extends at least 5 feet out from the face of the building exterior. The plug material should consist of clay compacted at a water content at or above the soil's optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report.

4.2.5 Grading and Drainage

Final surrounding grades should slope down and away from the structure on all sides to prevent ponding of water next to the structures. Gutters and downspouts that drain water a minimum of 10 feet beyond the footprints of the proposed structures are recommended. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots.

4.2.6 Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. The use of light construction equipment would aid in reducing subgrade disturbance. The use of remotely operated equipment, such as a backhoe, would be beneficial to perform cuts and reduce subgrade disturbance. Should unstable subgrade conditions develop, stabilization measures will need to be employed. Evaluation of the need and recommendations for subgrade stabilization can be provided during construction as the geotechnical conditions are exposed.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content to within the range outlined in section **4.2.3 Compaction Requirements** prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade and foundation soils should not be planted next to the structures. Trees and shrubbery should be kept away from the exterior of the structures a distance at least equal to 1½ times their expected mature height.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of compacted structural fill; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs and pavement.

4.3 Foundations

In our opinion, all proposed structures can be supported by shallow, spread footing foundation systems bearing on the medium stiff to hard native clay or on newly placed compacted structural fill. In no case should foundations bear on or above existing uncontrolled fill. Further, if any existing uncontrolled fill remains within the building footprints after site grading, this material should be removed and replaced with new compacted structural fill. Design recommendations for shallow foundations are presented in the following sections.

4.3.1 Shallow Foundation Design Recommendations

DESCRIPTION	Column	Wall
Net allowable bearing pressure [1]		
■ **Native clay or compacted structural fill**	3,000 psf	3,000 psf
Minimum dimensions	30 inches	18 inches
Minimum embedment below finished grade for frost protection [2]	36 inches	36 inches
Approximate total settlement [3]		
■ **BCOF**	< 1 inch	< 1 inch
■ **BNHQ & DFAC**	< 1 inch	< 1 inch
Estimated differential settlement [3]		
■ **BCOF**	< ¾ inch between columns	< ¾ inch over 40 feet
■ **BNHQ & DFAC**		< ¾ inch over 40 feet
Allowable passive pressure [4]	1,500 psf	
Ultimate coefficient of sliding friction [4]	0.32	

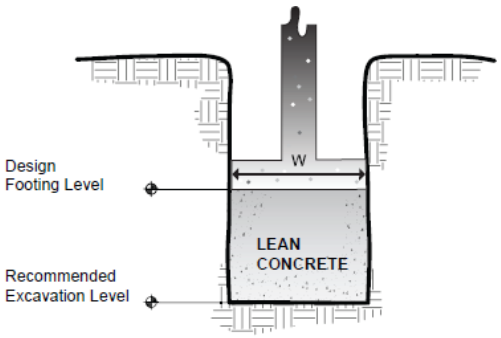
1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any existing uncontrolled fill or soft native soils, if encountered, will be undercut and replaced with compacted structural fill. Based upon a Factor of Safety of 3.
2. And to reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas.
3. The above settlement estimates from foundation loads have assumed that the maximum footing size is 9 feet for column footings and 3 feet for continuous footings.

4. The sides of the excavation for the spread footing foundation must be nearly vertical and the concrete should be placed neat against these vertical faces for the passive earth pressure values to be valid. If the loaded side is sloped or benched, and then backfilled, the allowable passive pressure will be significantly reduced. Passive resistance in the upper 3 feet of the soil profile should be neglected. If passive resistance is used to resist lateral loads, the base friction should be neglected.

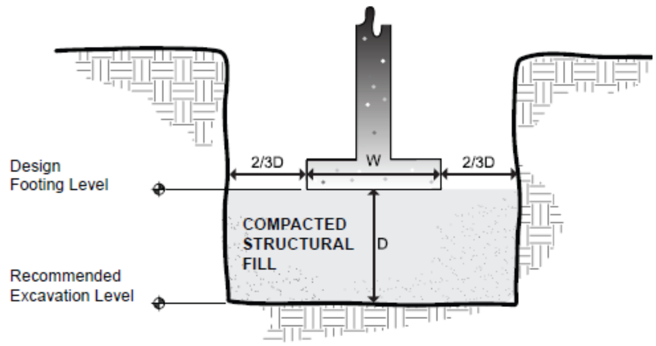
4.3.2 Construction Considerations

The base of all foundation excavations should be free of water and loose soil and rock prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, or frozen, the affected soil should be removed prior to placing concrete. If the bearing soils are likely to be disturbed, a lean concrete mud-mat can be placed over the bearing soils if the excavations must remain open over night or for an extended period of time. It is recommended that Terracon be retained to observe and test the soil foundation bearing materials.

If unsuitable bearing soils or existing uncontrolled fill are encountered in footing excavations, the excavation could be extended deeper to suitable soils and the footing could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. As an alternative, the footings could also bear on properly compacted structural backfill extending down to the suitable soils. (See figure at lower left.) Overexcavation for compacted structural fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with well graded granular material placed in lifts of 9 inches or less in loose thickness (6 inches or less if using hand guided compaction equipment) and compacted to at least 98 percent of the material's standard effort maximum dry density (ASTM D 698). (See figure at lower right.)



Lean Concrete Backfill



Overexcavation / Backfill

NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

4.4 Seismic Considerations

Code Used	Site Classification
2009 International Building Code (IBC) [1]	D [2]

1. In general accordance with the *2009 International Building Code,* Table 1613.5.2.
2. The 2009 International Building Code requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope requested does not include the required 100 foot soil profile determination. Borings for this site extended to a maximum depth of approximately 30 feet and this seismic site class assignment considers that sandstone bedrock continues below the maximum depth of the subsurface exploration. Additional exploration to greater depths could be considered to confirm the conditions below the current depth of exploration. Alternatively, a geophysical exploration could be utilized in order to attempt to justify a more favorable seismic site class.

The short period spectral acceleration coefficient, S_s, and the one second period spectral acceleration coefficient, S_1, for Fort Leonard Wood are 0.3g and 0.12g, respectively, in accordance with Unified Facilities Criteria (UFC) 3-310-01, Table C-2. These values are based on a seismic site class B. Adjusted for the effects of a site class D, S_{MS} and S_{M1} are 0.47g and 0.28g, respectively, in general accordance with the 2009 IBC Tables 1613.5.3(1) and (2).

4.5 Floor Slab

4.5.1 Design Recommendations

ITEM	DESCRIPTION
Floor slab support	24-inch low volume change zone and special subgrade preparation [1]
Modulus of subgrade reaction	100 pounds per square inch per inch (psi/in) for point loading conditions
Aggregate base course/capillary break [2]	6 inches of free draining granular material

1. Floor slabs should be structurally independent of building footings and walls to reduce the possibility of floor slab cracking caused by differential movement between the slab and foundation.

   Because of the moderate to high shrink-swell potential of the fat clay subgrade soils, we recommend a low volume change layer be developed below the floor slab. This layer should be at least 24 inches thick and should meet the Low Volume Change Material criteria outlined in section **4.2 Earthwork**.

   We recommend subgrades be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompacted. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density until construction of the building floor slabs.

2. The floor slab design should include a capillary break, comprised of free-draining, compacted, granular material, at least 6 inches thick and can be considered as part of the low volume change zone. Free-draining granular material should have less than 5 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or any cracks that develop should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

4.5.2 Construction Considerations

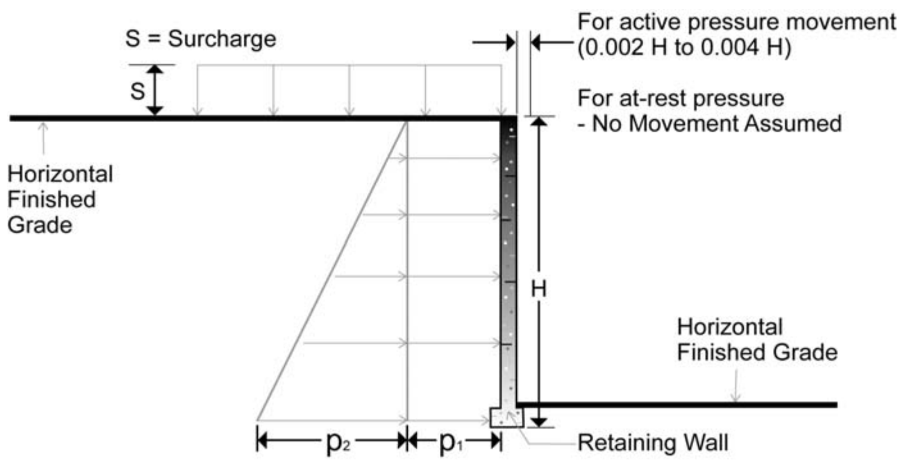
Many of the clay soils in this locale have the potential to increase or decrease in volume with variations in moisture content. Soil having high plasticity characteristics (i.e., fat clay) generally has a greater potential for moisture related volume change than less plastic materials such as lean clay. However, even low plasticity soils can swell significantly if their moisture levels are initially low.

On most project sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, floor slab subgrades may not be suitable for placement of base rock and concrete and corrective action will be required.

We recommend the area underlying floor slabs be rough graded and then thoroughly proofrolled with a loaded tandem axle dump truck prior to final grading and placement of base rock. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the base rock and concrete.

4.6 Lateral Earth Pressures

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



Earth Pressure Coefficients

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (K_a)	Granular - 0.33	40	(0.33)S	(40)H
	Lean Clay - 0.42	50	(0.42)S	(50)H
At-Rest (K_o)	Granular - 0.46	55	(0.46)S	(55)H
	Lean Clay - 0.58	70	(0.58)S	(70)H
Passive (K_p)	Granular - 3.0	360	---	---
	Lean Clay - 2.4	288	---	---

<u>Applicable conditions to the above include:</u>

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 **H** to 0.004 **H**, where **H** is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf
- Horizontal backfill, compacted between 95 and 98 percent of standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall

- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45, 45 and 60 degrees from vertical for the active, at-rest and passive cases, respectively. To calculate the resistance to sliding, a value of 0.32 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

To control hydrostatic pressure behind the wall we recommend that a drain be installed at the foundation wall with a collection pipe leading to a reliable discharge. If this is not possible, then combined hydrostatic and lateral earth pressures should be calculated for lean clay backfill using an equivalent fluid weighing 90 and 100 pcf for active and at-rest conditions, respectively. For granular backfill, an equivalent fluid weighing 85 and 90 pcf should be used for active and at-rest, respectively. These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

4.7 Pavements

4.7.1 Subgrade Preparation

On most project sites, the site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to improve trafficability temporarily. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the pavement subgrades be proof-rolled within two days prior to commencement of actual paving operations. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified to a depth of 8 inches and chemically treated with hydrated lime treated to provide a uniform subgrade for pavement construction. In lieu of chemically treating the subgrade with hydrated lime,,the upper 8 inches of subgrade could be overexcavated and replaced with subbase placed and compacted in accordance with the recommendations outlined in section **4.2 Earthwork** to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

4.7.2 Design Considerations

Traffic patterns and anticipated loading conditions provided by USACE for the DFAC are approximately 320 passenger vehicles per day, 4 delivery box trucks per day, 1 tractor trailer per day, and 1 trash removal truck per day (assumed). Anticipated traffic loadings for the BCOFs and BNHQ were provided as 400 passenger vehicle trips per day and 60 passenger vehicle trips per day, respectively. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Per UFC 3-250-01FA dated January 16, 2004 Section 18-8, use of state highway design options is acceptable for a Design Index (DI) less than 4. Per this same document, we established the following criteria:

Category	Design Value	
	Parking Areas and Drive Lanes	Delivery Lanes and Loading Docks
Traffic Category	II [1]	III [1]
Street Classification	E [2]	E [2]
Design Index	2 [1]	3 [1]
Design Life (years)	25	25

1. Determined utilizing section 3-2 and table 3-1 of UFC 3-250-01FA, January 16, 2004.
2. Determined utilizing section 3-3 of TM 5-822-2, July 1987 as referenced by section 3-2 of UFC 3-250-01FA.

Pavement thicknesses were determined using AASHTO design methods in accordance with the Missouri Department of Transportation (MoDOT) design procedures and a pavement performance period of 25 years. Pavement section design calculations are included in Appendix D.

Pavement design methods are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade such as the soils encountered on this project. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade.

Expansive soils are present at this site. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these recommendations are followed some pavement distress could still occur. It is, therefore, important to minimize moisture changes in the subgrade both during construction and during the life of the pavement to reduce shrink/swell movements.

As described in section **4.7.1 Subgrade Preparation**, chemically treating the subgrade with hydrated lime is presented as a means to reduce the risk of expansive soils impacting pavements at the site. We recommend that a mix design be performed with samples of the hydrated lime to be used and the site soils. This will aid in optimizing the mix design and evaluating for potential negative reactions such as sulfate induced heave. Since hydrated lime can vary significantly in terms of chemical composition and subgrade soils can vary significantly in terms of amounts of soluble sulfates present, it will be important that samples of the actual proposed modifying agent be used in the laboratory mix design.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following in the design and layout of pavements:

- Final grades adjacent to parking lots and drives should slope down and away from pavement edges at a minimum 2%;
- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage;
- Install pavement drainage surrounding areas anticipated for frequent wetting (e.g. garden centers, wash racks);
- Install joint sealant and seal cracks immediately;
- Seal all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils;
- Place compacted, low permeability backfill against the exterior side of curb and gutter; and,
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

4.7.3 Estimates of Minimum Pavement Thickness

Typical Pavement Section Thickness (inches) on Prepared Subgrade [1]						
Traffic Area	**Alternative**	**Asphalt Concrete Surface Course [2]**	**Asphalt Concrete Base Course [3]**	**Portland Cement Concrete [4]**	**Aggregate Base Course [5]**	**Total Thickness**
Parking Areas and Drive Lanes	PCC	--	--	5.0	4.0	9.0
	AC	1.5	1.5	--	6.0	9.0

Typical Pavement Section Thickness (inches) on Prepared Subgrade [1]						
Traffic Area	**Alternative**	**Asphalt Concrete Surface Course [2]**	**Asphalt Concrete Base Course [3]**	**Portland Cement Concrete [4]**	**Aggregate Base Course [5]**	**Total Thickness**
Delivery Lanes and Loading Docks	PCC	--	--	7.0	4.0	11
	AC	2.0	2.0	--	8.0	12.0
Trash Container Pads [6]	PCC	--	--	7.0	4.0	11.0

1. Prepared subgrade to consist of a minimum of 8 inches of hydrated lime treated soil or compacted subbase.
2. Asphaltic surface course mixtures should be in accordance with Type B or Type C mixtures, Section 403 of the Missouri Standard Specifications for Highway Construction. The mixture should have a minimum Marshall stability of 1,800 pounds, and the surface course should be compacted to a minimum of 97 percent Marshall density (ASTM D 1559).
3. Asphaltic concrete base course mixtures should conform to the requirements in Section 301 of the Missouri Standard Specifications for Highway Construction. The asphalt base course should be compacted to a minimum density equal to 95 percent of ASTM D 1559.
4. 4,000 psi at 28 days, 4-inch maximum slump, 5 to 7 percent air entrained, 6-sack min. mix. PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.
5. MoDOT Type 5 crushed limestone base material (CLBM).
6. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.

4.7.4 Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

4.7.5 Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore preventive maintenance should be planned and provided for through an on-going pavement management program. Preventive maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements.

Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. We recommend Terracon be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

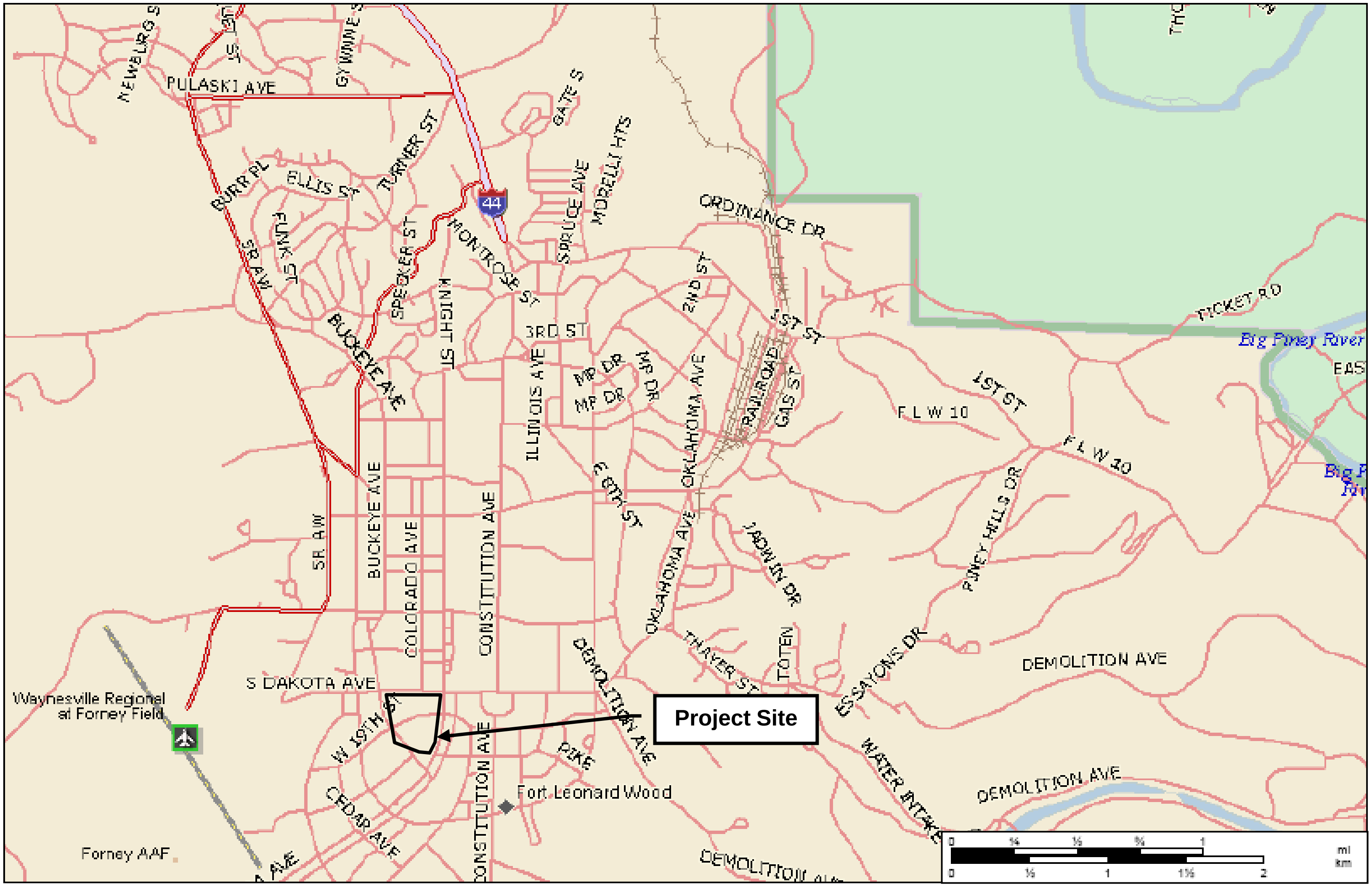
The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

Section:



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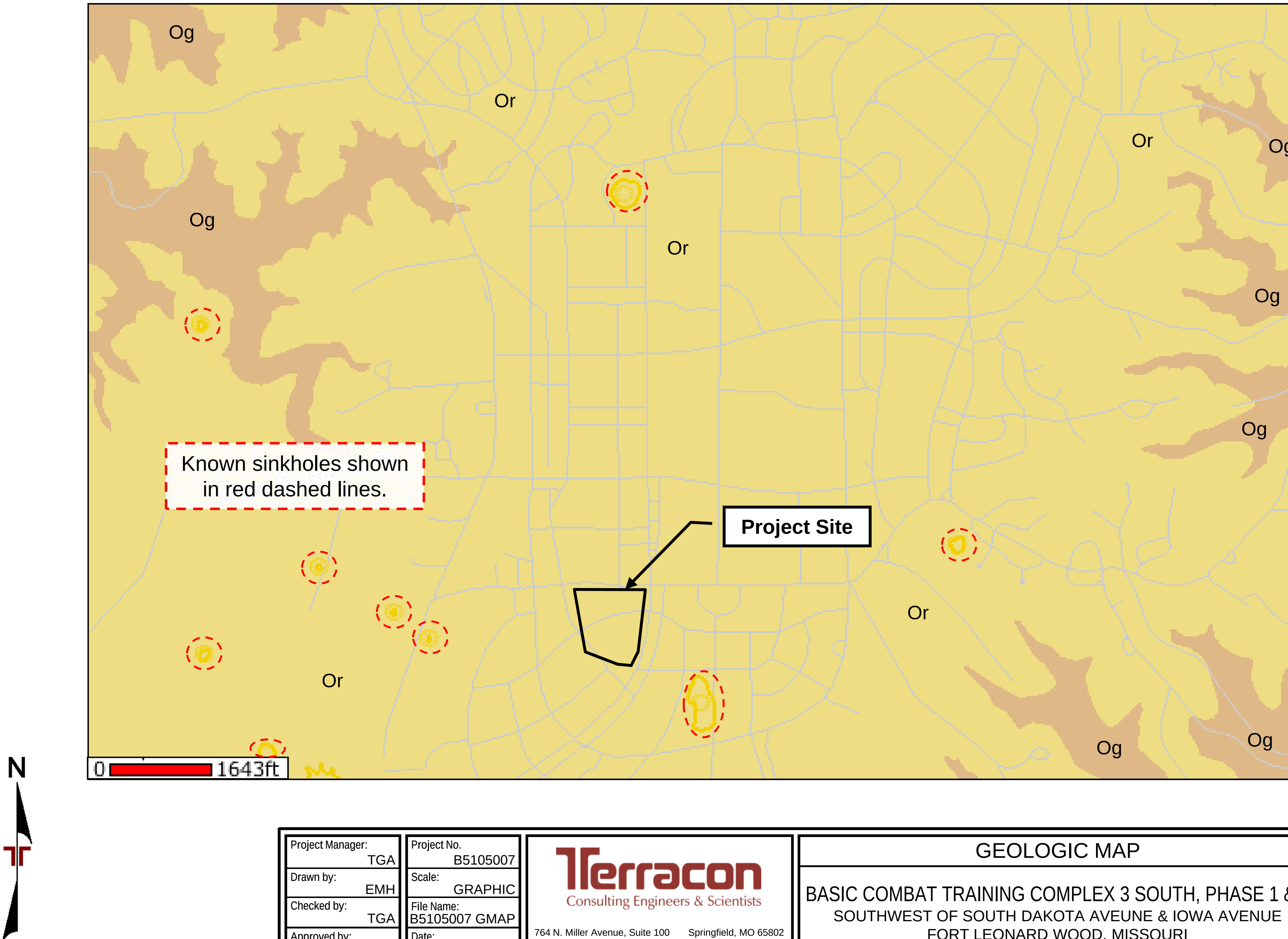
Project Manager: TGA	Project No. B5105007	Terracon Consulting Engineers & Scientists	SITE LOCATION MAP	Exhibit
Drawn by: EMH	Scale: GRAPHIC	764 N. Miller Ave., Suite 100 Springfield, Missouri 65202	BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2	A-1
Checked by: TGA	File Name: B5105007_SMAP	P [417] 864 5100 F [417] 864 0871	SOUTHWEST OF SOUTH DAKOTA AVENUE & IOWA AVENUE	
Approved by: TGA	Date: 5/3/10		FORT LEONARD WOOD, MISSOURI	

Section:



Project Manager: TGA	Project No. B5105007
Drawn by: EMH	Scale: GRAPHIC
Checked by: TGA	File Name: B5105007 GMAP
Approved by: TGA	Date: 5/3/2010

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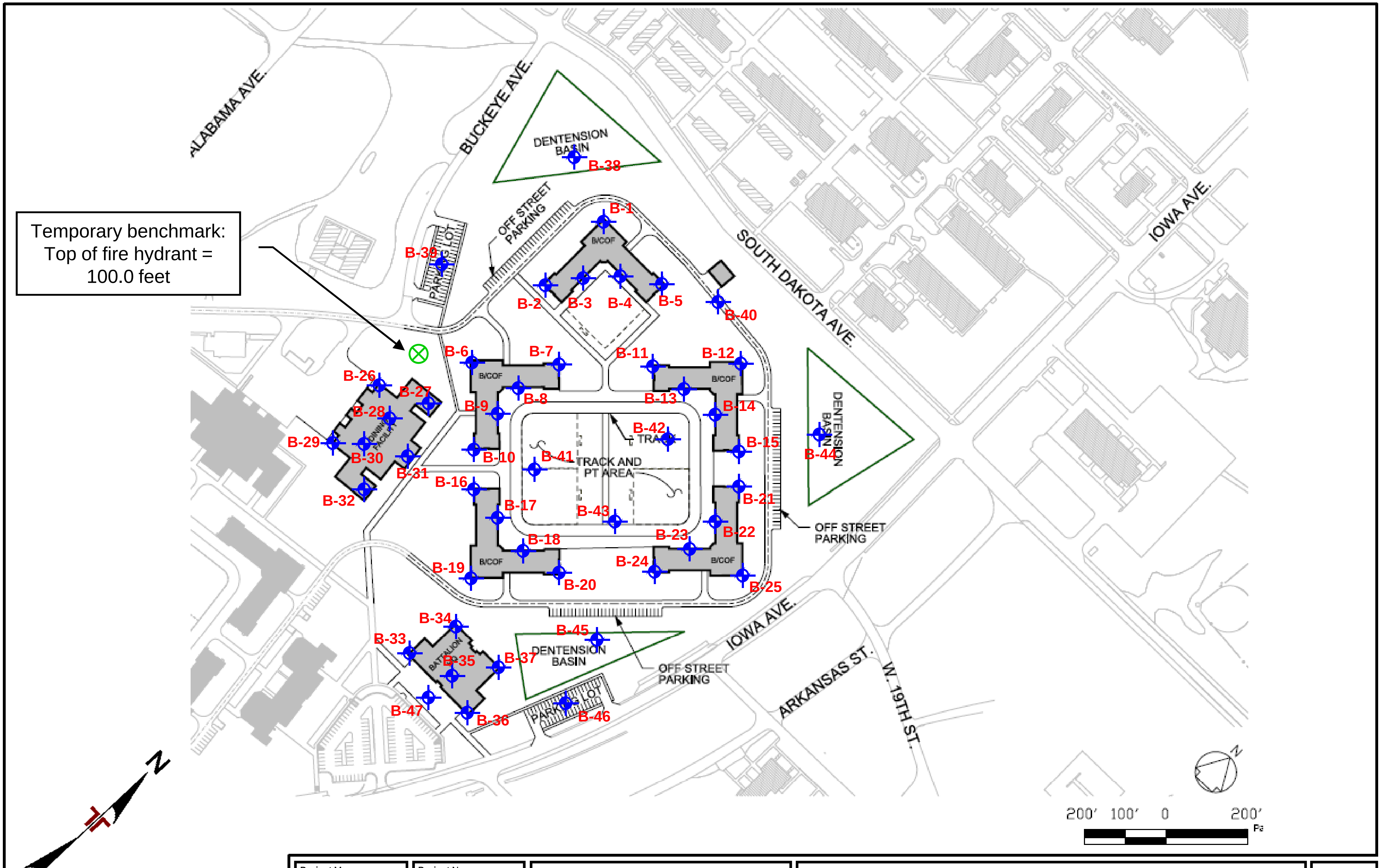
GEOLOGIC MAP

BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2
SOUTHWEST OF SOUTH DAKOTA AVEUNE & IOWA AVENUE
FORT LEONARD WOOD, MISSOURI

Exhibit
A-2

Section:



NOTES

1. BASE DRAWING PROVIDED BY OTHERS
2. DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: TGA	Project No. B5105007
Drawn by: EMH	Scale: GRAPHIC
Checked by: TGA	File Name: B5105007BPLAN
Approved by: TGA	Date: 5/14/2010

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Consulting Engineers & Scientists
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BORING LOCATION DIAGRAM

BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2
SOUTHWEST OF SOUTH DAKOTA AVENUE & IOWA AVENUE
FORT LEONARD WOOD, MISSOURI

Exhibit
A-3

LOG OF BORING B-01

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-01
COORDINATES: N 37.7442, W 92.12516 ;
ELEVATION: +85.0 (ft)
DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA | DRILLING METHOD(S): HS, WB | LABORATORY DATA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
(ft): Water Level 24HR after drilling.
7.5(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–1.0	HS		12" GRAVEL						
1.0–4.0	SS-1	7 11 4	FILL, GRAVELLY FAT CLAY, WITH ASPHALT RUBBLE, RED BROWN				15.3		PP:+9000
	HS								
4.0–13.5	SS-2	5 8 5	FAT CLAY, GRAVELLY, RED BROWN, STIFF TO VERY STIFF	CH			26.6		
	WB								
	SS-3	4 4 4		CH			22.4		PP:4500
	WB								
13.5–20	SS-4	1 1 1	FAT CLAY, GRAY, BROWN, RED BROWN, VERY SOFT TO VERY STIFF	CH			32.7		PP:3000
	WB								
	SS-5	4 6 8		CH			30.2		PP:9000

LEGEND:
GP - USCS Poorly-graded Gravel
Fill (made ground)
CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-01

US Army Corps of Engineers®

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-01
COORDINATES: N 37.7442, W 92.12516 ;
ELEVATION: +85.0 (ft) DATE(S) DRILLED: 3/12/10 - 3/12/10

DRILLING METHOD(S): HS, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
(ft): Water Level 24HR after drilling.
7.5(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
20–23.5			WB				FAT CLAY, GRAY, BROWN, RED BROWN, VERY SOFT TO VERY STIFF *(continued)* - TRACE COBBLES BELOW 20 FEET						
23.5–25			SS-6	4 4 5				CH			30.9		PP:1000
25–28.5			WB										
28.5–30			SS-7	4 3 2			30.0	CH			26.9		PP:2000

BOTTOM OF BORING

NOTE: BORING CAVED IN AT 5 FEET AND THE REMAINING OPEN PORTION OF THE BORE WAS BACKFILLED IMMEDIATELY UPON COMPLETION OF DRILLING; NO DELAYED WATER LEVEL MEASUREMENTS WERE OBTAINED.

LEGEND
- GP - USCS Poorly-graded Gravel
- Fill (made ground)
- CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG_A_2005 B5105007 5-12-10_EMH.GPJ 5/12/10

LOG OF BORING B-02

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-02
COORDINATES: N 37.74342, W 92.12517 ;
ELEVATION: +91.5 (ft)
DATE(S) DRILLED: 3/23/10 - 3/23/10

DRILLING METHOD(S): PA, WB

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
8.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND:
- Fill (made ground)
- CL - USCS Low Plasticity Clay
- CH - USCS High Plasticity Clay
- Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0	PA		FILL, FAT CLAY, WITH SAND AND GRAVEL, RED BROWN						
	SS-1	2 2 3					36.9		PP:3500
	PA								
	SS-2	2 3 3					21.1		PP:1500
	PA								
7.0			LEAN CLAY, TRACE SAND, GRAY, BROWN, VERY STIFF						
	SS-3	3 6 8		CL			19.4		PP:7500
	PA								
	SS-4	15 18 21		CH			18.3		PP:+9000
	PA								
18.5			FAT CLAY, WITH GRAVEL, RED BROWN, GRAY, VERY STIFF						
	SS-5	6 7 8		CH			38.1		PP:7000

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-02

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-02
COORDINATES: N 37.74342, W 92.12517 ;
ELEVATION: +91.5 (ft) DATE(S) DRILLED: 3/23/10 - 3/23/10

FIELD DATA | DRILLING METHOD(S): PA, WB | LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
8.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22			PA				FAT CLAY, WITH GRAVEL, RED BROWN, GRAY, VERY STIFF *(continued)* - PRACTICAL AUGER REFUSAL AT 22.5 FEET (22.3)						
24–28			SS-6; WB	50/0"			***SANDSTONE, SEVERELY TO MODERATELY WEATHERED, BROWN - CLAYEY AND RED BROWN BELOW 28.5 FEET						
30			SS-7	6 11 14			(30.0)				28.1		PP:+9000

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

LEGEND:
- Fill (made ground)
- CL - USCS Low Plasticity Clay
- CH - USCS High Plasticity Clay
- Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG_A_2005 B5105007 5-12-10_EMH.GPJ 5/12/10

LOG OF BORING B-03

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-03
COORDINATES: N 37.7437, W 92.12489 ;
ELEVATION: +85.0 (ft) DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA | DRILLING METHOD(S): HS, WB | LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
(ft): Water Level 24HR after drilling.
7.5(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	OTHER LAB DATA
0.0–1.0	HS		12" GRAVEL (1.0)					
1.0–3.5	SS-1	15 12 6	CLAYEY GRAVEL, WITH SAND, BROWN, RED BROWN, MEDIUM DENSE (3.5)	GC	53	38	11.3	S:17
	HS							
3.5–8.5	SS-2	7 7 7	FAT CLAY, WITH GRAVEL, TRACE SAND, GRAY, RED BROWN, VERY STIFF (8.5)	CH			21.3	PP:4500
	WB							
8.5–20.0	SS-3	1 2 2	FAT CLAY, GRAY, RED BROWN, MEDIUM STIFF TO VERY STIFF	CH			25.7	PP:500
	WB							
	SS-4	2 3 5		CH			27.0	PP:6000
	WB							
	SS-5	5 6 8	(20.0)	CH			23.2	PP:9000

Depth marks: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

LEGEND
- GP - USCS Poorly-graded Gravel
- GC - USCS Clayey Gravel
- CH - USCS High Plasticity Clay

Column headings: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %; Additional Field Data; USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-03

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-03
COORDINATES: N 37.7437, W 92.12489 ;
ELEVATION: +85.0 (ft) DATE(S) DRILLED: 3/12/10 - 3/12/10

DRILLING METHOD(S): HS, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
(ft): Water Level 24HR after drilling.
7.5(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA — OTHER LAB DATA: S: Minus 200 Sieve (%), PP: Pocket Penetrometer (psf), C: Confining Pressure (psi), F: Failure Strain (%), T: Total Sulfates, P: Soil pH, O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22			WB				FAT CLAY, GRAVELLY, WITH COBBLES, BROWN, GRAY, VERY STIFF TO HARD	GP - USCS Poorly-graded Gravel; GC - USCS Clayey Gravel; CH - USCS High Plasticity Clay						
24			SS-6	37 50/5"					CH			14.7		
26			WB											
28-30			SS-7	13 31 15					CH			21.4		PP:5500
30							30.0							

BOTTOM OF BORING

NOTE: BORING CAVED IN AT 5 FEET AND THE REMAINING OPEN PORTION OF THE BORE WAS BACKFILLED IMMEDIATELY UPON COMPLETION OF DRILLING; NO DELAYED WATER LEVEL MEASUREMENTS WERE OBTAINED.

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-04

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-04
COORDINATES: N 37.7437, W 92.12469 ;
ELEVATION: +85.5 (ft)
DATE(S) DRILLED: 3/12/10 - 3/12/10

DRILLING METHOD(S): HS, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
15.0(ft)**: Water Level 24HR after drilling.
7.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND:
- GP - USCS Poorly-graded Gravel
- CH - USCS High Plasticity Clay
- Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

FIELD DATA / DESCRIPTION OF STRATUM

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM
0–1.0	HS		12" GRAVEL
1.0–10.0	SS-1 (2–3 ft)	7 9 6	FAT CLAY, GRAVELLY, TRACE SAND, RED BROWN, GRAY, VERY STIFF TO SOFT
	HS		
	SS-2 (4–5 ft)	5 5 6	
	WB		
	SS-3 (9–10 ft)	3 2 1	
10.0–15.0	SS-4 (10–11 ft)	2 2 4	FAT CLAY, GRAY, BROWN, STIFF TO VERY STIFF
	WB		
	SS-5 (14–15 ft)	9 10 14	
15.0–	WB		***SANDSTONE, SEVERELY WEATHERED, OCCASSIONALLY CLAYEY, BROWN, GRAY
	SS-6 (~18.7 ft)	50/4"	

LABORATORY DATA

Sample	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
SS-1	CH			17.3		PP:7500
SS-2	CH			15.9		PP:8000
SS-3	CH			19.6		
SS-4	CH			29.6		PP:2000
SS-5	CH			14.3		PP:4000
SS-6				9.2		

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-04

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-04
COORDINATES: N 37.7437, W 92.12469 ;
ELEVATION: +85.5 (ft)
DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA

DRILLING METHOD(S): HS, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
15.0(ft)**: Water Level 24HR after drilling.
7.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
			WB				***SANDSTONE, SEVERELY WEATHERED, OCCASSIONALLY CLAYEY, BROWN, GRAY *(continued)*						
22													
24			SS-5	50/6"							32.7		PP:8000
26			WB										
28													
			SS-8	20 7 11							24.4		PP:9000
30							30.0						

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

LEGEND
GP - USCS Poorly-graded Gravel
CH - USCS High Plasticity Clay
Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-05

SHEET 1 of 2

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-05
COORDINATES: N 37.74383, W 92.12443 ;
ELEVATION: +85.0 (ft) DATE(S) DRILLED: 3/12/10 - 3/12/10

DRILLING METHOD(S): HS, WB

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
6.0(ft)**: Water level after drilling.
16.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND:
GP - USCS Poorly-graded Gravel
GC - USCS Clayey Gravel
CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.7	GP		HS				8" GRAVEL (0.7)						
0.7–2	GC		HS				CLAYEY GRAVEL, WITH SAND, GRAY BROWN, RED BROWN, MEDIUM DENSE						
2	GC		SS-1	6 4 5				GC			19.0		PP:4500
3	GC		HS										
4	GC		SS-2	4 4 4			(5.0)	GC	42	23	20.4		S:45 PP:3500
5–9	CH		WB				FAT CLAY, GRAVELLY, GRAY, RED BROWN, STIFF						
9	CH		SS-3	4 6 4				CH			19.3		PP:3500
10–13.5	CH		WB				(13.5)						
13.5	CH		SS-4	8 10 11			FAT CLAY, WITH SAND AND GRAVEL, RED BROWN, VERY STIFF	CH			13.5		PP:6000
15–18.5	CH		WB										
18.5–20	CH		SS-5	12 10 7				CH			26.5		PP:5000

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-05

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-05
COORDINATES: N 37.74383, W 92.12443 ;
ELEVATION: +85.0 (ft)
DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA

DRILLING METHOD(S): HS, WB

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
16.0(ft)**: Water Level 24HR after drilling.
6.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT LL	PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22			WB				FAT CLAY, WITH SAND AND GRAVEL, RED BROWN, VERY STIFF *(continued)* 23.5						
24			SS-6	8 10 38			FAT CLAY, GRAVELLY, DARK GRAY, RED BROWN, HARD	CH			42.1		
26			WB										
28							- SANDY AND RED BROWN BELOW 28.5 FEET						
30			SS-7	10 23 18			30.0	CH			17.9		
							BOTTOM OF BORING						

LEGEND
GP - USCS Poorly-graded Gravel
GC - USCS Clayey Gravel
CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-06

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-06
COORDINATES: N 37.74295, W 92.125 ;
ELEVATION: +99.0 (ft)
DATE(S) DRILLED: 3/8/10 - 3/8/10

DRILLING METHOD(S): HS, WB
Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

LEGEND: Topsoil; CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.1	PA		1"ROOT ZONE (0.1)						
0.1–8.5			FAT CLAY, GRAVELLY, BROWN, RED BROWN, VERY STIFF TO HARD (8.5)						
	SS-1	3 5 8		CH			17.2		PP:8000
	PA								
	SS-2	18 21 28		CH			11.5		
	PA								
8.5–20			FAT CLAY, WITH GRAVEL, RED BROWN, VERY STIFF TO HARD						
	SS-3	6 10 18		CH			37.1		PP:8000
	PA								
	SS-4	11 6 7		CH			42.1		PP:8500
	PA		- WITH SAND AND COBBLES BELOW 18.5 FEET						
	SS-5	4 6 8		CH			29.6		PP:8500

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-06

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-06
COORDINATES: N 37.74295, W 92.125 ;
ELEVATION: +99.0 (ft)
DATE(S) DRILLED: 3/8/10 - 3/8/10

FIELD DATA

DRILLING METHOD(S): HS, WB

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS: LIQUID LIMIT (LL)	ATTERBERG LIMITS: PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
	CH						FAT CLAY, WITH GRAVEL, RED BROWN, VERY STIFF TO HARD *(continued)*	Topsoil; CH - USCS High Plasticity Clay						
22	CH		PA											
24	CH		SS-6	5 15 21					CH			26.9		PP:3000
26	CH		PA											
28	CH													
30	CH		SS-7	4 5 7			30.0		CH			37.1		PP:6500
							BOTTOM OF BORING							

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-07

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-07
COORDINATES: N 37.74331, W 92.12451 ;
ELEVATION: +96.5 (ft)
DATE(S) DRILLED: 3/4/10 - 3/8/10

FIELD DATA | DRILLING METHOD(S): HS, WB | LABORATORY DATA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
1.5(ft)**: Water level after drilling.
8.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	ATTERBERG LIMITS: LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–8.5	Fill		HS				FILL, CLAYEY GRAVEL, FAT CLAY, WITH SAND, RED BROWN, GRAY						
2			SS-1	3 4 6					75	55	18.8		S:48 PP:4500
			HS										
4			SS-2	3 3 3							19.8		PP:4500
6			HS										
8							8.5						
8.5–12.5	CH		SS-3	5 4 4			FAT CLAY, WITH SAND, TRACE GRAVEL, STIFF	CH			48.0		PP:4000
10–12			HS				12.5						
12.5–17.5	Sandstone						***SANDSTONE, SEVERELY WEATHERED, VERY LIGHT GRAY, RED BROWN						
14			SS-4	50/6"			- PRACTICAL AUGER REFUSAL AT 14.5 FEET				9.9		
16			WB				17.5						
17.5			SS-5	50/0"			BOTTOM OF BORING						
							***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.						

LEGEND:
- Fill (made ground)
- CH - USCS High Plasticity Clay
- Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-08

SHEET 1 of 2

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-08
COORDINATES: N 37.74297, W 92.12458 ;
ELEVATION: +103.0 (ft) DATE(S) DRILLED: 3/3/10 - 3/3/10

DRILLING METHOD(S): HS, WB
Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
5.0(ft)**: Water level after drilling.
7.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND: Topsoil; CL - USCS Low Plasticity Clay; CH - USCS High Plasticity Clay; Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

FIELD DATA / DESCRIPTION OF STRATUM

DEPTH (ft)	SOIL SYMBOL	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM
0–0.1	Topsoil			1"ROOT ZONE (0.1)
0.1–3.5	CL	HS		LEAN CLAY, WITH GRAVEL, GRAY, BROWN, STIFF (3.5)
		SS-1	6 5 4	
		HS		
3.5–16.5	CH	SS-2	3 6 6	FAT CLAY, GRAVELLY, WITH SAND, RED BROWN, STIFF TO VERY STIFF (16.5)
		HS		
		SS-3	8 8 6	
		HS		
		SS-4	6 5 5	
		HS		
16.5–20	Sandstone	SS-5	50/4"	***SANDSTONE, SEVERELY WEATHERED, VERY LIGHT GRAY
		WB		
		SS-6	45 50/6"	

LABORATORY DATA

Sample	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
SS-1	CH			14.2		PP:3500
SS-2	CH			32.6		PP:8000
SS-3	CH			35.4		PP:7500
SS-4	CH			38.6		PP:9000
SS-5				2.8		
SS-6				17.4		

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-08

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-08
COORDINATES: N 37.74297, W 92.12458 ;
ELEVATION: +103.0 (ft)
DATE(S) DRILLED: 3/3/10 - 3/3/10

DRILLING METHOD(S): HS, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
5.0(ft)**: Water level after drilling.
7.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA: S: Minus 200 Sieve (%), PP: Pocket Penetrometer (psf), C: Confining Pressure (psi), F: Failure Strain (%), T: Total Sulfates, P: Soil pH, O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
20–24	WB		***SANDSTONE, SEVERELY WEATHERED, VERY LIGHT GRAY *(continued)* - SHALEY WITH TRACE GRAVEL BELOW 22 FEET						
24	SS-7	7 9 9					42.8		PP:5000
26–28	WB								
29–30	SS-8	6 10 7	30.0				19.9		
			BOTTOM OF BORING ***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.						

LEGEND: Topsoil; CL - USCS Low Plasticity Clay; CH - USCS High Plasticity Clay; Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-09

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-09
COORDINATES: N 37.74284, W 92.12457 ;
ELEVATION: +105.0 (ft)
DATE(S) DRILLED: 3/3/10 - 3/3/10

DRILLING METHOD(S): HS, WB
Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
9.0(ft)**: Water Level 24HR after drilling.
6.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND: Topsoil; CH - USCS High Plasticity Clay; Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.1			1"ROOT ZONE (0.1)						
0.1–13.5	HS		FAT CLAY, WITH SAND, TRACE GRAVEL, RED BROWN, STIFF TO HARD						
2	SS-1	4 4 5		CH			40.6		PP:7000
	HS								
4	SS-2	7 6 6		CH			39.9		PP:6500
6–8	HS								
9	SS-3	7 30 8		CH			29.1		PP:3500
10–13	HS		13.5						
13.5–19.0	SS-4	7 7 7	FAT CLAY, WITH SAND AND GRAVEL, RED BROWN, VERY STIFF	CH			44.7		PP:8000
15–18	HS		- PRACTICAL AUGER REFUSAL AT 19 FEET						
19.0	SS-5	8 50/5"	***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY	CH			32.8		PP:6500
20									

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-09

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-09
COORDINATES: N 37.74284, W 92.12457 ;
ELEVATION: +105.0 (ft)   DATE(S) DRILLED: 3/3/10 - 3/3/10

DRILLING METHOD(S): HS, WB

Driler: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
6.0(ft)**: Water level after drilling.
9.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND: Topsoil; CH - USCS High Plasticity Clay; Sandstone

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: %	Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
20–23.5	Sandstone		WB					***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY *(continued)*						
23.5–25	Sandstone		SS-6	4 3 4				- CLAYEY AND SHALEY WITH TRACE GRAVEL BELOW 23.5 FEET				27.8		PP:3000
25–28.5	Sandstone		WB											
28.5–30	Sandstone		SS-7	6 8 6				30.0				30.4		

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-10

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-10
COORDINATES: N 37.74253, W 92.12451 ;
ELEVATION: +110.0 (ft) DATE(S) DRILLED: 3/3/10 - 3/3/10

DRILLING METHOD(S): PA, WB

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
16.0(ft)**: Water Level 24HR after drilling.
4.5(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND:
GP - USCS Poorly-graded Gravel
CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.5	PA		6" GRAVEL (0.5)						
0.5–18.5			FAT CLAY, WITH GRAVEL, RED BROWN, GRAY, STIFF TO HARD						
~2	SS-1	5 5 5		CH			37.9		PP:7500
~3	PA								
~4	SS-2	9 8 7		CH	82	56	35.6		S:61 PP:+9000
5–8.5	WB								
~9	SS-3	6 6 5		CH			27.6		PP:8000
10–13.5	WB								
~14	SS-4	4 7 30		CH			43.8		PP:7000
15–18.5	WB		(18.5)						
18.5–20	SS-5	4 5 9	FAT CLAY, GRAVELLY, OCCASSIONALLY SANDY, RED BROWN, STIFF TO HARD	CH			24.5		PP:8500

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-10

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-10
COORDINATES: N 37.74253, W 92.12451 ;
ELEVATION: +110.0 (ft)
DATE(S) DRILLED: 3/3/10 - 3/3/10

DRILLING METHOD(S): PA, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
- NONE(ft): Water Level during drilling.
- 16.0(ft)**: Water Level 24HR after drilling.
- 4.5(ft)**: Water level after drilling.

** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS: LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22			WB				FAT CLAY, GRAVELLY, OCCASSIONALLY SANDY, RED BROWN, STIFF TO HARD *(continued)*	GP - USCS Poorly-graded Gravel; CH - USCS High Plasticity Clay						
24			SS-6	18 21 22					CH			15.2		
26–28			WB											
30			SS-7	3 2 4			30.0		CH			29.6		
							BOTTOM OF BORING							

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-11

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-11
COORDINATES: N 37.74362, W 92.12398 ;
ELEVATION: +95.5 (ft) DATE(S) DRILLED: 3/22/10 - 3/22/10

FIELD DATA | DRILLING METHOD(S): PA, WB | LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
6.0(ft)**: Water level after drilling.
8.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	OTHER LAB DATA
0	PA		FILL, FAT CLAY, WITH SAND AND GRAVEL, RED BROWN					
2	SS-1	3 4 6					37.5	PP:5000
	PA		3.0					
3.0			FAT CLAY, TRACE SAND, RED BROWN, GRAY, MEDIUM STIFF					
4	SS-2	2 3 3		CH	93	63	34.1	S:55 PP:4500
6	PA							
8			- WITH GRAVEL AND COBBLES BELOW 8.5 FEET					
	SS-3	11 50/6"	9.5	CH			27.6	PP:4500
9.5			***SANDSTONE, SEVERELY WEATHERED, VERY LIGHT GRAY - PRACTICAL AUGER REFUSAL AT 10 FEET					
10–15	WB							
16	SS-4	13 14 18					15.3	PP:7500
17–18	WB							
18.5			- WITH GRAVEL AND OCCASSIONALLY CLAYEY BELOW 18.5 FEET					
19–20	SS-5	13 16 14					12.5	

LEGEND: Fill (made ground); CH - USCS High Plasticity Clay; Sandstone

Column headings: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %; RQD: %; Additional Field Data; USCS SYMBOL; ATTERBERG LIMITS: LIQUID LIMIT (LL), PLASTIC INDEX (PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-11

US Army Corps of Engineers®

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-11
COORDINATES: N 37.74362, W 92.12398 ;
ELEVATION: +95.5 (ft)
DATE(S) DRILLED: 3/22/10 - 3/22/10

DRILLING METHOD(S): PA, WB

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
8.0(ft)**: Water Level 24HR after drilling.
6.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

FIELD DATA							DESCRIPTION OF STRATUM	LABORATORY DATA					
DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data		USCS SYMBOL	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22	Sandstone		WB				***SANDSTONE, SEVERELY WEATHERED, VERY LIGHT GRAY - PRACTICAL AUGER REFUSAL AT 10 FEET *(continued)*						
24	Sandstone		SS-6	5 14 15							14.4		
26	Sandstone		WB										
28	Sandstone		SS-7	50/4"			28.8				12.0		
							BOTTOM OF BORING ***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.						

LEGEND:
- Fill (made ground)
- CH - USCS High Plasticity Clay
- Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-12

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-12
COORDINATES: N 37.74391, W 92.12333 ;
ELEVATION: +103.0 (ft) DATE(S) DRILLED: 3/12/10 - 3/12/10

DRILLING METHOD(S): PA, WB

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
9.0(ft)**: Water Level 24HR after drilling.
5.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND: Fill (made ground); CH - USCS High Plasticity Clay; Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–1.0	Fill		PA				FILL, LEAN TO FAT CLAY, WITH GRAVEL, GRAY (1.0)						
1.0–2.5	CH		SS-1	4 4 4			FAT CLAY, WITH GRAVEL, RED BROWN, BROWN, STIFF TO HARD	CH			35.5		
2.5–3.5	CH		PA										
3.5–5.0	CH		SS-2	9 12 18				CH			30.1		PP:6500
5.0–8.5	CH		PA				- WITH GRAVEL AND COBBLES BELOW 8.5 FEET						
8.5–9.8	CH		SS-3	17 10 50/3"			- APPARENT BOULDER AT 10.5 FEET TO 11.5 FEET	CH			13.5		PP:6000
9.8–13.5	CH		PA										
13.5–15.0	CH		SS-4	8 9 10				CH			35.6		PP:8000
15.0–16.0	CH		PA				(16.0)						
16.0–18.5	Sandstone		WB				***SANDSTONE, SEVERELY WEATHERED, CLAYEY, LIGHT GRAY - TRACE GRAVEL BELOW 18.5 FEET						
18.5–20	Sandstone		SS-5	50/3"							12.6		

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-12

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-12
COORDINATES: N 37.74391, W 92.12333 ;
ELEVATION: +103.0 (ft)
DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA

DRILLING METHOD(S): PA, WB

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
5.0(ft)**: Water level after drilling.
9.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22	Sandstone		WB				***SANDSTONE, SEVERELY WEATHERED, CLAYEY, LIGHT GRAY - TRACE GRAVEL BELOW 18.5 FEET *(continued)*						
24	Sandstone		SS-6	50/5"							11.8		
26	Sandstone		WB										
28	Sandstone												
30	Sandstone		SS-7	12 48 14			30.0				12.2		PP:5000

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

LEGEND
- Fill (made ground)
- CH - USCS High Plasticity Clay
- Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-13

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-13
COORDINATES: N 37.74358, W 92.1238 ;
ELEVATION: +99.0 (ft)
DATE(S) DRILLED: 3/22/10 - 3/23/10

FIELD DATA | DRILLING METHOD(S): PA, WB | LABORATORY DATA

Driller: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
7.0(ft)**: Water level after drilling.
11.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

LEGEND: Fill (made ground); Sandstone

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: %	Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0	Fill		PA					FILL, FAT CLAY, WITH SAND AND GRAVEL, TRACE ASPHALT RUBBLE, RED BROWN, BROWN						
2			SS-1	2 2 3								27.0		PP:4000
			PA											
4			SS-2	2 2 8								20.8		PP:3000
6			PA											
8.5	Sandstone		SS-3	50/2"				***SANDSTONE, SEVERELY WEATHERED, CLAYEY, LIGHT GRAY, RED BROWN				12.3		
10–12			WB											
14			SS-4	14 19 23								18.4		PP:6000
16			WB											
18.5			SS-5	50/6"				- WITH GRAVEL BELOW 18.5 FEET				17.8		PP:3000
20														

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-13

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-13
COORDINATES: N 37.74358, W 92.1238 ;
ELEVATION: +99.0 (ft) DATE(S) DRILLED: 3/22/10 - 3/23/10

DRILLING METHOD(S): PA, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
11.0(ft)**: Water Level 24HR after drilling.
7.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

FIELD DATA columns: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %; Additional Field Data

LABORATORY DATA columns: USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	MOISTURE CONTENT (%)
			***SANDSTONE, SEVERELY WEATHERED, CLAYEY, LIGHT GRAY, RED BROWN *(continued)*	
	WB			
22				
24	SS-6	50/5"		12.2
26	WB			
28			- CHERT SEAM AT 28 FEET TO 28.5 FEET	
	SS-7	50/3"	28.8	14.5
			BOTTOM OF BORING	

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

LEGEND: Fill (made ground); Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-14

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-14
COORDINATES: N 37.74359, W 92.12354 ;
ELEVATION: +102.0 (ft) DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA — DRILLING METHOD(S): PA, WB — LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
7.0(ft)**: Water level after drilling.
22.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

Column headings: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %; RQD: %; Additional Field Data; DESCRIPTION OF STRATUM; LEGEND; USCS SYMBOL; ATTERBERG LIMITS: LIQUID LIMIT (LL), PLASTIC INDEX (PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

Depth (ft)	Sample/Drill Method	Blows	USCS Symbol	LL	PI	Moisture Content (%)	Lab Visual Grouping	Other Lab Data
~1	SS-1	50/0"						
	PA							
~4	SS-2	6 6 8				16.8		
	PA							PP:4000
~9	SS-3	24 50/3"	CH			16.5		
	PA							
~14	SS-4	19 25 37	CH			39.5		PP:8500
	PA							
	WB							
~18.5	SS-5	50/4"				20.5		

DESCRIPTION OF STRATUM:

0.0–5.0: FILL, FAT CLAY, WITH GRAVEL, COBBLES AND BOULDERS, BROWN, RED BROWN

5.0–16.0: FAT CLAY, WITH GRAVEL AND COBBLES, RED BROWN, HARD

16.0: ***SANDSTONE, SEVERELY WEATHERED, OCCASSIONALLY CLAYEY, LIGHT GRAY, BROWN, RED BROWN
- PRACTICAL AUGER REFUSAL AT 17.5 FEET

LEGEND:
- Fill (made ground)
- CH - USCS High Plasticity Clay
- Sandstone

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-14

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-14
COORDINATES: N 37.74359, W 92.12354 ;
ELEVATION: +102.0 (ft)   DATE(S) DRILLED: 3/12/10 - 3/12/10

DRILLING METHOD(S): PA, WB

Driler: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
22.0(ft)**: Water Level 24HR after drilling.
7.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	MOISTURE CONTENT (%)	OTHER LAB DATA
20–23	WB		***SANDSTONE, SEVERELY WEATHERED, OCCASSIONALLY CLAYEY, LIGHT GRAY, BROWN, RED BROWN *(continued)*		
23.5–25	SS-6	11 15 34		19.0	PP:6000
25–28.5	WB				
28.5–29.2	SS-7	44 50/2"	29.2	8.1	
			BOTTOM OF BORING		

LEGEND:
Fill (made ground)
CH - USCS High Plasticity Clay
Sandstone

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-15

SHEET 1 of 2

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-15
COORDINATES: N 37.74352, W 92.12323 ;
ELEVATION: +104.5 (ft) DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA

DRILLING METHOD(S): PA, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
18.0(ft)**: Water Level 24HR after drilling.
6.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–1.0	PA		FILL, LEAN TO FAT CLAY, TRACE GRAVEL, BROWN (1.0)	Fill (made ground)						
1.0–2.5	SS-1	3 4 5	FAT CLAY, WITH SAND, TRACE GRAVEL, RED BROWN, GRAY, STIFF TO VERY STIFF	CH - USCS High Plasticity Clay	CH	94	65	33.7		S:81 PP:3000
2.5–3.5	PA									
3.5–5.0	SS-2	6 9 14			CH			19.0		PP:6000
5.0–8.5	PA		(8.5)							
8.5–10.0	SS-3	8 18 10	FAT CLAY, GRAVELLY, RED BROWN, VERY STIFF TO HARD		CH			8.6		PP:5500
10.0–13.3	PA		- PRACTICAL AUGER REFUSAL ON APPARENT BOULDER AT 13.3 FEET							
13.3–18.5	WB									
18.5–20.0	SS-4	4 9 12						18.3		PP:5000

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-15

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-15
COORDINATES: N 37.74352, W 92.12323 ;
ELEVATION: +104.5 (ft)
DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA | DRILLING METHOD(S): PA, WB | LABORATORY DATA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
18.0(ft)**: Water Level 24HR after drilling.
6.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA:
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22			WB				FAT CLAY, GRAVELLY, RED BROWN, VERY STIFF TO HARD *(continued)*	Fill (made ground); CH - USCS High Plasticity Clay						
24			SS-5	6 24 4								41.0		PP:8000
26			WB											
28–30			SS-6	9 28 14			30.0					14.1		PP:7000
30							BOTTOM OF BORING							

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-16

SHEET 1 of 2

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-16
COORDINATES: N 37.74235, W 92.12424 ;
ELEVATION: +113.0 (ft)
DATE(S) DRILLED: 3/3/10 - 3/3/10

DRILLING METHOD(S): PA, WB

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
28.0(ft)**: Water Level 24HR after drilling.
5.5(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND:
- GP - USCS Poorly-graded Gravel
- CH - USCS High Plasticity Clay
- Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0 - 0.5	PA		6" GRAVEL						
0.5 - 1.5	PA		FAT CLAY, TRACE GRAVEL, RED BROWN, BROWN, STIFF TO VERY STIFF						
1.5 - 3	SS-1	5 9 10		CH			19.0		PP:+9000
3 - 3.5	PA								
3.5 - 5	SS-2	5 7 10		CH			37.6		PP:9000
5 - 8.5	WB								
8.5 - 10	SS-3	3 4 6		CH			39.5		PP:9000
10 - 13.5	WB								
13.5 - 15	SS-4	7 8 17	FAT CLAY, WITH GRAVEL, RED BROWN, BROWN, STIFF TO VERY STIFF	CH			34.9		PP:+9000
15 - 18.5	WB								
18.5 - 20	SS-5	5 5 7		CH			43.3		PP:7500

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-16

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-16
COORDINATES: N 37.74235, W 92.12424 ;
ELEVATION: +113.0 (ft)
DATE(S) DRILLED: 3/3/10 - 3/3/10

FIELD DATA

DRILLING METHOD(S): PA, WB

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
28.0(ft)**: Water Level 24HR after drilling.
5.5(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22			WB				FAT CLAY, WITH GRAVEL, RED BROWN, BROWN, STIFF TO VERY STIFF *(continued)* — 23.5						
24			SS-6	50/4"			***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY, RED BROWN				48.0		PP:6500
26			WB										
28							- CLAYEY BELOW 28.5 FEET						
30			SS-7	14 12 10			30.0				17.0		PP:+9000

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

LEGEND
GP - USCS Poorly-graded Gravel
CH - USCS High Plasticity Clay
Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-17

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-17
COORDINATES: N 37.74231, W 92.12383 ;
ELEVATION: +115.0 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA
Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

LEGEND:
- Topsoil
- CL - USCS Low Plasticity Clay
- CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.2	PA		2"ROOT ZONE (0.2)						
0.2–3.5	SS-1	16 26 6	LEAN CLAY, SANDY, WITH GRAVEL, LIGHT BROWN, VERY STIFF (3.5)	CL	40	22	15.0		S:55
	PA								
3.5–20	SS-2	16 18 31	FAT CLAY, GRAVELLY, TRACE SAND, RED BROWN, BROWN, VERY STIFF TO HARD	CH			10.7		
	PA								
	SS-3	12 14 19		CH			28.8		PP:+9000
	PA								
	SS-4	8 9 16		CH			32.5		PP:+9000
	PA								
	SS-5	17 25 22		CH			18.7		

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-17

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-17
COORDINATES: N 37.74231, W 92.12383 ;
ELEVATION: +115.0 (ft) DATE(S) DRILLED: 3/9/10 - 3/9/10

FIELD DATA | DRILLING METHOD(S): PA | LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
							FAT CLAY, GRAVELLY, TRACE SAND, RED BROWN, BROWN, VERY STIFF TO HARD *(continued)*						
22			PA										
24			SS-6	30 50/6"				CH			18.3		
26			PA										
28							- APPARENT SANDSTONE AT 29.5 FEET						
			SS-7	18 8 50/3"			29.8	CH			35.5		PP:+9000
							BOTTOM OF BORING						

LEGEND
- Topsoil
- CL - USCS Low Plasticity Clay
- CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-18

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-18
COORDINATES: N 37.7422, W 92.12392 ;
ELEVATION: +117.0 (ft) DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.2	PA		2"ROOT ZONE (0.2)						
			FAT CLAY, WITH GRAVEL, RED BROWN, GRAY						
2	SS-1	3 7 10		CH			18.0		PP:5000
	PA								
4	SS-2	11 10 15		CH			22.5		PP:9000
6–8	PA								
10	SS-3	5 7 14		CH			32.0		PP:+9000
12	PA		- OCCASSIONALLY SANDY BELOW 13.5 FEET						
14	SS-4	6 9 9		CH			23.5		PP:+9000
16–18	PA		- WITH COBBLES BELOW 18.5 FEET						
20	SS-5	11 24 26		CH			19.7		PP:4000

LEGEND: Topsoil; CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

FIELD DATA columns: DEPTH (ft), SOIL SYMBOL, BREAKS: bb or mb, SAMPLE/DRILL METHOD, BLOWS, TORVANE KG/CM SQ (equally spaced along sample), RC: % RQD: %, Additional Field Data

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-18

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-18
COORDINATES: N 37.7422, W 92.12392 ;
ELEVATION: +117.0 (ft) DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

LEGEND: Topsoil; CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
21–28.6	PA		FAT CLAY, WITH GRAVEL, RED BROWN, GRAY *(continued)*						
24	SS-6	26 50/3"		CH			10.9		
26	PA								
28.6	SS-7	50/1"	28.6	CH					
			BOTTOM OF BORING						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-19

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-19
COORDINATES: N 37.74184, W 92.12385 ;
ELEVATION: +117.0 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

FIELD DATA — DRILLING METHOD(S): PA — LABORATORY DATA

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–1			PA				2"ROOT ZONE — 0.2	Topsoil						
1–2.5			SS-1	8 12 27			FAT CLAY, WITH GRAVEL, BROWN, GRAY, RED BROWN, HARD	CH - USCS High Plasticity Clay	CH			18.9		PP:8000
2.5–3.5			PA				3.5							
3.5–5			SS-2	7 18 21			FAT CLAY, GRAVELLY, RED BROWN, STIFF TO VERY STIFF		CH			18.0		PP:8500
5–8.5			PA											
8.5–10			SS-3	7 11 16					CH			26.4		PP:+9000
10–13.5			PA											
13.5–15			SS-4	6 6 10					CH			38.9		PP:+9000
15–18.5			PA				- WITH SAND BELOW 18.5 FEET							
18.5–20			SS-5	9 7 7					CH			21.0		PP:6000

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-19

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-19
COORDINATES: N 37.74184, W 92.12385 ;
ELEVATION: +117.0 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

FIELD DATA

DRILLING METHOD(S): PA

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

LEGEND
Topsoil
CH - USCS High Plasticity Clay

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
							FAT CLAY, GRAVELLY, RED BROWN, STIFF TO VERY STIFF *(continued)*						
22			PA										
24			SS-6	4 14 15				CH			39.9		PP:9000
26			PA										
28							- WITH COBBLES BELOW 28 FEET						
			SS-7	7 5 5				CH			36.3		PP:5000
30							30.0						
							BOTTOM OF BORING						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-20

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-20
COORDINATES: N 37.74231, W 92.1235 ;
ELEVATION: +110.5 (ft)
DATE(S) DRILLED: 3/11/10 - 3/11/10

DRILLING METHOD(S): PA, WB

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
5.0(ft)**: Water level after drilling.
8.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND: Topsoil; CH - USCS High Plasticity Clay; Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.2	PA		2"ROOT ZONE (0.2)						
0.2–8.5	SS-1	5 50/5"	FAT CLAY, GRAVELLY, GRAY, RED BROWN, HARD	CH	56	32	13.4		S:60
	PA								
	SS-2	16 19 25		CH			29.7		PP:+9000
	PA		(8.5)						
8.5–18.5	SS-3	6 18 23	FAT CLAY, SANDY, RED BROWN, GRAY, HARD	CH			22.2		PP:+9000
	PA								
	SS-4	10 11 50/4"		CH			22.2		PP:+9000
	PA		(18.5)						
18.5–19.5	SS-5	50/3"	***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY, BROWN, RED BROWN - PRACTICAL AUGER REFUSAL AT 19.5 FEET				21.2		PP:+9000
	WB								

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-20

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-20
COORDINATES: N 37.74231, W 92.1235 ;
ELEVATION: +110.5 (ft)
DATE(S) DRILLED: 3/11/10 - 3/11/10

FIELD DATA

DRILLING METHOD(S): PA, WB

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
8.0(ft)**: Water Level 24HR after drilling.
5.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
							***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY, BROWN, RED BROWN - PRACTICAL AUGER REFUSAL AT 19.5 FEET *(continued)* - CLAYEY AT 20 FEET TO 27.5 FEET						
22			SS-6	9 6 8							30.8		PP:+9000
			WB										
24			SS-7	6 7 14							19.7		PP:8500
26			WB										
28			SS-8	50/2"			28.7				6.3		

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

LEGEND
- Topsoil
- CH - USCS High Plasticity Clay
- Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-21

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-21
COORDINATES: N 37.74337, W 92.12303 ;
ELEVATION: +108.0 (ft) DATE(S) DRILLED: 3/11/10 - 3/11/10

DRILLING METHOD(S): PA, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
4.5(ft)**: Water level after drilling.
11.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

FIELD DATA columns: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %, Additional Field Data

LABORATORY DATA columns: USCS SYMBOL; ATTERBERG LIMITS: LIQUID LIMIT (LL), PLASTIC INDEX (PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%), PP: Pocket Penetrometer (psf), C: Confining Pressure (psi), F: Failure Strain (%), T: Total Sulfates, P: Soil pH, O: Other lab data defined in Remarks

Depth (ft)	Sample/Drill Method	Blows	Description of Stratum	USCS Symbol	LL	PI	Moisture Content (%)	Lab Visual Grouping	Other Lab Data
0–0.1	PA		1"ROOT ZONE (0.1)						
0.1–17.5			FAT CLAY, WITH SAND AND GRAVEL, GRAY, RED BROWN, BROWN, HARD						
~1.5–3	SS-1	10 12 19		CH	74	48	26.3		S:84 PP:+9000
~3–4	PA								
~4–5.5	SS-2	5 7 11		CH			33.3		PP:+9000
~5.5–9	PA								
~9–10.5	SS-3	8 9 10		CH			23.4		PP:+9000
~10.5–14	PA								
~14–15.5	SS-4	22 11 10		CH			32.3		PP:9000
~15.5–18.3	PA		(17.5)						
17.5–			***SANDSTONE, SEVERELY WEATHERED, VERY LIGHT GRAY, RED BROWN - PRACTICAL AUGER REFUSAL AT 18.3 FEET						

LEGEND: Topsoil; CH - USCS High Plasticity Clay; Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-21

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-21
COORDINATES: N 37.74337, W 92.12303 ;
ELEVATION: +108.0 (ft) DATE(S) DRILLED: 3/11/10 - 3/11/10

FIELD DATA

DRILLING METHOD(S): PA, WB

LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
▽ NONE(ft): Water Level during drilling.
▼ 4.5(ft)**: Water level after drilling.
▼ 11.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: %	Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
			WB					***SANDSTONE, SEVERELY WEATHERED, VERY LIGHT GRAY, RED BROWN - PRACTICAL AUGER REFUSAL AT 18.3 FEET *(continued)*						
22			SS-5	50/5"								14.1		
			WB											
24			SS-6	9 12 18				- CLAYEY BELOW 23.5 FEET				24.1		
26			WB											
28			SS-7	10 5 6								35.0		
30								30.0 BOTTOM OF BORING ***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.						

LEGEND
- Topsoil
- CH - USCS High Plasticity Clay
- Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-22

SHEET 1 of 2

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-22
COORDINATES: N 37.74318, W 92.12288 ;
ELEVATION: +106.0 (ft) DATE(S) DRILLED: 3/11/10 - 3/11/10

DRILLING METHOD(S): PA, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
1.0(ft)**: Water Level 24HR after drilling.
1.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

FIELD DATA: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: % RQD: %; Additional Field Data

LABORATORY DATA: USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

Depth (ft)	Sample/Drill Method	Blows	Description of Stratum	USCS Symbol	LL	PI	Moisture Content (%)	Lab Visual Grouping	Other Lab Data
0–0.2	PA		2"ROOT ZONE (0.2)						
0.2–8.5			FAT CLAY, RED BROWN, GRAY, BROWN, VERY STIFF						
	SS-1	5 6 12		CH			29.0		PP:+9000
	PA		- SANDY BELOW 3.5 FEET						
	SS-2	8 14 29		CH			29.4		PP:+9000
	PA		(8.5)						
8.5–14.0	SS-3	50/6'	FAT CLAY, SANDY, WITH GRAVEL AND COBBLES, RED BROWN, GRAY, BROWN, HARD	CH			13.5		PP:5000
	PA		(14.0)						
	SS-4	50/6'		CH			34.6		PP:+9000
14.0–	PA		***SANDSTONE, SEVERELY WEATHERED, WITH CHERT GRAVEL, OCCASSIONALLY CLAYEY, LIGHT GRAY, BROWN, RED BROWN - PRACTICAL AUGER REFUSAL AT 14.5 FEET						
	WB								
20							10.2		

LEGEND: Topsoil; CH - USCS High Plasticity Clay; Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-22

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-22
COORDINATES: N 37.74318, W 92.12288 ;
ELEVATION: +106.0 (ft) DATE(S) DRILLED: 3/11/10 - 3/11/10

FIELD DATA | DRILLING METHOD(S): PA, WB | LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
1.0(ft)**: Water Level 24HR after drilling.
1.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT LL	PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
			SS-5	35 27 28			***SANDSTONE, SEVERELY WEATHERED, WITH CHERT GRAVEL, OCCASSIONALLY CLAYEY, LIGHT GRAY, BROWN, RED BROWN - PRACTICAL AUGER REFUSAL AT 14.5 FEET *(continued)*				10.2		
22			WB										
24			SS-6	17 22 18							19.8		
26			WB										
28													
			SS-7	15 16 50							15.2		
30							30.0						

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

LEGEND
- Topsoil
- CH - USCS High Plasticity Clay
- Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-23

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-23
COORDINATES: N 37.74289, W 92.122933 ;
ELEVATION: +104.0 (ft) DATE(S) DRILLED: 3/22/10 - 3/22/10

DRILLING METHOD(S): PA, WB

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
14.0(ft)**: Water Level 24HR after drilling.
7.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LEGEND: Topsoil; CH - USCS High Plasticity Clay; Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.3	PA		3"ROOT ZONE (0.3)						
0.3–3.5	SS-1	8 12 14	FAT CLAY, GRAVELLY, GRAY, RED BROWN, VERY STIFF	CH			14.5		
	PA		(3.5)						
3.5–17.5	SS-2	7 8 14	FAT CLAY, TRACE GRAVEL, RED BROWN, GRAY, VERY STIFF TO HARD	CH	76	50	29.1		S:83 PP:9000
	PA								
	SS-3	12 50/4"	- WITH GRAVEL AND COBBLES BELOW 8.5 FEET	CH			21.8		PP:9000
	PA								
	SS-4	8 10 15		CH			22.4		PP:+9000
	PA		(17.5)						
17.5–18			***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY, BROWN, RED BROWN - PRACTICAL AUGER REFUSAL AT 18 FEET						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-23

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-23
COORDINATES: N 37.74289, W 92.122933 ;
ELEVATION: +104.0 (ft) DATE(S) DRILLED: 3/22/10 - 3/22/10

FIELD DATA — DRILLING METHOD(S): PA, WB — LABORATORY DATA

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
14.0(ft)**: Water Level 24HR after drilling.
7.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
20–24			WB				***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY, BROWN, RED BROWN - PRACTICAL AUGER REFUSAL AT 18 FEET *(continued)* - CLAYEY BELOW 22 FEET	Topsoil CH - USCS High Plasticity Clay Sandstone						
24–25.5			SS-5	6 7 10								30.1		PP:5500
25.5–29			WB											
29–30			SS-6	43 20 10			30.0					9.8		

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-24

SHEET 1 of 2

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-24
COORDINATES: N 37.74202, W 92.12277 ;
ELEVATION: +103.7 (ft)
DATE(S) DRILLED: 3/9/10 - 3/10/10

DRILLING METHOD(S): PA, WB
Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
6.0(ft)**: Water Level 24HR after drilling.
3.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

FIELD DATA: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %, Additional Field Data

LABORATORY DATA: USCS SYMBOL; ATTERBERG LIMITS: LIQUID LIMIT (LL), PLASTIC INDEX (PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.2	PA		2"ROOT ZONE (0.2)						
			FAT CLAY, WITH GRAVEL, GRAY, HARD						
2	SS-1	10 14 18		CH			15.4		
	PA		(3.5)						
4	SS-2	7 12 18	FAT CLAY, TRACE GRAVEL, RED BROWN, HARD	CH			31.4		PP:9000
6–8	PA		- WITH GRAVEL BELOW 8 FEET						
	SS-3	19 21 18		CH			20.7		PP:+9000
10–12	PA		(12.5)						
	WB		***CLAYEY SHALE, SEVERELY WEATHERED, RED BROWN, BROWN - PRACTICAL AUGER REFUSAL AT 12.7 FEET						PP:++9000
14	SS-4	4 6 12					28.8		
16–18	WB		- WITH GRAVEL AND WEATHERED SANDSTONE BELOW 19 FEET						
20	SS-5	16 18					25.1		

LEGEND: Topsoil; CH - USCS High Plasticity Clay; Shale

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-24

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-24
COORDINATES: N 37.74202, W 92.12277 ;
ELEVATION: +103.7 (ft)   DATE(S) DRILLED: 3/9/10 - 3/10/10

FIELD DATA | DRILLING METHOD(S): PA, WB | LABORATORY DATA

Driller: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
6.0(ft)**: Water Level 24HR after drilling.
3.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS: LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22, 24			WB	9			***CLAYEY SHALE, SEVERELY WEATHERED, RED BROWN, BROWN - PRACTICAL AUGER REFUSAL AT 12.7 FEET *(continued)*					25.1		
25.4			SS-8	50/0"			BOTTOM OF BORING							

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

LEGEND: Topsoil; CH - USCS High Plasticity Clay; Shale

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG_A_2005 B5105007 5-12-10_EMH.GPJ 5/12/10

LOG OF BORING B-25

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-25
COORDINATES: N 37.74298, W 92.1225 ;
ELEVATION: +98.0 (ft)
DATE(S) DRILLED: 3/22/10 - 3/22/10

DRILLING METHOD(S): PA, WB

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
13.0(ft)**: Water Level 24HR after drilling.
6.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

FIELD DATA: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %, Additional Field Data

LABORATORY DATA: USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%), PP: Pocket Penetrometer (psf), C: Confining Pressure (psi), F: Failure Strain (%), T: Total Sulfates, P: Soil pH, O: Other lab data defined in Remarks

DESCRIPTION OF STRATUM

Depth (ft)	Description	Sample/Drill Method	Blows	USCS Symbol	LL	PI	Moisture Content (%)	Lab Visual Grouping	Other Lab Data
0–0.2	2"ROOT ZONE	PA							
0.2–2.5	LEAN CLAY, GRAVELLY, DARK BROWN, STIFF	SS-1	3, 4, 6	CH			18.5		PP:5000
2.5–11.0	FAT CLAY, WITH SAND, GRAVEL AND COBBLES, RED BROWN, BROWN, HARD	PA							
		SS-2	8, 12, 22	CH			13.4		PP:+9000
		PA							
	- APPARENT BOULDER AT 10 FEET TO 10.5 FEET	SS-3	15, 50/6"	CH			15.9		PP:+9000
		PA							
11.0–20	***SANDSTONE, SEVERELY WEATHERED, CHERTY, OCCASSIONALLY CLAYEY, LIGHT GRAY, RED BROWN - PRACTICAL AUGER REFUSAL AT 11.3 FEET	WB							
		SS-4	18, 50/6"				17.7		
		WB							
		SS-5	18, 14, 13				10.1		

LEGEND

- Topsoil
- CL - USCS Low Plasticity Clay
- CH - USCS High Plasticity Clay
- Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-25

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-25
COORDINATES: N 37.74298, W 92.1225 ;
ELEVATION: +98.0 (ft)
DATE(S) DRILLED: 3/22/10 - 3/22/10

FIELD DATA | DRILLING METHOD(S): PA, WB | LABORATORY DATA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
- NONE(ft): Water Level during drilling.
- 13.0(ft)**: Water Level 24HR after drilling.
- 6.0(ft)**: Water level after drilling.

** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA:
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
							***SANDSTONE, SEVERELY WEATHERED, CHERTY, OCCASSIONALLY CLAYEY, LIGHT GRAY, RED BROWN - PRACTICAL AUGER REFUSAL AT 11.3 FEET *(continued)*						
22			WB										
24			SS-6	50/2"									
26			WB										
28													
			SS-7	20 21 24									
30							30.0						
							BOTTOM OF BORING						
							***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.						

LEGEND
- Topsoil
- CL - USCS Low Plasticity Clay
- CH - USCS High Plasticity Clay
- Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-26

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-26
COORDINATES: N 37.74239, W 92.12545 ;
ELEVATION: +98.0 (ft) DATE(S) DRILLED: 3/15/10 - 3/15/10

FIELD DATA

DRILLING METHOD(S): PA, WB

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
6.0(ft)**: Water level after drilling.
8.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0.1			PA				1"ROOT ZONE	Topsoil						
			SS-1	50/3"			FAT CLAY, WITH COBBLES, GRAY, HARD	CH - USCS High Plasticity Clay	CH			12.1		PP:3000
3.5			PA											
4			SS-2	8 7 7			FAT CLAY, RED BROWN, GRAY, VERY STIFF - WITH SAND AND GRAVEL BELOW 5 FEET		CH	98	67	34.9		S:91 PP:6000
6			PA			6.0 water level after drilling								
8						8.0 water level 24HR after drilling								
9			SS-3	4 7 9					CH			22.5		PP:5000
12			PA											
14.5			SS-4	17 50/5"					CH			41.2		PP:+9000
			PA				***SANDSTONE, SEVERELY WEATHERED, OCCASSIONALLY CLAYEY, LIGHT GRAY - PRACTICAL AUGER REFUSAL AT 14.8 FET	Sandstone						
16			WB											
20.0			SS-5	26 16 14								16.9		

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-26

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-26
COORDINATES: N 37.74239, W 92.12545 ;
ELEVATION: +98.0 (ft) DATE(S) DRILLED: 3/15/10 - 3/15/10

FIELD DATA

DRILLING METHOD(S): PA, WB

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
8.0(ft)**: Water Level 24HR after drilling.
6.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
							BOTTOM OF BORING ***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.	Topsoil CH - USCS High Plasticity Clay Sandstone						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-27

SHEET 1 of 2

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-27
COORDINATES: N 37.74247, W 92.12507 ;
ELEVATION: +104.5 (ft)
DATE(S) DRILLED: 3/15/10 - 3/15/10

DRILLING METHOD(S): PA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

LEGEND:
CH - USCS High Plasticity Clay
Sandstone

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0	CH		PA				FAT CLAY, WITH GRAVEL, DARK BROWN, BROWN, RED BROWN, STIFF (POSSIBLE FILL)						
2			SS-1	3 4 7				CH			18.6		PP:4000
			PA										
4			SS-2	3 4 6				CH			20.7		PP:3500
6			PA										
8.5	CH						FAT CLAY, WITH SAND AND GRAVEL, RED BROWN, GRAY, HARD						
10			SS-3	3 7 10				CH			29.0		PP:6000
12			PA										
14			SS-4	4 8 32				CH			19.8		PP:5000
16			PA										
18.5	Sandstone		SS-5	50/4"			***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY, BROWN - WITH CHERT FRAGMENTS AND CLAYEY BELOW 20 FEET				2.5		
20			PA										

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-27

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-27
COORDINATES: N 37.74247, W 92.12507 ;
ELEVATION: +104.5 (ft)   DATE(S) DRILLED: 3/15/10 - 3/15/10

FIELD DATA | DRILLING METHOD(S): PA | LABORATORY DATA

Driller: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
			SS-6	50/6"			20.5					5.7		
							BOTTOM OF BORING ***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.	CH - USCS High Plasticity Clay Sandstone						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-28

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-28
COORDINATES: N 37.74226, W 92.12519 ;
ELEVATION: +101.0 (ft)
DATE(S) DRILLED: 3/15/10 - 3/15/10

DRILLING METHOD(S): PA

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

FIELD DATA / DESCRIPTION OF STRATUM / LABORATORY DATA

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.1	PA		1"ROOT ZONE (0.1)						
0.1–3.5			FAT CLAY, WITH GRAVEL, GRAY, VERY STIFF						
2	SS-1	9 7 8		CH			13.5		PP:6000
	PA		(3.5)						
3.5–18.8			FAT CLAY, GRAVELLY, RED BROWN, BROWN, VERY STIFF						
4	SS-2	16 14 13		CH			17.9		PP:6000
6–8	PA								
9	SS-3	8 6 8		CH			28.7		PP:3000
10–12	PA		- WITH COBBLES BELOW 13.5 FEET						
14	SS-4	5 6 50/5"		CH			20.6		PP:7000
16	PA								
18.8	SS-5	50/3"	(18.8) BOTTOM OF BORING	CH			15.8		PP:7000

LEGEND: Topsoil; CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

Field data columns: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %; RQD: %; Additional Field Data

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-29

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-29
COORDINATES: N 37.74188, W 92.1254 ;
ELEVATION: +99.0 (ft)
DATE(S) DRILLED: 3/23/10 - 3/23/10

DRILLING METHOD(S): PA, WB

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
3.0(ft)**: Water level after drilling.
6.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	OTHER LAB DATA
0–0.1	PA		1"ROOT ZONE (0.1)					
0.1–5.0	SS-1	3 4 7	FAT CLAY, RED BROWN, GRAY, STIFF	CH			31.5	PP:9000
	PA							
	SS-2	3 4 6	(5.0)	CH			34.5	PP:6000
5.0–18.6	PA		FAT CLAY, GRAVELLY, WITH COBBLES, GRAY, RED BROWN, VERY STIFF TO HARD					
	SS-3	7 50/5"	- WITH BOULDERS AT 9 FEET TO 11 FEET	CH			20.9	PP:5000
	PA							
	SS-4	4 7 9		CH			14.5	PP:8500
	PA		- PRACTICAL AUGER REFUSAL AT 16.3 FEET					
	WB		- APPARENT SANDSTONE AT 18.6 FEET (18.6)					
18.6	SS-5	50/1"	BOTTOM OF BORING	CH			19.6	

LEGEND: Topsoil; CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-30

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-30
COORDINATES: N 37.74202, W 92.12517 ;
ELEVATION: +98.5 (ft)
DATE(S) DRILLED: 3/23/10 - 3/23/10

FIELD DATA

DRILLING METHOD(S): PA, WB

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
1.0(ft)**: Water Level 24HR after drilling.
1.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0.0–0.1	PA		1"ROOT ZONE						
0.1–2.5	SS-1	5 18 21	FAT CLAY, WITH GRAVEL, BROWN, HARD (POSSIBLE FILL)	CH			18.6		
2.5–15.0	PA		FAT CLAY, GRAVLLY, WITH COBBLES, RED BROWN, GRAY, HARD						
	SS-2	8 10 11		CH			17.6		PP:9000
	PA								
	SS-3	7 8 16		CH			28.4		PP:9000
	PA								
	SS-4	8 12 12		CH			28.5		PP:+9000
15.0–18.6	PA		***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY - PRACTICAL AUGER REFUSAL AT 15.5 FEET						
	WB								
18.6	SS-5	50/1"					15.8		
			BOTTOM OF BORING						
			***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES						

LEGEND
- Topsoil
- CH - USCS High Plasticity Clay
- Sandstone

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

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LOG OF BORING B-30

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-30
COORDINATES: N 37.74202, W 92.12517 ;
ELEVATION: +98.5 (ft)
DATE(S) DRILLED: 3/23/10 - 3/23/10

FIELD DATA

DRILLING METHOD(S): PA, WB

LABORATORY DATA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
1.0(ft)**: Water level after drilling.
1.0(ft)**: Water Level 24HR after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS LIQUID LIMIT LL	ATTERBERG LIMITS PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks
							AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.	Topsoil CH - USCS High Plasticity Clay Sandstone						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-31

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-31
COORDINATES: N 37.74222, W 92.12486 ;
ELEVATION: +105.5 (ft) DATE(S) DRILLED: 3/15/10 - 3/15/10

FIELD DATA | DRILLING METHOD(S): PA | LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling. NONE(ft): Water level after drilling.
18.0(ft): Water Level 24HR after drilling.

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–1	CL		PA				LEAN CLAY, SANDY, WITH GRAVEL AND COBBLES, GRAY, RED BROWN, STIFF (POSSIBLE FILL)						
			SS-1	50/6"				CL			14.2		
2			PA										
4			SS-2	8 4 7				CL	31	17	13.5		S:59 PP:1000
6–8			PA				8.5						
	CH		SS-3	6 12 14			FAT CLAY, TRACE SAND AND GRAVEL, RED BROWN, GRAY, VERY STIFF TO HARD	CH			44.2		PP:4500
10–12			PA				- WITH COBBLES BELOW 13.5 FEET						
14			SS-4	6 50/1"			- APPARENT BOULDER AT 15.3 FEET TO 16.3 FEET	CH			11.4		
16–18			PA										
20			SS-5	6 8 17			20.0	CH			22.5		PP:+9000

LEGEND:
CL - USCS Low Plasticity Clay
CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-31

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-31
COORDINATES: N 37.74222, W 92.12486 ;
ELEVATION: +105.5 (ft) DATE(S) DRILLED: 3/15/10 - 3/15/10

FIELD DATA | DRILLING METHOD(S): PA | LABORATORY DATA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
18.0(ft): Water Level 24HR after drilling.

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS: LIQUID LIMIT (LL)	ATTERBERG LIMITS: PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
							BOTTOM OF BORING	CL - USCS Low Plasticity Clay CH - USCS High Plasticity Clay						

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG_A_2005 B5105007 5-12-10_EMH.GPJ 5/12/10

LOG OF BORING B-32

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-32
COORDINATES: N 37.74177, W 92.12493 ;
ELEVATION: +100.5 (ft)   DATE(S) DRILLED: 3/23/10 - 3/23/10

FIELD DATA | DRILLING METHOD(S): PA | LABORATORY DATA

Driller: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

Legend: Topsoil; CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	OTHER LAB DATA
0–0.1	PA		1"ROOT ZONE (0.1)					
	SS-1	7 5 7	FAT CLAY, WITH SAND AND GRAVEL, RED BROWN, BROWN, STIFF TO VERY STIFF	CH			13.5	PP:+9000
	PA							
	SS-2	5 6 7		CH			24.3	PP:8500
	PA		(8.5)					
	SS-3	7 9 17	FAT CLAY, WITH COBBLES, RED BROWN, VERY STIFF	CH			29.2	PP:+9000
	PA							
	SS-4	4 5 10		CH			33.4	PP:7000
	PA		- APPARENT SANDSTONE AT 18.6 FEET (18.6)					
18.6	SS-5	50/1"	BOTTOM OF BORING	CH			12.4	

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-32

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-32
COORDINATES: N 37.74177, W 92.12493 ;
ELEVATION: +100.5 (ft) DATE(S) DRILLED: 3/23/10 - 3/23/10

FIELD DATA

DRILLING METHOD(S): PA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	ATTERBERG LIMITS: LIQUID LIMIT LL	PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
							AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.	Topsoil CH - USCS High Plasticity Clay						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-33

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-33
COORDINATES: N 37.74132, W 92.12374 ;
ELEVATION: +115.5 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA
Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

FIELD DATA: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %; Additional Field Data

LABORATORY DATA: USCS SYMBOL; ATTERBERG LIMITS: LIQUID LIMIT (LL), PLASTIC INDEX (PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

Depth (ft)	Sample/Drill Method	Blows	Description of Stratum	USCS Symbol	LL	PI	Moisture Content (%)	Lab Visual Grouping	Other Lab Data
0–0.2	PA		2"ROOT ZONE (0.2)						
0.2–3.5	SS-1	9, 50/6"	CLAYEY GRAVEL, WITH COBBLES, GRAY, RED BROWN, DENSE (3.5)	GC	32	15	9.1		S:22
	PA								
3.5–	SS-2	14, 17, 27	FAT CLAY, GRAVELLY, RED BROWN, HARD	CH			12.5		PP:+9000
	PA		- WITH SAND AT 8.5 FEET TO 23.5 FEET						
	SS-3	11, 8, 12		CH			26.0		PP:+9000
	PA								
	SS-4	13, 12, 14		CH			22.1		PP:3500
	PA								
–20	SS-5	14, 15, 29		CH			17.0		

LEGEND:
- Topsoil
- GC - USCS Clayey Gravel
- CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-33

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-33
COORDINATES: N 37.74132, W 92.12374 ;
ELEVATION: +115.5 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA
Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
20–24	PA		FAT CLAY, GRAVELLY, RED BROWN, HARD *(continued)*						
24–25.5	SS-6	12 15 17		CH			12.3		PP:+9000
25.5–29	PA								
29–30	SS-7	7 7 14	30.0	CH			21.2		PP:+9000
30			BOTTOM OF BORING						

Column headers also include: SOIL SYMBOL; BREAKS: bb or mb; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %, Additional Field Data; LEGEND; ATTERBERG LIMITS.

LEGEND:
- Topsoil
- GC - USCS Clayey Gravel
- CH - USCS High Plasticity Clay

OTHER LAB DATA:
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-34

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-34
COORDINATES: N 37.74167, W 92.12365 ;
ELEVATION: +116.5 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

FIELD DATA: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: % RQD: % Additional Field Data

LABORATORY DATA: USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

Depth (ft)	Sample/Drill Method	Blows	Description of Stratum	USCS Symbol	LL	PI	Moisture Content (%)	Lab Visual Grouping	Other Lab Data
0–0.2	PA		2"ROOT ZONE (0.2)						
1–2	SS-1	5 6 8	FAT CLAY, TRACE SAND AND GRAVEL, GRAY, BROWN, VERY STIFF	CH			20.1		PP:9000
3	PA		(3.5)						
4	SS-2	13 13 14	FAT CLAY, GRAVELLY, BROWN, RED BROWN, VERY STIFF TO HARD	CH			17.1		PP:8500
5–8.5	PA								
9	SS-3	8 6 10		CH			33.1		PP:5000
10–13.5	PA								
14	SS-4	11 13 29		CH			21.4		PP:9000
15–18.5	PA		- OCCASSIONALLY SANDY BELOW 18.5 FEET						
19	SS-5	9 14 12		CH			16.4		PP:5500

LEGEND:
Topsoil
CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-34

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-34
COORDINATES: N 37.74167, W 92.12365 ;
ELEVATION: +116.5 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

FIELD DATA | DRILLING METHOD(S): PA | LABORATORY DATA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

OTHER LAB DATA:
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
20–24	CH		PA				FAT CLAY, GRAVELLY, BROWN, RED BROWN, VERY STIFF TO HARD *(continued)*						
24–25.5	CH		SS-6	4 8 11				CH			31.1		PP:9000
25.5–29	CH		PA										
29–30	CH		SS-7	7 17 23			30.0	CH			20.6		PP:6000
30							BOTTOM OF BORING						

LEGEND:
- Topsoil
- CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-35

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-35
COORDINATES: N 37.74136, W 92.12337 ;
ELEVATION: +115.5 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA

Driler: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

FIELD DATA / DESCRIPTION OF STRATUM / LABORATORY DATA

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	OTHER LAB DATA
0–0.2	PA		2"ROOT ZONE (0.2)					
0.2–3.5	SS-1	8 19 23	FAT CLAY, GRAVELLY, GRAY, BROWN, RED BROWN, HARD (3.5)	CH			11.9	
	PA							
3.5–20	SS-2	10 16 29	FAT CLAY, GRAVELLY, RED BROWN, BROWN, HARD	CH			15.0	PP:+9000
	PA							
	SS-3	11 9 12		CH			28.8	PP:+9000
	PA							
	SS-4	10 11 21		CH			13.0	PP:+9000
	PA							
	SS-5	9 15 16		CH			17.9	PP:+9000

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Column headings: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %, Additional Field Data; USCS SYMBOL; ATTERBERG LIMITS: LIQUID LIMIT (LL), PLASTIC INDEX (PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

LEGEND:
Topsoil
CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-35

Department of the Army
Kansas City District
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700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers ®

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-35
COORDINATES: N 37.74136, W 92.12337 ;
ELEVATION: +115.5 (ft) DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

FIELD DATA: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %, Additional Field Data

LABORATORY DATA: USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
22	PA		FAT CLAY, GRAVELLY, RED BROWN, BROWN, HARD *(continued)*						
			- WITH COBBLES AND SANDY BELOW 23.5 FEET						
24	SS-6	7 50/6"		CH			30.9		PP:8000
26	PA								
28									
30	SS-7	2 3 4	30.0	CH			45.3		PP:5000
			BOTTOM OF BORING						

LEGEND:
Topsoil
CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-36

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-36
COORDINATES: N 37.7412, W 92.12291 ;
ELEVATION: +111.0 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

FIELD DATA / LABORATORY DATA

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.2	PA		2"ROOT ZONE (0.2)	Topsoil						
2	SS-1	3 3 3	FAT CLAY, GRAVELLY, RED BROWN, GRAY, BROWN, MEDIUM STIFF TO HARD	CH - USCS High Plasticity Clay	CH	78	56	21.0		S:59
	PA									
4	SS-2	2 2 3			CH			26.7		PP:3000
6–8	PA									
9	SS-3	6 7 9			CH			29.0		PP:4500
12	PA									
14	SS-4	12 12 21			CH			41.6		PP:5000
16–18	PA									
19–20	SS-5	30 13 12			CH			8.2		PP:8000

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG_A_2005 B5105007 5-12-10_EMH.GPJ 5/12/10

LOG OF BORING B-36

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-36
COORDINATES: N 37.7412, W 92.12291 ;
ELEVATION: +111.0 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

FIELD DATA

DRILLING METHOD(S): PA

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

LEGEND
Topsoil
CH - USCS High Plasticity Clay

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
							FAT CLAY, GRAVELLY, RED BROWN, GRAY, BROWN, MEDIUM STIFF TO HARD *(continued)*						
22			PA										
							- WITH COBBLES BELOW 23.5 FEET						
24			SS-6	50/6"				CH			11.1		PP:5500
26			PA										
28													
			SS-7	24 24 50/2"			29.7	CH			37.7		PP:5000
							BOTTOM OF BORING						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-37

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-37
COORDINATES: N 37.74159, W 92.1232 ;
ELEVATION: +111.5 (ft) DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): HS, WB
Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

FIELD DATA columns: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %, Additional Field Data

LABORATORY DATA columns: USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%), PP: Pocket Penetrometer (psf), C: Confining Pressure (psi), F: Failure Strain (%), T: Total Sulfates, P: Soil pH, O: Other lab data defined in Remarks

Depth (ft)	Sample/Drill Method	Blows	Description of Stratum	USCS Symbol	LL	PI	Moisture Content (%)	Lab Visual Grouping	Other Lab Data
0–0.2	PA		2"ROOT ZONE (0.2)						
0.2–3.5	SS-1	3 3 4	FAT CLAY, TRACE GRAVEL, GRAY BROWN, STIFF	CH			23.7		PP:4000
	PA		(3.5)						
3.5–13.5	SS-2	11 8 19	FAT CLAY, WITH GRAVEL, RED BROWN, VERY STIFF TO HARD	CH			21.2		PP:+9000
	PA								
	SS-3	5 7 10		CH			30.7		PP:6000
	PA		(13.5)						
13.5–20	SS-4	18 20 28	FAT CLAY, GRAVELLY, OCCASSIONALLY SANDY, RED BROWN, HARD	CH			21.2		PP:5000
	PA		- WITH COBBLES BELOW 18.5 FEET						
	SS-5	10 50/4"		CH			27.5		PP:8000

LEGEND: Topsoil; CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-37

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-37
COORDINATES: N 37.74159, W 92.1232 ;
ELEVATION: +111.5 (ft) DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): HS, WB
Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

FIELD DATA columns: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %; Additional Field Data

LABORATORY DATA columns: USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
			FAT CLAY, GRAVELLY, OCCASSIONALLY SANDY, RED BROWN, HARD *(continued)*						
22	PA								
24	SS-5	50/2"		CH			14.7		PP:6000
26	PA		- APPARENT BOULDER AT 26.5 FEET TO 28 FEET						
28			- APPARENT SANDSTONE AT 29 FEET						
	SS-6	50/6"	29.0	CH			49.1		PP:8000
			BOTTOM OF BORING						

LEGEND:
Topsoil
CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-38

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-38
COORDINATES: N 37.74426, W 92.12521 ;
ELEVATION: +86.0 (ft)
DATE(S) DRILLED: 3/15/10 - 3/15/10

FIELD DATA

DRILLING METHOD(S): PA

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

LABORATORY DATA

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	USCS SYMBOL	LIQUID LIMIT LL	PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
	GP		PA				8" GRAVEL 0.7						
2	Fill		SS-1	12 10 11			FILL, FAT CLAY, WITH SAND AND GRAVEL, TRACE ASPHALT RUBBLE, BROWN, DARK BROWN, RED BROWN				8.0		
			PA										
4			SS-2	7 7 8				CH			7.7		PP:2500
6			PA										
8							8.5						
	CH		SS-3	3 4 7			FAT CLAY, WITH SAND AND GRAVEL, RED BROWN, STIFF	CH			27.6		PP:5000
10							10.0 BOTTOM OF BORING						

LEGEND
- GP - USCS Poorly-graded Gravel
- Fill (made ground)
- CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-39

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-39
COORDINATES: N 37.74324, W 92.12573 ;
ELEVATION: +87.5 (ft)
DATE(S) DRILLED: 3/23/10 - 3/23/10

DRILLING METHOD(S): PA

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0.0–0.2	PA		2"ROOT ZONE (0.2)						
0.2–3.0	SS-1	4 8 11	FILL, GRAVELLY LEAN CLAY, GRAY, BROWN (3.0)		36	18	14.2		S:51 PP:6000
	PA								
3.0–8.5	SS-2	5 7 8	FAT CLAY, WITH GRAVEL, GRAY, BROWN, VERY STIFF (8.5)	CH			23.7		PP:6500
	PA								
8.5–10.0	SS-3	4 5 9	FAT CLAY, TRACE SAND AND GRAVEL, RED BROWN, VERY STIFF (10.0)	CH			44.6		PP:7000
10.0			BOTTOM OF BORING						

LEGEND: Topsoil; Fill (made ground); CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-40

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

US Army Corps of Engineers

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-40
COORDINATES: N 37.74424, W 92.12342 ;
ELEVATION: +88.0 (ft)
DATE(S) DRILLED: 3/15/10 - 3/15/10

DRILLING METHOD(S): PA, WB

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
(ft): Water Level 24HR after drilling.
3.0(ft)**: Water level after drilling.
** Boring advanced using mud rotary drilling techniques. Meaningful post drilling observations to detect naturally ocurring water levels could not be obtained with drilling fluids in the borehole.

FIELD DATA: DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: %	Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	LIQUID LIMIT LL	PLASTIC INDEX PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0.0–0.8	GP		PA					10" GRAVEL (0.8)	GP - USCS Poorly-graded Gravel						
0.8–2.5	CH		SS-1	13, 50/4"				FAT CLAY, WITH SAND AND GRAVEL, BROWN, RED BROWN (POSSIBLE FILL) - PRACTICAL AUGER REFUSAL AT 2.5 FEET (2.5)	CH - USCS High Plasticity Clay	CH			9.5		
			PA												
2.5–8.8	Sandstone		WB					***SANDSTONE, SEVERELY WEATHERED, LIGHT GRAY (8.8)	Sandstone						
			SS-2, WB	50/0"											
			SS-3	50/4"											

OTHER LAB DATA: S: Minus 200 Sieve (%), PP: Pocket Penetrometer (psf), C: Confining Pressure (psi), F: Failure Strain (%), T: Total Sulfates, P: Soil pH, O: Other lab data defined in Remarks

BOTTOM OF BORING

***CLASSIFICATION ESTIMATED FROM DISTURBED SAMPLES. CORE SAMPLES AND PETROGRAPHIC ANALYSIS MAY REVEAL OTHER ROCK TYPES.

NOTE: BORING B-40 WAS LOCATED WITHIN AN EXISTING GRAVEL PARKING LOT. THE BORING WAS BACKFILLED IMMEDIATELY UPON COMPLETION OF DRILLING; NO DELAYED WATER LEVEL MEASUREMENTS WERE OBTAINED.

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-41

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-41
COORDINATES: N 37.74272, W 92.12406 ;
ELEVATION: +112.5 (ft)
DATE(S) DRILLED: 3/12/10 - 3/12/10

DRILLING METHOD(S): PA

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	BREAKS: bb or mb	SAMPLE/DRILL METHOD	BLOWS	TORVANE KG/CM SQ (equally spaced along sample)	RC: % RQD: % Additional Field Data	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	LIQUID LIMIT (LL)	PLASTIC INDEX (PI)	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–1.5	CH		PA				FAT CLAY, TRACE GRAVEL, RED BROWN, VERY STIFF	CH - USCS High Plasticity Clay						
1.5–3.0	CH		SS-1	5 6 8					CH	86	59	32.9		S:89 PP:9000
3.0–3.5	CH		PA				3.5							
3.5–5.0	CH		SS-2	6 9 9			FAT CLAY, WITH SAND AND GRAVEL, RED BROWN, GRAY, VERY STIFF		CH			30.4		PP:9000
5.0–8.5	CH		PA											
8.5–10.0	CH		SS-3	4 6 9			10.0		CH			39.2		PP:+9000
							BOTTOM OF BORING							

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-42

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-42
COORDINATES: N 37.74326, W 92.12368 ;
ELEVATION: +109.5 (ft) DATE(S) DRILLED: 3/12/10 - 3/12/10

FIELD DATA

DRILLING METHOD(S): PA

Driller: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

LABORATORY DATA

OTHER LAB DATA
S: Minus 200 Sieve (%)
PP: Pocket Penetrometer (psf)
C: Confining Pressure (psi)
F: Failure Strain (%)
T: Total Sulfates
P: Soil pH
O: Other lab data defined in Remarks

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–1.5	PA		LEAN CLAY, WITH GRAVEL, GRAY, STIFF (POSSIBLE FILL)						
1.5–3	SS-1	2 3 6		CL	43	27	20.4		S:58 PP:7000
3–3.5	PA		3.5						
3.5–4.4	SS-2	4 50/5"	FAT CLAY, WITH GRAVEL AND COBBLES, RED BROWN, VERY STIFF	CH			18.0		PP:9000
4.4–8.5	PA								
8.5–10	SS-3	5 10 5	10.0	CH			23.4		PP:5500
			BOTTOM OF BORING						

LEGEND
CL - USCS Low Plasticity Clay
CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-43

SHEET 1 of 1

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-43
COORDINATES: N 37.74268, W 92.12355 ;
ELEVATION: +111.5 (ft)
DATE(S) DRILLED: 3/11/10 - 3/11/10

DRILLING METHOD(S): PA

Driler: SB Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.2	PA		2"ROOT ZONE (0.2)	Topsoil						
0.2–3.5	SS-1	3 4 6	FAT CLAY, TRACE GRAVEL, BROWN, GRAY, STIFF	CH - USCS High Plasticity Clay	CH			23.6		PP:5000
	PA		(3.5)							
3.5–10.0	SS-2	15 19 27	FAT CLAY, GRAVELLY, WITH SAND, RED BROWN, GRAY, HARD		CH			10.7		
	PA									
	SS-3	8 10 29	(10.0)		CH			20.2		PP:+9000
			BOTTOM OF BORING							

Other lab data key: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

Field data columns: DEPTH (ft), SOIL SYMBOL, BREAKS: bb or mb, SAMPLE/DRILL METHOD, BLOWS, TORVANE KG/CM SQ (equally spaced along sample), RC: %, RQD: %, Additional Field Data

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-44

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-44
COORDINATES: N 37.74389, W 92.12268 ;
ELEVATION: +110.0 (ft)   DATE(S) DRILLED: 3/12/10 - 3/12/10

DRILLING METHOD(S): PA

Driller: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

LEGEND:
GP - USCS Poorly-graded Gravel
CH - USCS High Plasticity Clay

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

DEPTH (ft)	SOIL SYMBOL	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0.0–0.7	GP	PA		8" GRAVEL (0.7)						
0.7–2.5	CH	SS-1	8 9 16	FAT CLAY, TRACE GRAVEL, BROWN, HARD (2.5)	CH			30.6		PP:3500
2.5–10.0	CH	PA		FAT CLAY, GRAVELLY, RED BROWN, HARD						
		SS-2	9 15 22		CH			25.7		
		PA								
		SS-3	12 14 27	(10.0)	CH			23.3		PP:7000
10.0				BOTTOM OF BORING						

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-45

SHEET 1 of 1

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-45
COORDINATES: N 37.74224, W 92.12307 ;
ELEVATION: +106.0 (ft)
DATE(S) DRILLED: 3/10/10 - 3/10/10

DRILLING METHOD(S): PA

Driler: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water level after drilling.
NONE(ft): Water Level 24HR after drilling.

FIELD DATA: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: % RQD: %; Additional Field Data

LABORATORY DATA: USCS SYMBOL; ATTERBERG LIMITS (LIQUID LIMIT LL, PLASTIC INDEX PI); MOISTURE CONTENT (%); LAB VISUAL GROUPING; OTHER LAB DATA

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

Depth (ft)	Sample/Drill Method	Blows	Description of Stratum	Legend	USCS Symbol	LL	PI	Moisture Content (%)	Lab Visual Grouping	Other Lab Data
0–0.2	PA		2"ROOT ZONE (0.2)	Topsoil						
0.2–4.0	SS-1	6 11 11	FAT CLAY, WITH GRAVEL, GRAY, BROWN, VERY STIFF	CH - USCS High Plasticity Clay	CH			18.0		PP:9000
	PA									
4.0–10.0	SS-2	7 9 10	FAT CLAY, WITH GRAVEL, RED BROWN, GRAY, VERY STIFF		CH			31.4		PP:9000
	PA									
	SS-3	10 10 10			CH			28.4		PP:9000
10.0			BOTTOM OF BORING							

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-46

US Army Corps of Engineers

Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-46
COORDINATES: N 37.74181, W 92.12283 ;
ELEVATION: +105.0 (ft)   DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA

Driller: SB   Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

FIELD DATA / LABORATORY DATA

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0.2	PA		2"ROOT ZONE						
	SS-1	4 30 41	FAT CLAY, WITH GRAVEL, BROWN, GRAY, HARD	CH			24.0		PP:3000
	PA								
	SS-2	23 27 31		CH			8.4		PP:1500
8.5	PA								
9.5	SS-3	12 50/6"	FAT CLAY, WITH SAND AND GRAVEL, RED BROWN, HARD				9.8		PP:+9000
			BOTTOM OF BORING						

Column headings also include: SOIL SYMBOL; BREAKS: bb or mb; TORVANE KG/CM SQ (equally spaced along sample); RC: %; RQD: %; Additional Field Data; ATTERBERG LIMITS.

OTHER LAB DATA: S: Minus 200 Sieve (%); PP: Pocket Penetrometer (psf); C: Confining Pressure (psi); F: Failure Strain (%); T: Total Sulfates; P: Soil pH; O: Other lab data defined in Remarks

LEGEND:
- Topsoil
- CH - USCS High Plasticity Clay

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

LOG OF BORING B-47

US Army Corps of Engineers
Department of the Army
Kansas City District
Corps of Engineers
700 Federal Building
Kansas City, MO 64106

PROJECT: Basic Combat Training Complex 3 South
LOCATION: South Dakota Ave and Iowa Ave; Fort Leonard Wood, Missouri
BORING NUMBER: B-47
COORDINATES: N 37.74108, W 92.12321 ;
ELEVATION: +114.0 (ft)
DATE(S) DRILLED: 3/9/10 - 3/9/10

DRILLING METHOD(S): PA

Driller: SB
Logged by:EMH

GROUNDWATER INFORMATION:
NONE(ft): Water Level during drilling.
NONE(ft): Water Level 24HR after drilling.
NONE(ft): Water level after drilling.

DEPTH (ft)	SAMPLE/DRILL METHOD	BLOWS	DESCRIPTION OF STRATUM	LEGEND	USCS SYMBOL	LL	PI	MOISTURE CONTENT (%)	LAB VISUAL GROUPING	OTHER LAB DATA
0–0.2	PA		2"ROOT ZONE (0.2)	Topsoil						
0.2–8.5	SS-1	3 3 3	FAT CLAY, WITH GRAVEL, GRAY, RED BROWN, MEDIUM STIFF TO STIFF	CH - USCS High Plasticity Clay	CH	86	57	26.5		S:64 PP:3000
	PA									
	SS-2	3 3 4			CH			31.5		PP:2500
	PA		(8.5)							
8.5–10.0	SS-3	4 4 4	FAT CLAY, WITH GRAVEL, RED BROWN, STIFF (10.0)		CH			19.4		PP:2500
			BOTTOM OF BORING							

Field data column headings: DEPTH (ft); SOIL SYMBOL; BREAKS: bb or mb; SAMPLE/DRILL METHOD; BLOWS; TORVANE KG/CM SQ (equally spaced along sample); RC: %, RQD: %; Additional Field Data

OTHER LAB DATA: S: Minus 200 Sieve (%) PP: Pocket Penetrometer (psf) C: Confining Pressure (psi) F: Failure Strain (%) T: Total Sulfates P: Soil pH O: Other lab data defined in Remarks

REMARKS: R: Blow Count Refusal = >50 blows/1/2 foot for SPT, > 100 blows for drive barrel; Sample abbreviations; SS-# = SPT Sample, ST-# = Shelby Tube, B-# = Core Box, S-# = Sack, M-# = Moisture Tin, P-# = Pull, R-# = Core Run; RC - Rock Core Recovery; RQD - Rock Quality Designation; DD - dry unit weight (pcf); WOH - weight of hammer;

Field Exploration Description

The boring locations were laid out by a Terracon engineer utilizing a site plan provided by the client and measuring from available site features prior to the arrival of the drill crew. Right angles for the boring locations were estimated. Ground surface elevations indicated on the boring logs were measured in the field using a surveyor's level and grade rod and were referenced to the top of the fire hydrant located approximately 40 feet southeast of the intersection of West 19th Street and Caisson Drive as indicated on the boring location diagram. This benchmark was assigned an elevation of 100 feet. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with an ATV-mounted rotary drill rig using continuous flight solid-stem and hollow-stem augers and mud rotary boring techniques to advance the boreholes. Samples of the soil encountered in the borings were obtained using the split-barrel sampling procedure. Bulk samples obtained from auger cuttings were collected for standard Proctor and CBR testing from borings located in proposed pavement areas.

In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. Where safe to do so, the borings were left open in order to obtain a delayed groundwater level reading. Following delayed groundwater level readings, the borings were backfilled to within 2 feet of the ground surface with Portland cement grout. The remaining 2 feet were backfilled with auger cuttings.

A field log of each boring was prepared by the field engineer. These logs included visual classifications of the materials encountered during drilling as well as an interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

APPENDIX B
LABORATORY TESTING

Laboratory Testing

Soil samples were tested in the laboratory to measure their natural water content and a calibrated hand penetrometer was used to estimate the approximate unconfined compressive strength of some samples. The calibrated hand penetrometer has been correlated with unconfined compression tests and provides a better estimate of soil consistency than visual examination alone. The test results are provided on the boring logs included in Appendix A.

Two (2) standard Proctor compaction tests (ASTM D 698) and two (2) California Bearing Ratio (CBR) tests were performed on samples of material obtained from Borings B-38 and B-46 located in proposed parking, drive, and detention basin areas. Test results are included is Appendix B of this report.

Descriptive classifications of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Also shown are estimated Unified Soil Classification Symbols. A brief description of this classification system is attached to this report. Selected samples were further classified using the results of Atterberg limit testing and minus #200 sieve analysis. The Atterberg limit test and minus #200 sieve results are provided on the boring logs.

Laboratory Test Result Summary
Basic Combat Training Complex 3 South, Phase 1 and 2
Terracon Project Number B5105007
Fort Leonard Wood, Missouri
5/14/2010

Boring	Sample ID	Depth From (feet)	Depth To (feet)	Moisture Content (%)	q_p (psf)	Atterberg Limits LL	PL	PI	P200 (%)	Notes
1	1	1.5	3.0	15	9000					- Fill to 4'
	2	3.5	5.0	27						
	3	8.5	10.0	22	4500					
	4	13.5	15.0	33	3000					
	5	18.5	20.0	30	9000					
	6	23.5	25.0	31	1000					
	7	28.5	30.0	27	2000					
2	1	1.0	2.5	37	3500					- Fill to 7'
	2	3.5	5.0	21	1500					
	3	8.5	10.0	19	7500					
	4	13.5	15.0	18	9000					
	5	18.5	20.0	38	7000					
	6	23.5	23.5							- No recovery
	7	28.5	30.0	28	9000					
3	1	1.5	3.0	11		53	15	38	17	- Too gravelly to obtain a qp value, gradation performed
	2	3.5	5.0	21	4500					
	3	8.5	10.0	26						
	4	13.5	15.0	27	6000					
	5	18.5	20.0	23	9000					
	6	23.5	23.9	15						- Too gravelly to obtain a qp value
	7	28.5	30.0	21	5500					
4	1	1.5	3.0	17	7500					
	2	3.5	5.0	16	8000					
	3	8.5	10.0	20						- Too gravelly to obtain a qp value
	4	10.0	11.5	30	2000					
	5	13.5	15.0	14	4000					
	6	18.5	18.8	9						
	7	23.5	24.0	33	8000					
	8	28.5	30.0	24	9000					
5	1	1.5	3.0	19	4500					
	2	3.5	5.0	20	3500	42	19	23	45	- Gradation performed
	3	8.5	10.0	19	3500					
	4	13.5	15.0	14	6000					
	5	18.5	20.0	27	5000					
	6	23.5	25.0	42						- Too gravelly to obtain a qp value
	7	28.5	30.0	18						- Too gravelly to obtain a qp value
6	1	1.0	2.5	17	8000					
	2	3.5	5.0	12						- Too gravelly to obtain a qp value
	3	8.5	10.0	37	8000					
	4	13.5	15.0	42	8500					
	5	18.5	20.0	30	8500					
	6	23.5	25.0	27	3000					
	7	28.5	30.0	37	6500					
7	1	1.5	3.0	19	4500	75	20	55	48	- Fill to 8.5', gradation performed
	2	3.5	5.0	20	4500					
	3	8.5	10.0	48	4000					
	4	13.5	14.0	10						
	5	18.5	18.5							- No recovery
8	1	1.5	3.0	14	3500					
	2	3.5	5.0	33	8000					
	3	8.5	10.0	35	7500					
	4	13.5	15.0	39	9000					
	5	17.0	17.3	3						
	6	18.5	19.0	17						
	7	23.5	25.0	43	5000					
	8	28.5	30.0	20						

Laboratory Test Result Summary
Basic Combat Training Complex 3 South, Phase 1 and 2
Terracon Project Number B5105007
Fort Leonard Wood, Missouri
5/14/2010

Terracon

Boring	Sample ID	Depth From (feet)	Depth To (feet)	Moisture Content (%)	q_p (psf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	P200 (%)	Notes
9	1	1.5	3.0	41	7000					
	2	3.5	5.0	40	6500					
	3	8.5	10.0	29	3500					
	4	13.5	15.0	45	8000					
	5	18.5	18.9	33	6500					
	6	23.5	25.0	28	3000					
	7	28.5	30.0	30						
10	1	1.5	3.0	38	7500					
	2	3.5	5.0	36	9000	82	26	56	61	- Gradation performed
	3	8.5	10.0	28	8000					
	4	13.5	15.0	44	7000					
	5	18.5	20.0	25	8500					
	6	23.5	25.0	15						
	7	28.5	30.0	30						
11	1	1.0	2.5	38	5000					- Fill to 3'
	2	3.5	5.0	34	4500	93	30	63	55	- Gradation performed
	3	8.5	9.5	28	4500					
	4	13.5	15.0	15	7500					
	5	18.5	20.0	13						
	6	23.5	25.0	14						
	7	28.5	28.8	12						
12	1	1.0	2.5	36						- Fill to 1'
	2	3.5	5.0	30	6500					
	3	8.5	10.0	14	6000					
	4	13.5	14.8	36	8000					
	5	18.5	18.8	13						
	6	23.5	23.9	12						
	7	28.5	30.0	12	5000					
13	1	1.0	2.5	27	4000					- Fill to 8.5'
	2	3.5	5.0	21	3000					
	3	8.5	8.7	12						
	4	13.5	15.0	18	6000					
	5	18.5	19.0	18	3000					
	6	23.5	23.9	12						
	7	28.5	28.8	15						
14	1	1.0	2.5							- No recovery, Fill to 5'
	2	3.5	5.0	17	4000					
	3	8.5	9.3	17						
	4	13.5	15.0	40	8500					
	5	18.5	18.8	21						
	6	23.5	25.0	19	6000					
	7	28.5	29.2	8						
15	1	1.0	2.5	34	3000	94	29	65	81	- Fill to 1', gradation performed
	2	3.5	5.0	19	6000					
	3	8.5	10.0	9	5500					
	4	18.5	20.0	18	5000					
	5	23.5	25.0	41	8000					
	6	28.5	30.0	14	7000					
16	1	1.5	3.0	19	9000					
	2	3.5	5.0	38	9000					
	3	8.5	10.0	40	9000					
	4	13.5	15.0	35	9000					
	5	18.5	20.0	43	7500					
	6	23.5	23.8	48	6500					
	7	28.5	30.0	17	9000					

Laboratory Test Result Summary
Basic Combat Training Complex 3 South, Phase 1 and 2
Terracon Project Number B5105007
Fort Leonard Wood, Missouri
5/14/2010

Boring	Sample ID	Depth From (feet)	Depth To (feet)	Moisture Content (%)	q_p (psf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	P200 (%)	Notes
17	1	1.0	2.5	15		40	18	22	55	- Gradation performed
	2	3.5	5.0	11						
	3	8.5	10.0	29	9000					- Too gravelly to obtain a qp value
	4	13.5	15.0	33	9000					- Too gravelly to obtain a qp value
	5	18.5	20.0	19						
	6	23.5	24.5	18						
	7	28.5	29.8	36	9000					
18	1	1.0	2.5	18	5000					
	2	3.5	5.0	23	9000					
	3	8.5	10.0	32	9000					
	4	13.5	15.0	24	9000					
	5	18.5	20.0	20	4000					
	6	23.5	24.3	11						
	7	28.5	28.6							- No recovery
19	1	1.0	2.5	19	8000					
	2	3.5	5.0	18	8500					
	3	8.5	10.0	26	9000					
	4	13.5	15.0	39	9000					
	5	18.5	20.0	21	6000					
	6	23.5	25.0	40	9000					
	7	28.5	30.0	36	5000					
20	1	1.0	1.9	13		56	24	32	60	
	2	3.5	5.0	30	9000					- Gradation performed
	3	8.5	10.0	22	9000					
	4	13.5	14.8	22	9000					
	5	18.5	18.8	21	9000					
	6	20.5	22.0	31	9000					
	7	23.5	25.0	20	8500					
	8	28.5	28.7	6						
21	1	1.0	2.5	26	9000	74	26	48	84	- Gradation performed
	2	3.5	5.0	33	9000					
	3	8.5	10.0	23	9000					
	4	13.5	15.0	32	9000					
	5	22.0	22.4	14						
	6	23.8	25.3	24						
	7	28.5	30.0	35						
22	1	1.0	2.5	29	9000					
	2	3.5	5.0	29	9000					
	3	8.5	9.0	14	5000					
	4	13.5	14.0	35	9000					
	5	18.5	21.0	10						
	6	23.5	25.0	20						
	7	28.5	30.0	15						
23	1	1.0	2.5	15						- Too gravelly to obtain a qp value
	2	3.5	5.0	29	9000	76	26	50	83	- Gradation performed
	3	8.5	9.3	22	9000					
	4	13.5	15.0	22	9000					
	5	23.5	25.0	30	5500					
	6	28.5	30.0	10						
24	1	1.0	2.5	15						
	2	3.5	5.0	31	9000					
	3	8.5	10.0	21	9000					
	4	13.6	15.1	29	9000					
	5	19.0	20.5	25						
	6	25.4	25.4							- No recovery

Laboratory Test Result Summary
Basic Combat Training Complex 3 South, Phase 1 and 2
Terracon Project Number B5105007
Fort Leonard Wood, Missouri
5/14/2010

Boring	Sample ID	Depth From (feet)	Depth To (feet)	Moisture Content (%)	q_p (psf)	Atterberg Limits LL	PL	PI	P200 (%)	Notes
25	1	1.0	2.5	19	5000					
	2	3.5	5.0	13	9000					
	3	8.5	9.5	16	9000					
	4	13.5	14.5	18						
	5	18.5	20.0	10						
	6	23.5	23.7							- 1" recovery
	7	28.5	30.0							- No recovery
26	1	1.0	1.3	12	3000					
	2	3.5	5.0	35	6000					- Gradation performed
	3	8.5	10.0	23	5000					
	4	13.5	14.4	41	9000					
	5	18.5	20.0	17						
27	1	1.0	2.5	19	4000					- Possible fill to 8.5'
	2	3.5	5.0	21	3500					
	3	8.5	10.0	29	6000					
	4	13.5	15.0	20	5000					
	5	18.5	18.8	3						
	6	20.0	20.5	6						
28	1	1.0	2.5	14	6000					
	2	3.5	5.0	18	6000					
	3	8.5	10.0	29	3000					
	4	13.5	14.6	21	7000					
	5	18.5	18.8	16	7000					
29	1	1.0	2.5	32	9000					
	2	3.5	5.0	35	6000					
	3	8.5	9.4	21	5000					
	4	13.5	15.0	15	8500					
	5	18.5	18.6	20						
30	1	1.0	2.5	19						- Possible fill to 2.5'
	2	3.5	5.0	18	9000					
	3	8.5	10.0	28	9000					
	4	13.5	15.0	29	9000					
	5	18.5	18.6	16						
31	1	1.0	1.5	14						- Possible fill to 8.5'
	2	3.5	5.0	14	1000	31	14	17	59	- Gradation performed
	3	8.5	10.0	44	4500					
	4	13.5	14.1	11						
	5	18.5	20.0	23	9000					
32	1	1.0	2.5	14	9000					
	2	3.5	5.0	24	8500					
	3	8.5	10.0	29	9000					
	4	13.5	15.0	33	7000					
	5	18.5	18.6	12						
33	1	1.0	2.0	9		32	17	15	22	- Gradation performed
	2	3.5	5.0	13	9000					
	3	8.5	10.0	26	9000					
	4	13.5	15.0	22	3500					
	5	18.5	20.0	17						
	6	23.5	25.0	12	9000					
	7	28.5	30.0	21	9000					
34	1	1.0	2.5	20	9000					
	2	3.5	5.0	17	8500					
	3	8.5	10.0	33	5000					
	4	13.5	15.0	21	9000					
	5	18.5	20.0	16	5500					
	6	23.5	25.0	31	9000					
	7	28.5	30.0	21	6000					

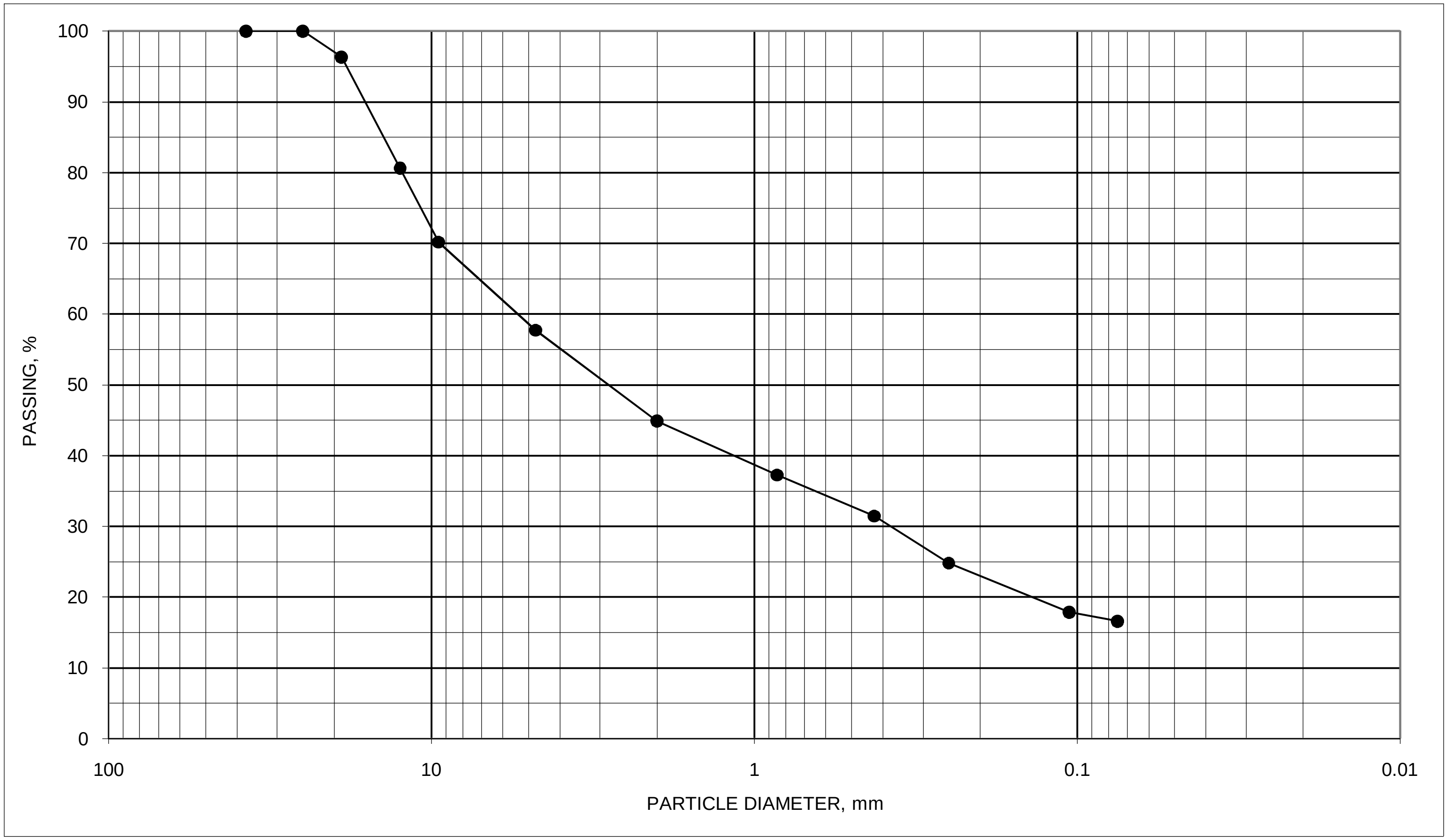
Laboratory Test Result Summary
Basic Combat Training Complex 3 South, Phase 1 and 2
Terracon Project Number B5105007
Fort Leonard Wood, Missouri
5/14/2010

Terracon

Boring	Sample ID	Depth From (feet)	Depth To (feet)	Moisture Content (%)	q_p (psf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	P200 (%)	Notes
35	1	1.0	2.5	12						
	2	3.5	5.0	15	9000					
	3	8.5	10.0	29	9000					
	4	13.5	15.0	13	9000					
	5	18.5	20.0	18	9000					
	6	23.5	24.5	31	8000					
	7	28.5	30.0	45	5000					
36	1	1.0	2.5	21		78	22	56	59	- Gradation performed
	2	3.5	5.0	27	3000					
	3	8.5	10.0	29	4500					
	4	13.5	15.0	42	5000					
	5	18.5	20.0	8	8000					
	6	23.5	24.0	11	5500					
	7	28.5	29.7	38	5000					
37	1	1.0	2.5	24	4000					
	2	3.5	5.0	21	9000					
	3	8.5	10.0	31	6000					
	4	13.5	15.0	21	5000					
	5	18.5	19.3	28	8000					
	6	23.5	23.7	15	6000					
	7	28.5	29.0	49	8000					
38	1	1.0	2.5	8						- Fill to 8.5', Standard Proctor and CBR performed on bulk sample from 1' to 7': MDD=112.9 pcf, w_{opt}=14.1%, CBR=2.0
	2	3.5	5.0	8	2500					
	3	8.5	10.0	28	5000					
39	1	1.0	2.5	14	6000	36	18	18	51	- Fill to 3', gradation performed
	2	3.5	5.0	24	6500					
	3	8.5	10.0	45	7000					
40	1	1.0	1.8	10						- Possible fill to 2.5'
	2	3.5	3.5							- No recovery
	3	8.5	8.8							- No recovery
41	1	1.5	3.0	33	9000	86	27	59	89	- Gradation performed
	2	3.5	5.0	30	9000					
	3	8.5	10.0	39	9000					
42	1	1.5	3.0	20	7000	43	16	27	58	- Possible fill to 3.5', gradation performed
	2	3.5	4.4	18	9000					
	3	8.5	10.0	23	5500					
43	1	1.0	2.5	24	5000					
	2	3.5	5.0	11						- Too gravelly to obtain a qp value
	3	8.5	10.0	20	9000					
44	1	1.0	2.5	31	3500					
	2	3.5	5.0	26						- Too gravelly to obtain a qp value
	3	8.5	10.0	23	7000					
45	1	1.0	2.5	18	9000					
	2	3.5	5.0	31	9000					
	3	8.5	10.0	28	9000					
46	1	1.0	2.5	24	3000					- Standard Proctor and CBR performed on bulk sample from 1' to 7': MDD=104.6 pcf, w_{opt}=18.0%, CBR=2.5
	2	3.5	5.0	8	1500					
	3	8.5	9.5	10	9000					
47	1	1.0	2.5	27	3000	86	29	57	64	- Gradation performed
	2	3.5	5.0	32	2500					
	3	8.5	10.0	19	2500					

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	96
1/2"	12.5	81
3/8"	9.50	70
#4	4.75	58
#10	2.00	45
#20	0.850	37
#40	0.425	31
#60	0.250	25
#140	0.106	18
#200	0.075	16.6

D60	5.3852
D30	0.3782



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-3	1	1 TO 3	CLAYEY GRAVEL WITH SAND BROWN, REDDISH BROWN & YELLOWISH BROWN	GC	11.3	53	15	38

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

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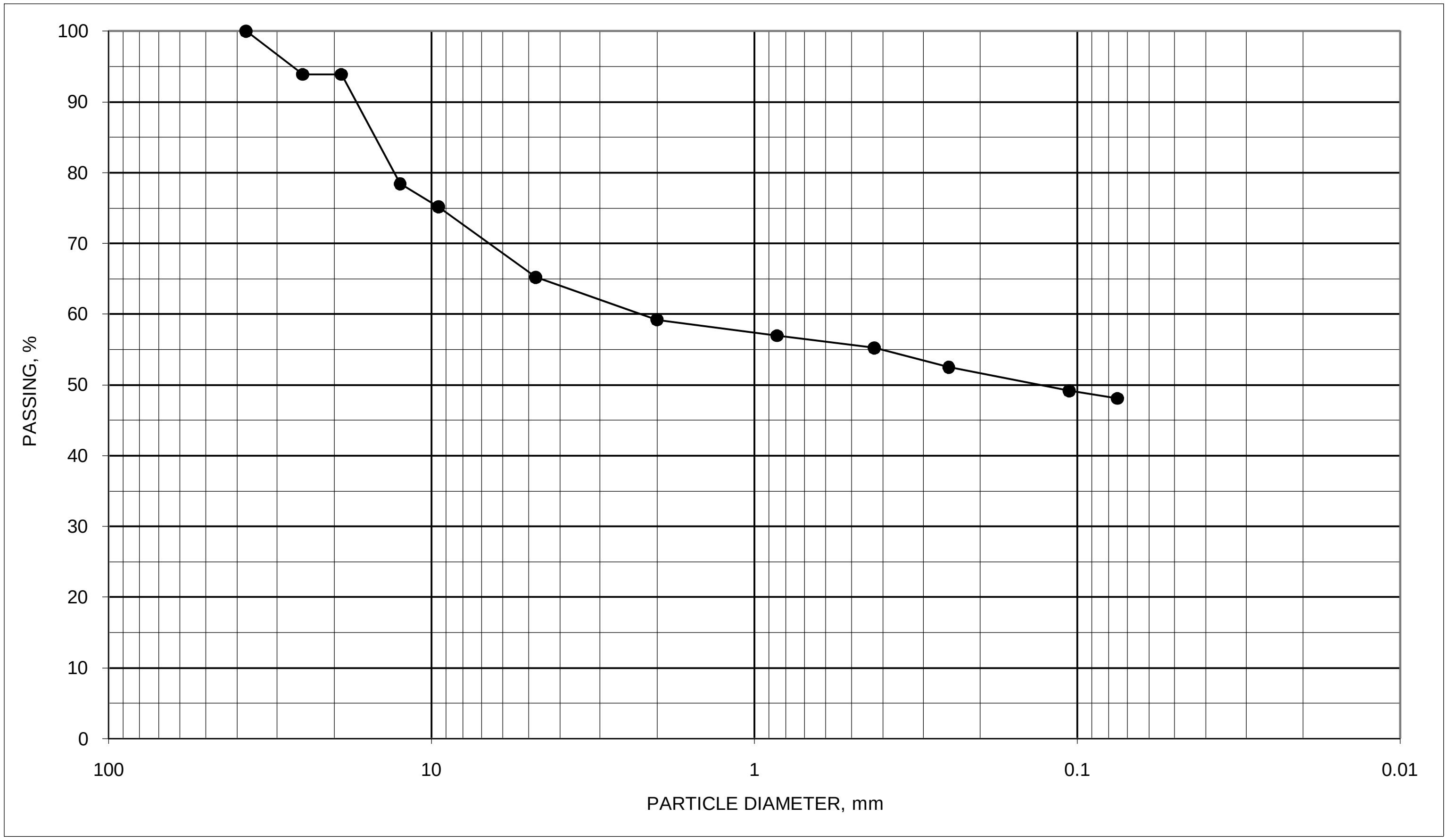
Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	94
3/4"	19.0	94
1/2"	12.5	78
3/8"	9.50	75
#4	4.75	65
#10	2.00	59
#20	0.850	57
#40	0.425	55
#60	0.250	52
#140	0.106	49
#200	0.075	48.1
	D60	2.2382



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-7	1	1.5 TO 3	CLAYEY GRAVEL WITH SAND REDDISH BROWN	GC	18.8	75	20	55

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

Terracon

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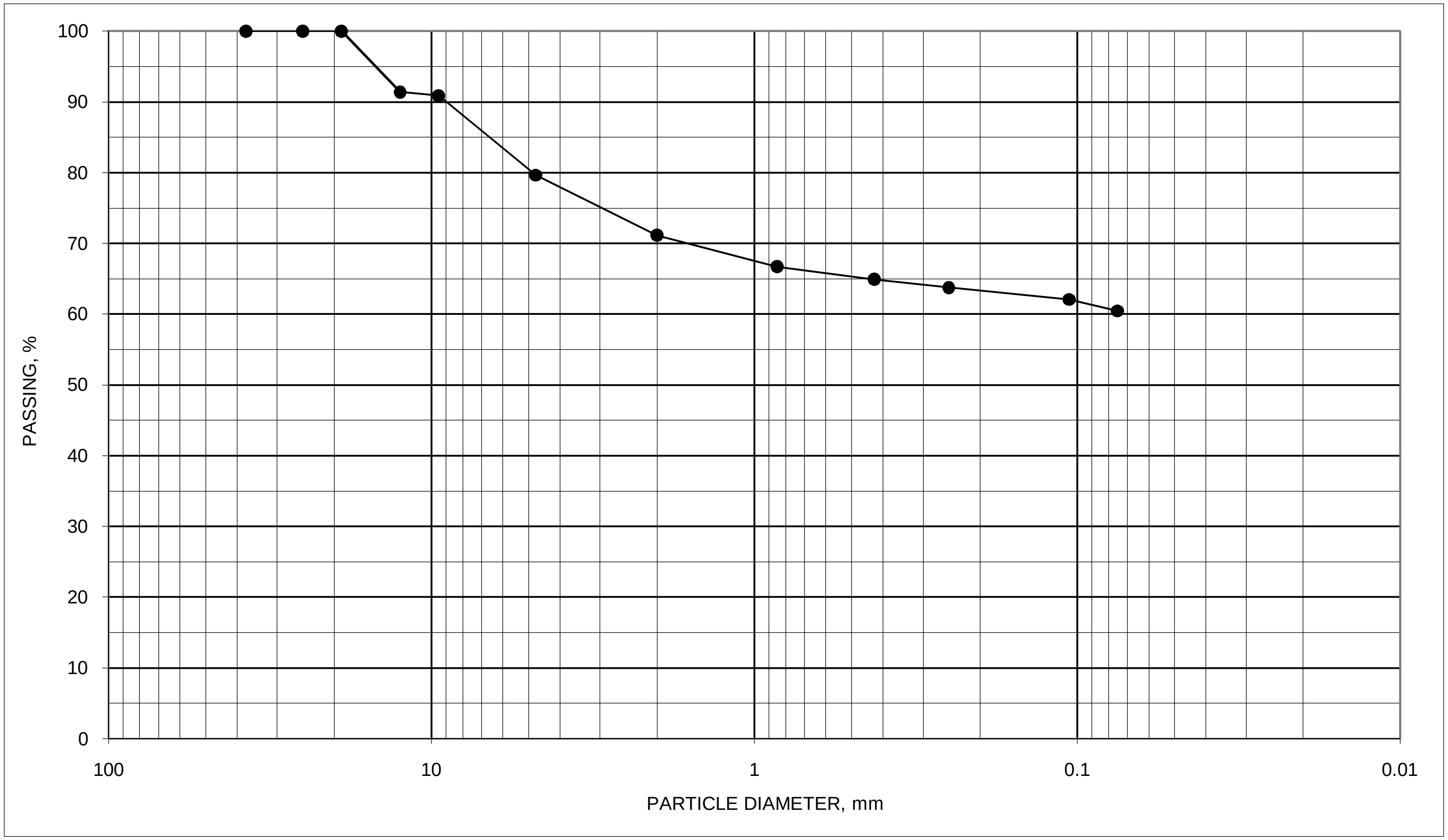
SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	100
1/2"	12.5	91
3/8"	9.50	91
#4	4.75	80
#10	2.00	71
#20	0.850	67
#40	0.425	65
#60	0.250	64
#140	0.106	62
#200	0.075	60.5



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-10	2	3.5 TO 5	GRAVELLY FAT CLAY WITH SAND REDDISH BROWN	CH	35.6	82	26	56

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

Terracon

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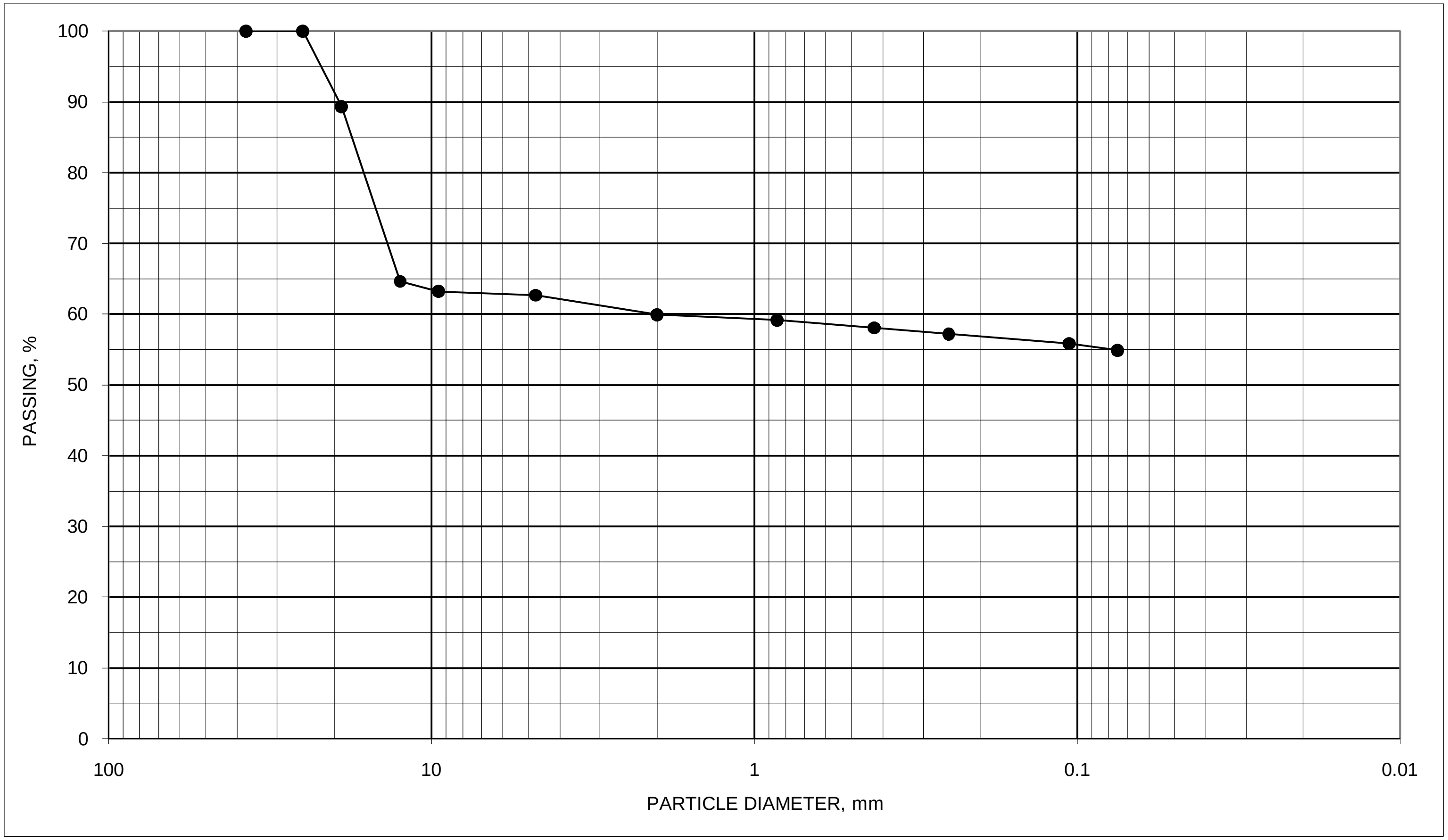
SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	89
1/2"	12.5	65
3/8"	9.50	63
#4	4.75	63
#10	2.00	60
#20	0.850	59
#40	0.425	58
#60	0.250	57
#140	0.106	56
#200	0.075	54.9

D60 2.0420



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-11	2	3.5 TO 5	GRAVELLY FAT CLAY REDDISH BROWN	CH	34.1	93	30	63

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

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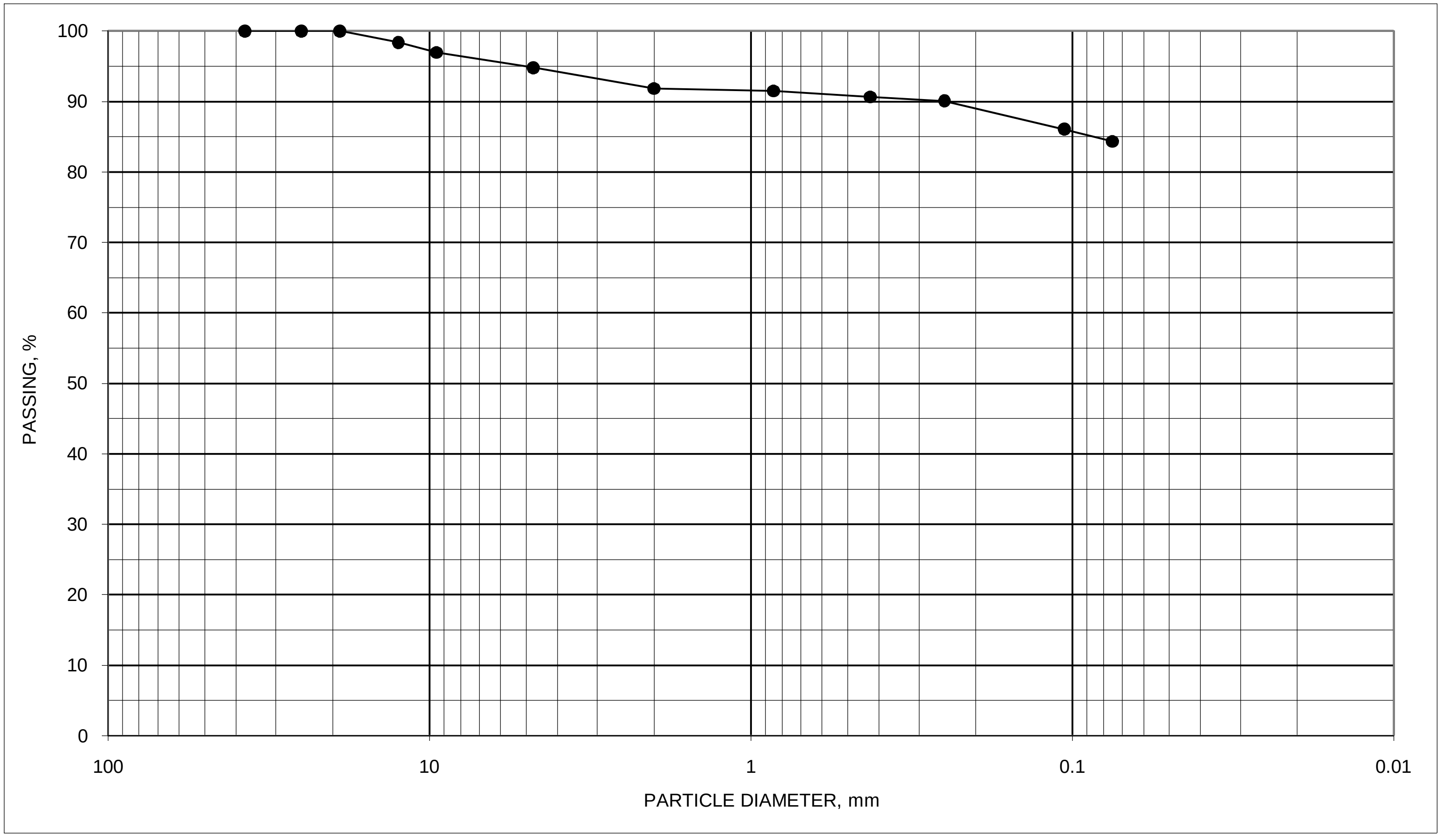
Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	100
1/2"	12.5	98
3/8"	9.50	97
#4	4.75	95
#10	2.00	92
#20	0.850	91
#40	0.425	91
#60	0.250	90
#140	0.106	86
#200	0.075	84.3



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-21	1	1 TO 2.5	FAT CLAY WITH SAND REDDISH BROWN & LIGHT GRAYISH BROWN	CH	26.3	74	26	48

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

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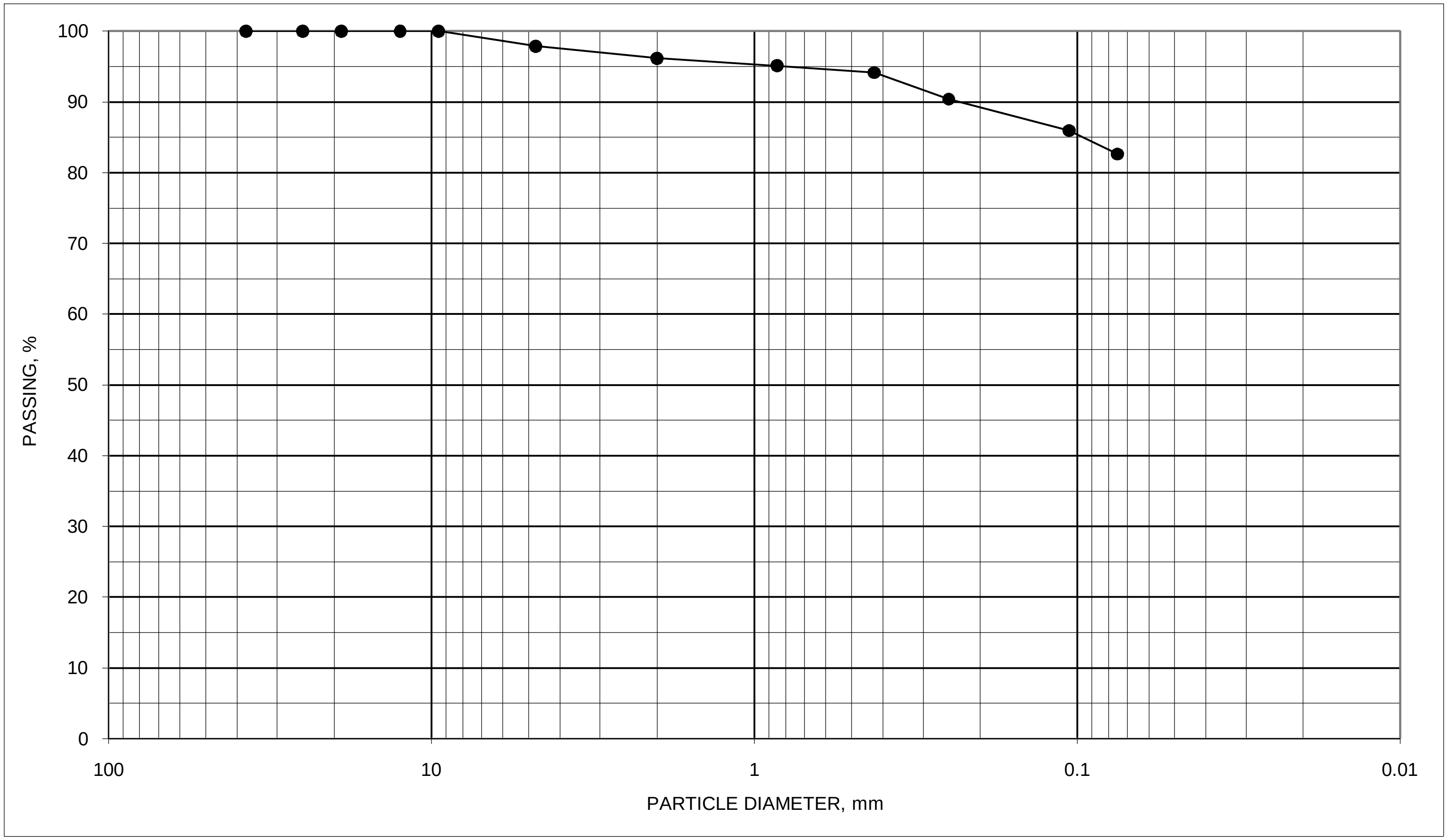
Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	100
1/2"	12.5	100
3/8"	9.50	100
#4	4.75	98
#10	2.00	96
#20	0.850	95
#40	0.425	94
#60	0.250	90
#140	0.106	86
#200	0.075	82.6



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-23	2	3.5 TO 5	FAT CLAY WITH SAND REDDISH BROWN	CH	29.1	76	26	50

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

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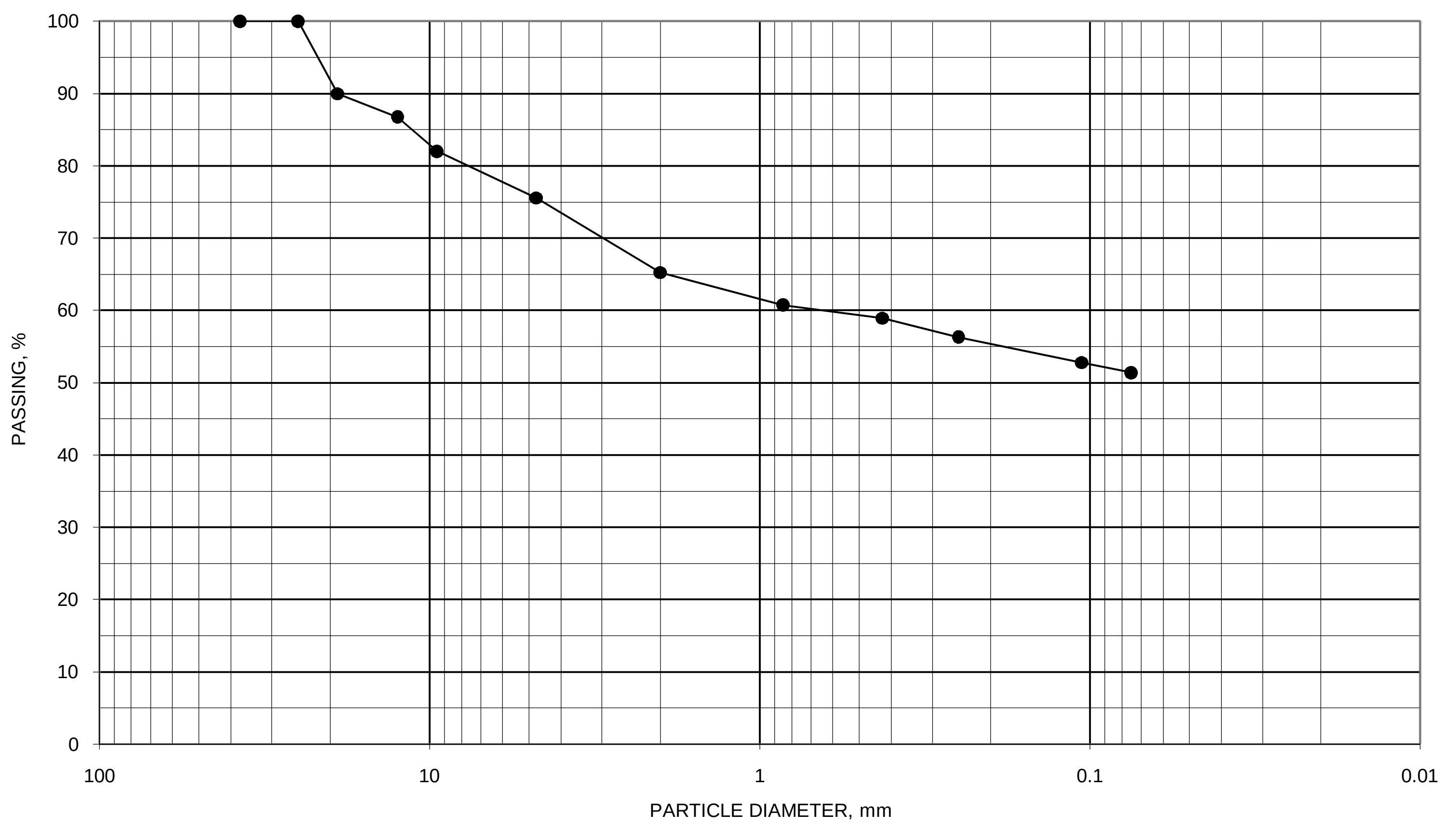
Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	90
1/2"	12.5	87
3/8"	9.50	82
#4	4.75	76
#10	2.00	65
#20	0.850	61
#40	0.425	59
#60	0.250	56
#140	0.106	53
#200	0.075	51.4

D60 0.6392



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-39	1	1 TO 2.5	GRAVELLY LEAN CLAY WITH SAND GRAYISH BROWN WITH REDDISH BROWN	CL	14.2	36	18	18

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

Terracon

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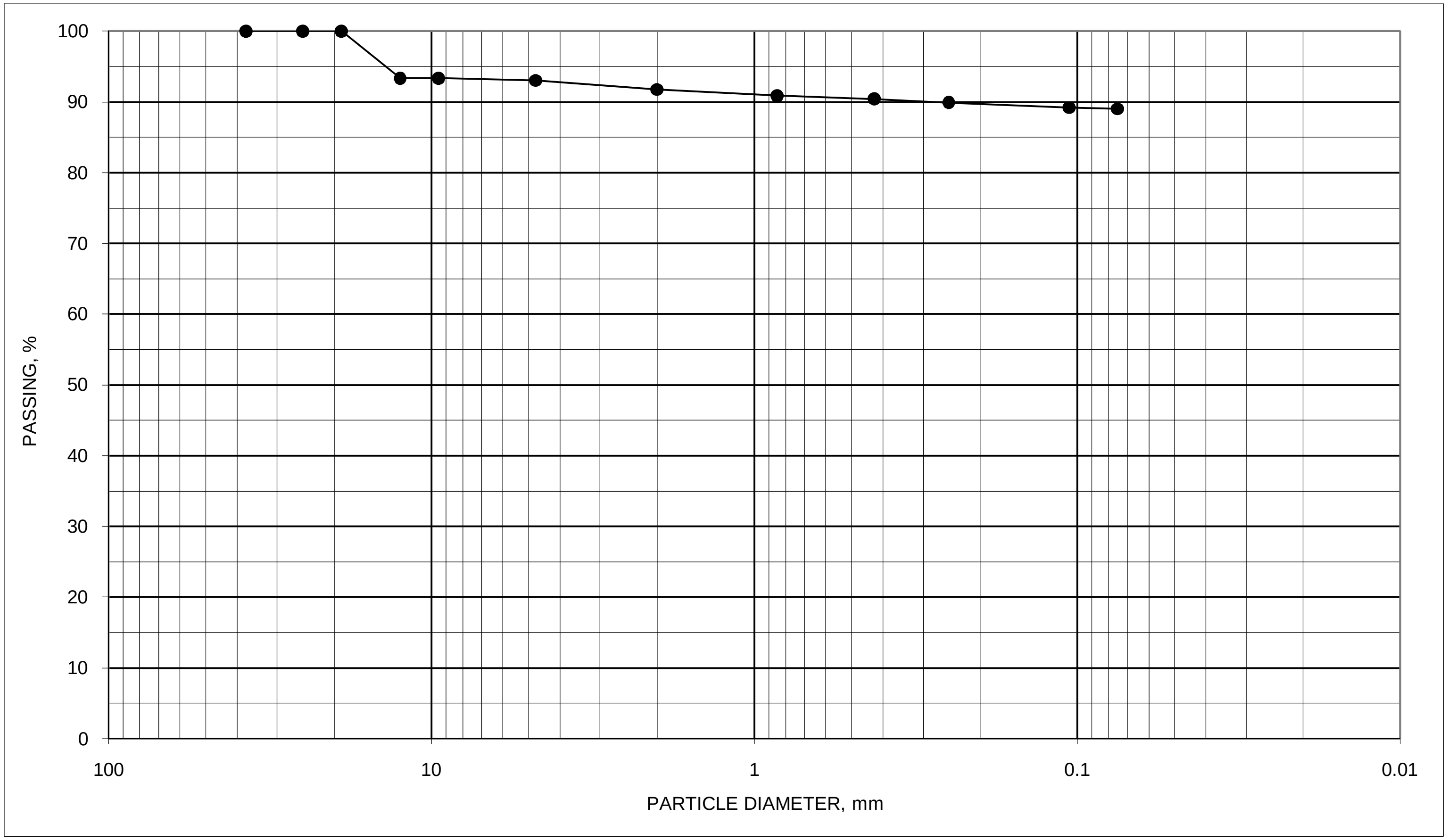
Section:

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	100
1/2"	12.5	93
3/8"	9.50	93
#4	4.75	93
#10	2.00	92
#20	0.850	91
#40	0.425	90
#60	0.250	90
#140	0.106	89
#200	0.075	89.0



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-41	1	1.5 TO 3	FAT CLAY REDDISH BROWN	CH	32.9	86	27	59

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

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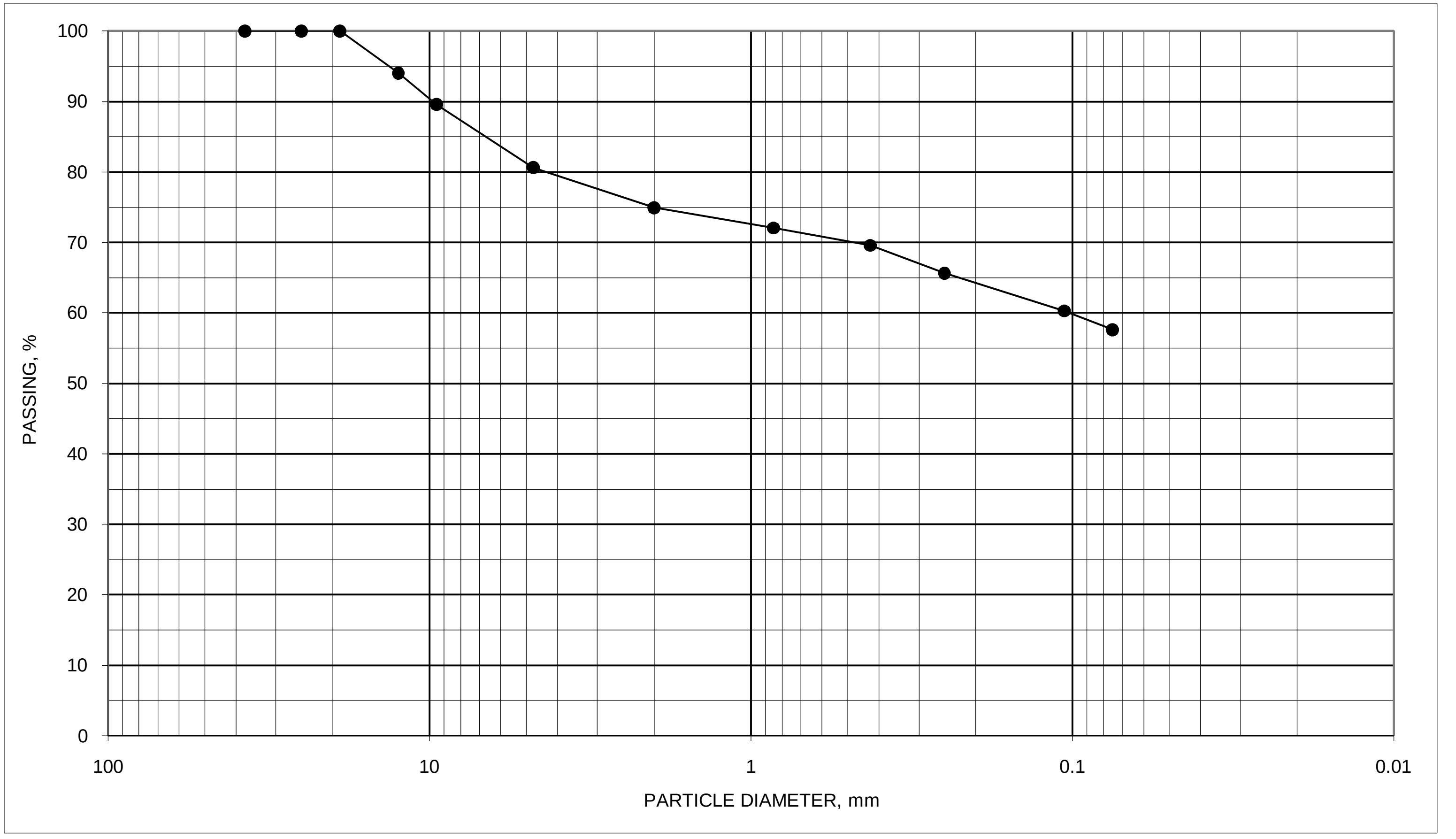
Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	100
1/2"	12.5	94
3/8"	9.50	90
#4	4.75	81
#10	2.00	75
#20	0.850	72
#40	0.425	70
#60	0.250	66
#140	0.106	60
#200	0.075	57.6

D60 0.1020



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-42	1	1.5 TO 3	SANDY LEAN CLAY WITH GRAVEL BROWN & GRAYISH BROWN	CL	20.4	43	16	27

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

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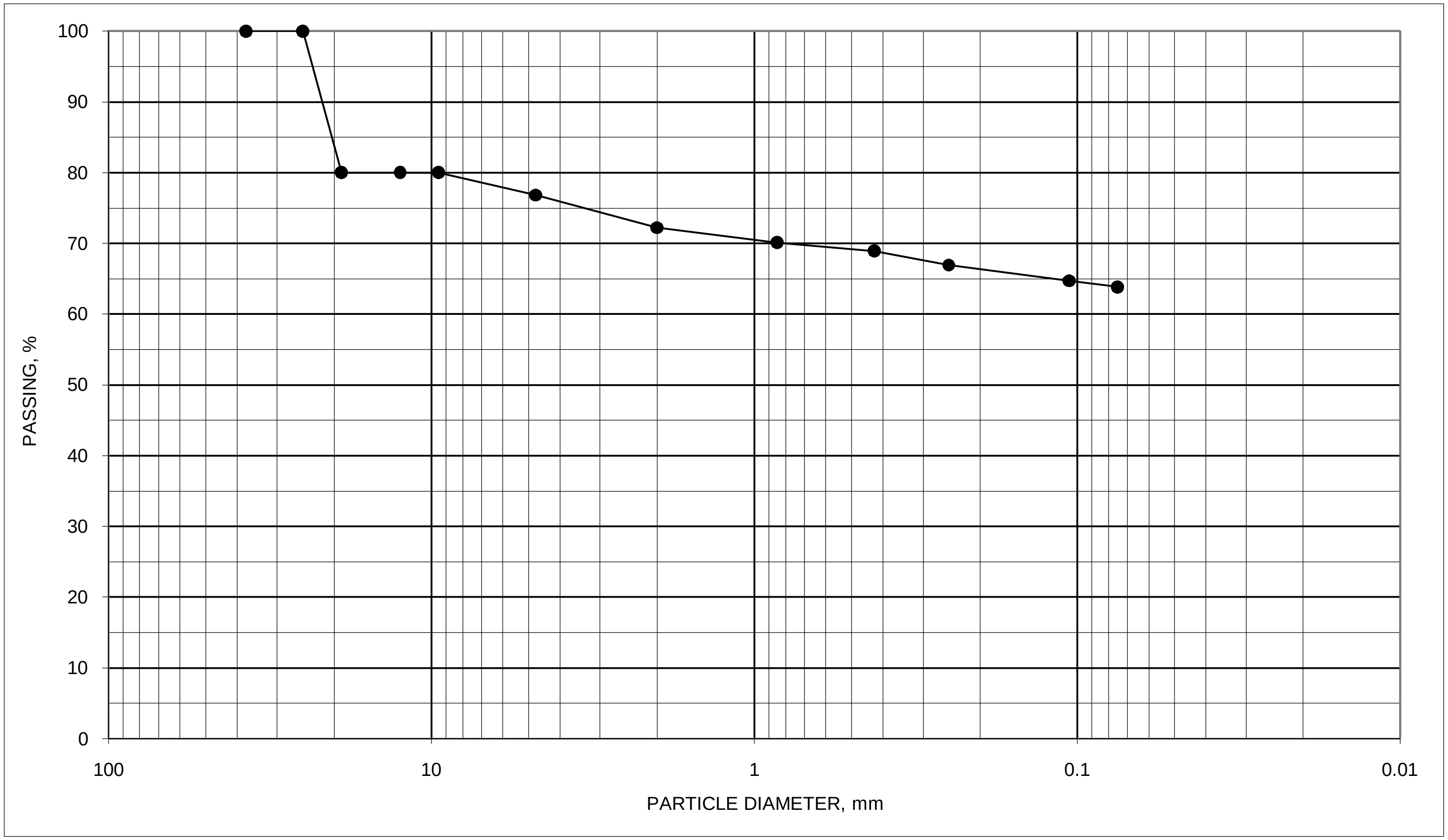
Section:

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	80
1/2"	12.5	80
3/8"	9.50	80
#4	4.75	77
#10	2.00	72
#20	0.850	70
#40	0.425	69
#60	0.250	67
#140	0.106	65
#200	0.075	63.8



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-47	1	1 TO 2.5	GRAVELLY FAT CLAY REDDISH BROWN TRACE YELLOWSIH BROWN	CH	26.5	86	29	57

PROJECT BASIC COMBAT TRAINING COMPLEX 3 SOUTH, PHASE 1 & 2

FORT LEONARD WOOD, MISSOURI JOB NO. B5105007 DATE 4/6/2010

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Laboratory Compaction Characteristics of Soil

Terracon
13910 West 96th Terrace
Lenexa, Kansas 66215
913-492-7777

Client Name: Tompkins Architects

Project Name: BCTC 3 SOUTH

Location: FORT LEONARD WOOD, MISSOURI

Source Material: Boring B-38, Bulk Sampe, 1.0 - 5.0 feet

Sample Description: Fat Clay (CH) with Gravel, reddish brown with dark gray

Material Designation: . Sample date:

Test Method: ASTM D1577 (Modified)

Test Procedure: Method A

Sample Preparation: Dry Preparation

Rammer: X Mechanical ___ Manual

Project No.: B5105007 Date: 3/31/2010

TEST RESULTS

Maximum Dry Unit Wt.: 112.9 pcf

Optimum Water Content: 14.1 %

Rock Correction Values

Maximum Dry Unit Wt.: 119.1 pcf

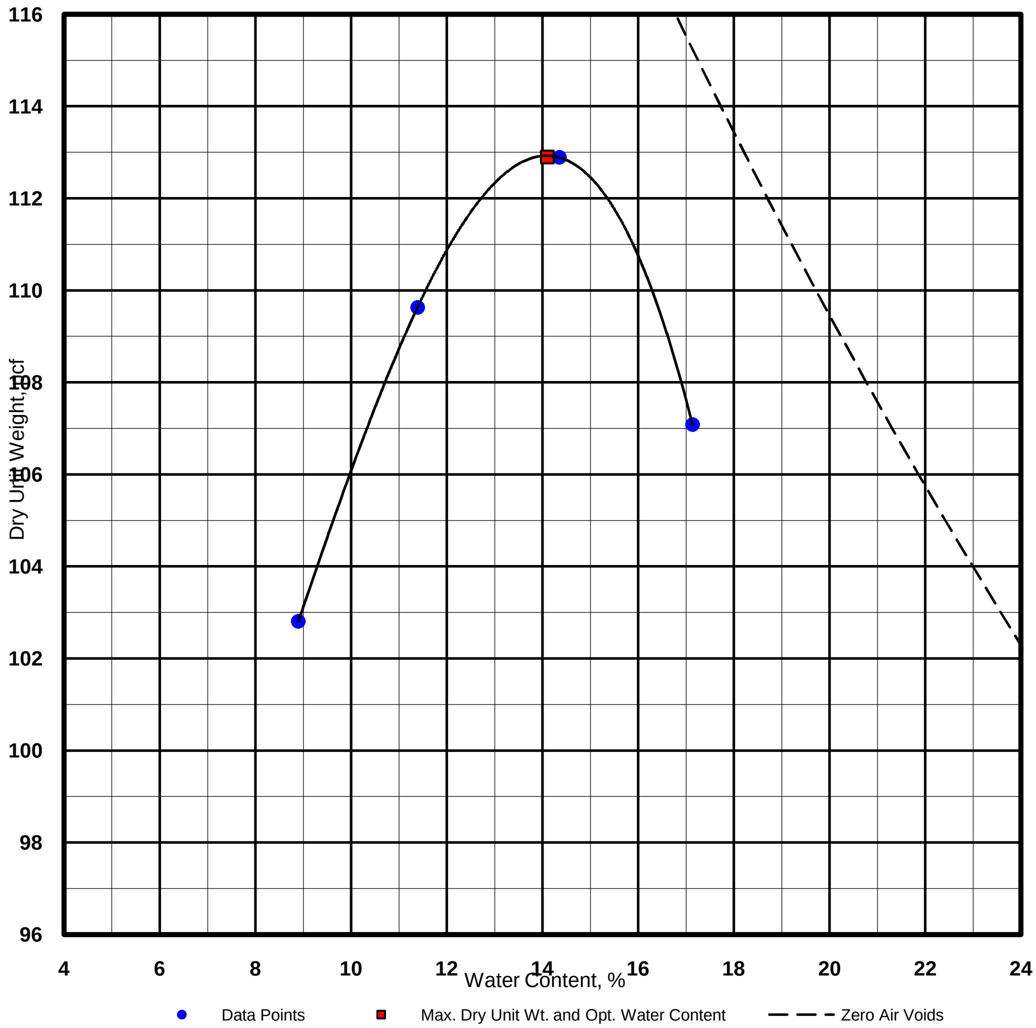
Optimum Water Content: 12.0 %

Natural Moisture, %:

% passing # 200 sieve:

Reviewed by:

Zero air voids for specific gravity of 2.70



Terracon

Laboratory Compaction Characteristics of Soil

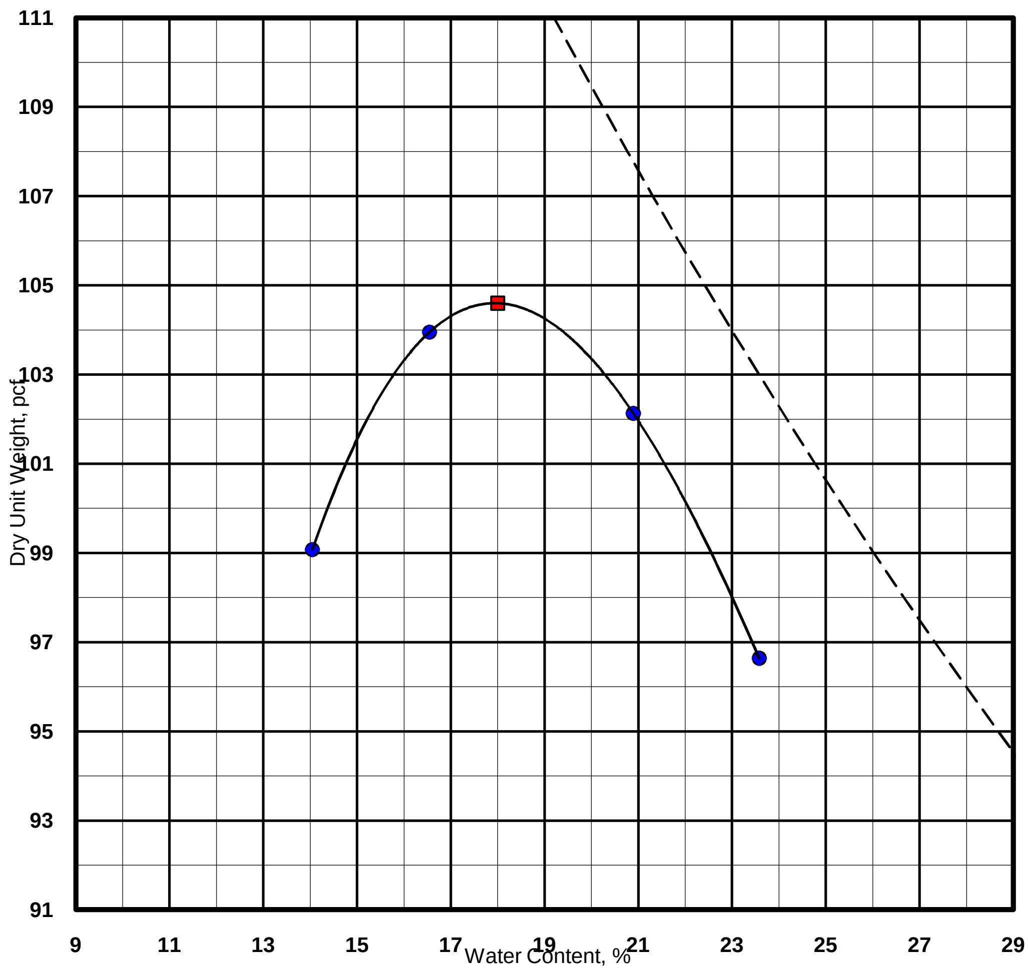
13910 West 96th Terrace
Lenexa, Kansas 66215
913-492-7777

Client Name: Tompkins Architects
Project No.: B5105007 Date: 3/31/2010
Project Name: BCTC 3 SOUTH
Location: FORT LEONARD WOOD, MISSOURI

TEST RESULTS
Maximum Dry Unit Wt.: 104.6 pcf
Optimum Water Content: 18.0 %

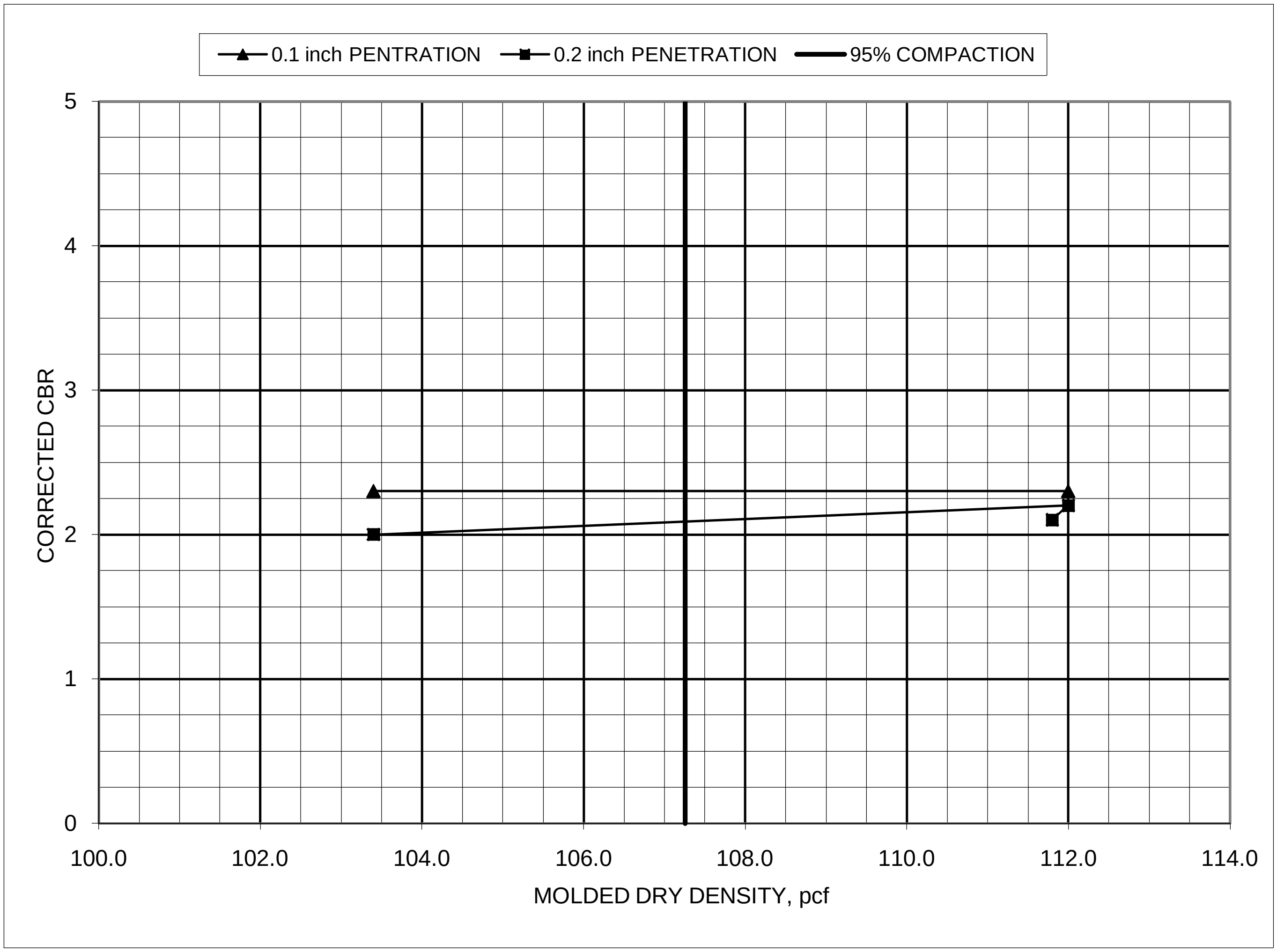
Source Material: Boring B-46, Bulk Sample; 1.0 - 7.0 feet
Sample Description: Fat Clay (CH), reddish brown
Material Designation: ______ Sample date: ______
Liquid Limit: 66 Plastic Limit: 19
Test Method: ASTM D698 (Standard)
Plasticity Index: 47
Test Procedure: Method A
Natural Moisture, %: ______
Sample Preparation: Dry Preparation
% passing # 200 sieve: ______
Rammer: X Mechanical ______ Manual
Reviewed by: ______

Zero air voids for specific gravity of 2.70



Data Points Max. Dry Unit Wt. and Opt. Water Content - - - - Zero Air

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOILS
ASTM D1883



MOLDED WATER CONTENT, %	MOLDED DRY DENSITY, pcf	MOLDED COMPACTION, %	CORRECTED CBR 0.1 inch	CORRECTED CBR 0.2 inch
15.5	103.4	91.6	2.3	2.0
15.9	112.0	99.2	2.3	2.2
16.0	111.8	99.0	NA	2.1

BORING NO. B-38 SAMPLE NO. BULK DEPTH, feet 1.0-7.0

DESCRIPTION FAT CLAY (CH) WITH GRAVEL, REDDISH BROWN WITH DARK GARY

JOB NAME: BCTC 3 SOUTH MAXIMUM DENSITY, pcf 112.9

JOB LOCATION: FORT LEONARD WOOD, MISSOURI OPTIMUM MOISTURE, % 1.1

JOB NO.: B5105007 LIQUID LIMIT 57

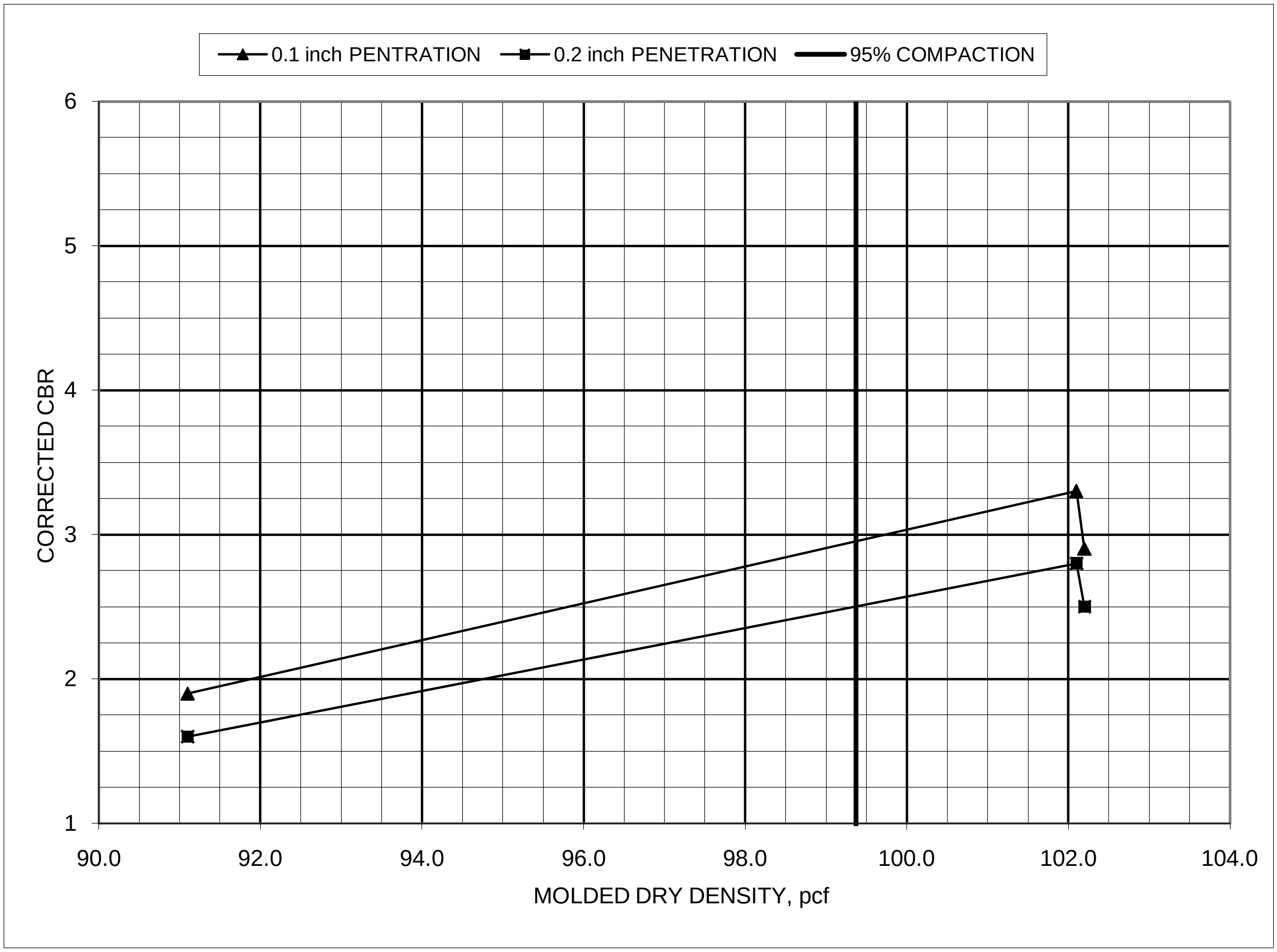
DATE: 4/9/2010 PLASTICITY INDEX 37

TESTED BY: ________ APPROVED BY: ________

Terracon

N:\Projects\2010\B5105007\Lab\B5105007 Logs and Lab Data 4-12-10\[B5105007 CBR Plot Report Multi Point B38-Bulk-1.0.xls]REP

CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOILS
ASTM D1883



MOLDED WATER CONTENT, %	MOLDED DRY DENSITY, pcf	MOLDED COMPACTION, %	CORRECTED CBR 0.1 inch	CORRECTED CBR 0.2 inch
21.2	91.1	87.1	1.9	1.6
21.3	102.1	97.6	3.3	2.8
21.7	102.2	97.7	2.9	2.5

BORING NO. B-46 SAMPLE NO. BULK DEPTH, feet 1.0-7.0

DESCRIPTION FAT CLAY (CH), REDDISH BROWN

JOB NAME: BCTC 3 SOUTH MAXIMUM DENSITY, pcf 104.6

JOB LOCATION: FORT LEONARD WOOD, MISSOURI OPTIMUM MOISTURE, % 18.0

JOB NO.: B5105007 LIQUID LIMIT 66

DATE: 4/6/2010 PLASTICITY INDEX 47

TESTED BY: ________ APPROVED BY: ________

Terracon

N:\Projects\2010\B5105007\Lab\B5105007 Logs and Lab Data 4-12-10\[B5105007 CBR Plot Report Multi Point B46-Bulk-1.0.xls]REP

APPENDIX C
CALCULATIONS

Pavement Design
(AASHTO 1993 Method)

Design Inputs		**Asphalt**			**Concrete**	
Sugrade Support	CBR =	2				
	Mr =	4000	psi	k =	90	pci
Reliability		85	%		85	%
Standard Deviation	So =	0.45			0.35	
Initial Serviceability	Po =	4.2			4.5	
Terminal Serviceability	Pt =	2.0			2.5	
Design Serviceability Loss,	ΔPSI =	2.2			2.0	

Layer Coefficients:

AC Surface and Binder	a_1 =	0.42
AC Base	a2 =	0.40
Aggregate Base	a3 =	0.14

Concrete Compressive Strength	=	4000	psi
Modulus of Elasticity of Concrete	=	3,600	ksi
Modulus of Rupture of Concrete:	=	580	
Load Transfer ("J" Factor)	=	3.1	
Drainage Coefficient	=	0.8	

	Parking and Drive Areas
Asphalt Section Traffic (18 kip ESAL) =	8,000

Asphalt Pavement Section	Drainage, m		
AC Surface + Binder		**1.5**	in.
Asphalt Base		**1.5**	in.
Aggregate Base	1.0	**6.0**	in.

Structural Number: **2.07**

Structural Number - Required ***1.88***

	Parking and Drive Areas
Concrete Section Traffic (18 kip ESAL) =	8,500

Concrete Pavement Section **5.0** in.

Project: Basic Combat Training Complex 3 Location: Fort Leonard Wood, Missouri

Project No. B5105007 Date: 05/13/10
Exhibit: C-14

Terracon

Pavement Design
(AASHTO 1993 Method)

Design Inputs		**Asphalt**			**Concrete**	
Sugrade Support	CBR =	2				
	Mr =	4000	psi	k =	90	pci
Reliability		85	%		85	%
Standard Deviation	So =	0.45			0.35	
Initial Serviceability	Po =	4.2			4.5	
Terminal Serviceability	Pt =	2.0			2.5	
Design Serviceability Loss,	ΔPSI =	2.2			2.0	

Layer Coefficients:

AC Surface and Binder	a_1 =	0.42
AC Base	a2 =	0.40
Aggregate Base	a3 =	0.14

Concrete Compressive Strength	=	4000	psi
Modulus of Elasticity of Concrete	=	3,600	ksi
Modulus of Rupture of Concrete:	=	580	
Load Transfer ("J" Factor)	=	3.1	
Drainage Coefficient	=	0.8	

Delivery Lanes/Loading Docks

Asphalt Section Traffic (18 kip ESAL) = 63,000

Asphalt Pavement Section	Drainage, m		
AC Surface + Binder		**2.0**	in.
Asphalt Base		**2.0**	in.
Aggregate Base	1.0	**8.0**	in.

Structural Number: **2.76**

Structural Number - Required ***2.62***

Delivery Lanes/Loading Docks

Concrete Section Traffic (18 kip ESAL) = 84,100

Concrete Pavement Section **5.2** in.

Project: Basic Combat Training Complex 3 Location: Fort Leonard Wood, Missouri

Project No. B5105007

Date: 05/13/10

Exhibit: C-15

Terracon

Terracon

PROJECT: Basic Combat Training Complex 3 South, Phase 1&2 (BCT3) Page 1 of 12

JOB NO. B510 5007 Date 5/13/10 Comp. By (emb) CHECKED BY:

Generalized Subsurface Profile: BCOF South

Elevation	B-16	B-17	B-18	B-19	B-20
120					
			117 — 0	117 — 0	
		115 — 0	CH w/ gravel	CH gravelly	
	113 — 0	CL			
		112 — 3			
110	CH w/ gravel	CH, gravelly			110 — 0
					CH w/sand + gravel
	$\bar{w}$ = 35	$\bar{w}$ = 23	$\bar{w}$ = 21	$\bar{w}$ = 28	
	$\bar{N}$ = 17	$\bar{N}$ = 39	$\bar{N}$ = 33	$\bar{N}$ = 25	
100	$\bar{q}$ = 8700	$\bar{q}$ = 9000	$\bar{q}$ = 8000	$\bar{q}$ = 7800	$\bar{w}$ = 23
					$\bar{N}$ = 39
					$\bar{q}$ = 8900
					92 — 18
90	90 — 23				
	Sandstone		88 — 29	87 — 30	Sandstone
		85 — 30			
	83 — 30				82 — 28
80					

Notes: According to USDA Soil Survey, Pulaski County residual soils are predominantly found in the area. These soils have been formed from chemical and physical weathering of the bedrock. The bedrock surface is very uneven due to these processes.

Form 112—5-93

PROJECT: BCT3 Page 2 of 12

JOB NO. B5105007 Date 5/13/10 Comp. By emD CHECKED BY:

A highly weathered sandstone layer was encountered in most borings at varied elevations across the site. It will be conservatively assumed that residual soils are present to a depth of 40 feet. The following simplified subsurface profile will be considered for settlement analyses:

0

Fat Clay (CH) w/
sand, gravel and cobbles

$\bar{w} = 23.5\%$
$\bar{N} = 31$ (bpf)
$\bar{q}_P = 6{,}700$ psf

Residual soil is assumed to be over consolidated based on experience and correlations. This assumption is also consistent with the geomorphological origins of the soil. (Refer to the following discussion.)

40
Incompressible layer

Form 112—5-93

Terracon

PROJECT: BCT3 Page 3 of 12

JOB NO. B5105007 Date 5/13/10 Comp. By emh CHECKED BY:

Atterberg Limits Tests were performed on 5 samples of native soil below 3 feet:

Boring	Sample	Depth	LL	PL	PI		LI
5	2	3.5-5	42	19	23		0.20
10	2	3.5-5	82	26	56	Liquidity Index,	-0.04
11	2	3.5-5	93	30	63	$LI = \frac{\overline{w} - PL}{LL - PL}$	-0.10
23	2	3.5-5	76	26	50		-0.05
26	2	3.5-5	98	31	67		-0.11

Native Fat Clay soils at the site have an average moisture content, $\overline{w} = 23.5\%$ and an average SPT-N, $\overline{N} = 31$

From USACE EM-1904:

- A high preconsolidation pressure may be anticipated if the natural water content is near or below the plastic limit. Based on a $\overline{w} = 23.5\%$, this is true at this site.
- An emperical relationship between the preconsolidation pressure and liquidity index (see Fig. I-1) can be used to estimate preconsolidation pressure. Based on the range of LI values, preconsolidation pressures of 1.5 to 25 tsf are estimated. (See attached)

Terracon's Experience

Terracon has performed a number of geotechnical explorations at Fort Leonard Wood. In 2005 consolidation tests were performed on Fat Clay soil samples:

$e_o = 0.812$ $C_c = 0.19$ $C_r = 0.057$ $\sigma'_p = 11.3$ tsf

constrained modulus: $\frac{\Delta \sigma_v}{\Delta \varepsilon} \approx 400$ tsf (or greater)

Form 112—5-93

4/8/12
emN

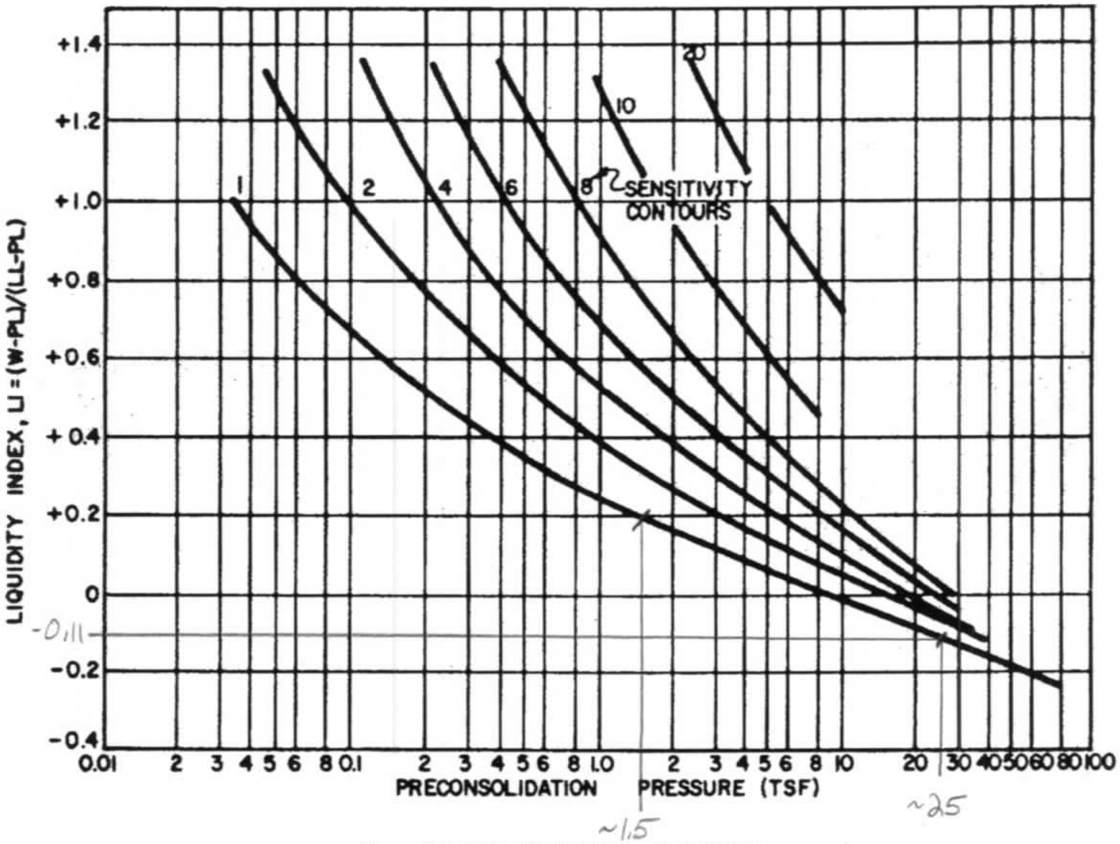


Figure 1-1. Preconsolidation Stress as a function of Liquidity Index LI and clay sensitivity (ratio of undisturbed to remolded shear strength) (After NAVFAC DM 7.1)

foundation load induces appreciable stress. The stress level at a particular point of soil beneath a foundation may be estimated by the theory of elasticity.

(1) Applicability of the theory of elasticity. Earth masses and foundation boundary conditions correspond approximately with the theory of plasticity (item 52).

(2) Stress distribution. Various laboratory, prototype, and full scale field tests of pressure cell measurements in response to applied surface loads on homogeneous soil show that the measured soil vertical stress distribution corresponds reasonably well to analytical models predicted by linear elastic analysis for similar boundary conditions.

(a) The Boussinesq method is commonly used to estimate the stress distribution in soil. This distribution indicates that the stressed zone decreases toward the edge of the foundation and becomes negligible (less than 10 percent of the stress intensity) at depths of about 6 times the width of an infinite strip or 2 times the width of a square foundation, Figure 1-2.

Terracon

PROJECT: BCT 3 Page 5 of 12

JOB NO. B5105007 Date 5/13/10 Comp. By emp CHECKED BY:

Settlement Estimation

Structural loads for the BCOF's & BNHQ were provided by the USACE via a 3/22/10 email. Loads for the DFAC were not provided and are assumed to be similar to the BNHQ. The loads are summarized below.

Building	Maximum (short term) Load (kips)	Sustained (long-term) Load (kips)
BCOF	210	124
BNHQ	45	30
DFAC	45	30

Based on the provided and assumed loads, and the recommended allowable bearing pressure of 3,000 psf, the following footing sizes are estimated:

Building	Minimum area @ 3,000 psf	Minimum Footing width, B, for square footing
BCOF	$\frac{210 \text{ kip}}{3 \text{ ksf}} = 70 \text{ ft}^2$	$\sqrt{70 \text{ ft}^2} = 8.4 \text{ ft}$
BNHQ/DFAC	$\frac{45 \text{ kip}}{3 \text{ ksf}} = 15 \text{ ft}^2$	$\sqrt{15 \text{ ft}^2} = 3.9 \text{ ft}$

Long-term applied pressure on square footing (B×B):

Building	Applied Stress (ksf)
BCOF	$\frac{124 \text{ kip}}{70 \text{ ft}^2} = 1{,}770 \text{ psf}$
BNHQ/DFAC	$\frac{30 \text{ kip}}{15 \text{ ft}^2} = 2{,}000 \text{ psf}$

Settlement estimates will be made for applied footing pressures ranging from 1,770 to 3,000 psf.

Form 112—5-93

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PROJECT: BCT 3 Page 6 of 12

JOB NO. B5105007 Date 5/13/10 Comp. By emh CHECKED BY:

Elastic Parameters for Native Fat Clay

Constrained modulus, D, estimated from oedometer testing:

$D = \frac{\Delta\sigma}{\Delta\varepsilon} = \frac{15\ tsf}{0.033} = 450\ tsf$ (from 2005 Ft. Leonard Wood consolidation test)

Correlations:

- $D = \frac{\Delta\sigma_v}{\Delta\varepsilon_v} = \frac{(1+e_o)\,P_{atm}}{0.435\,C_c} = 2.3 \times C' \times P_{atm} = 2.433\,C' \Rightarrow D = 2.433(480) = 1{,}170\ tsf$

  From Cheney & Chassie $C' \approx 480$ for OC sandy clay w/ $\bar{N} = 31$
  (refer to Figure 1)

- From Fig. D-2 USACE EM1904 for $\overline{PI} = 52$

  $K_{c(min)} = 80$ $K_{c(max)} = 300$ (refer to Figure D-2)

  From borings B-1 through B-37:

  $q_p(design) = 3{,}000\ psf \Rightarrow S_u = 1{,}500\ psf$

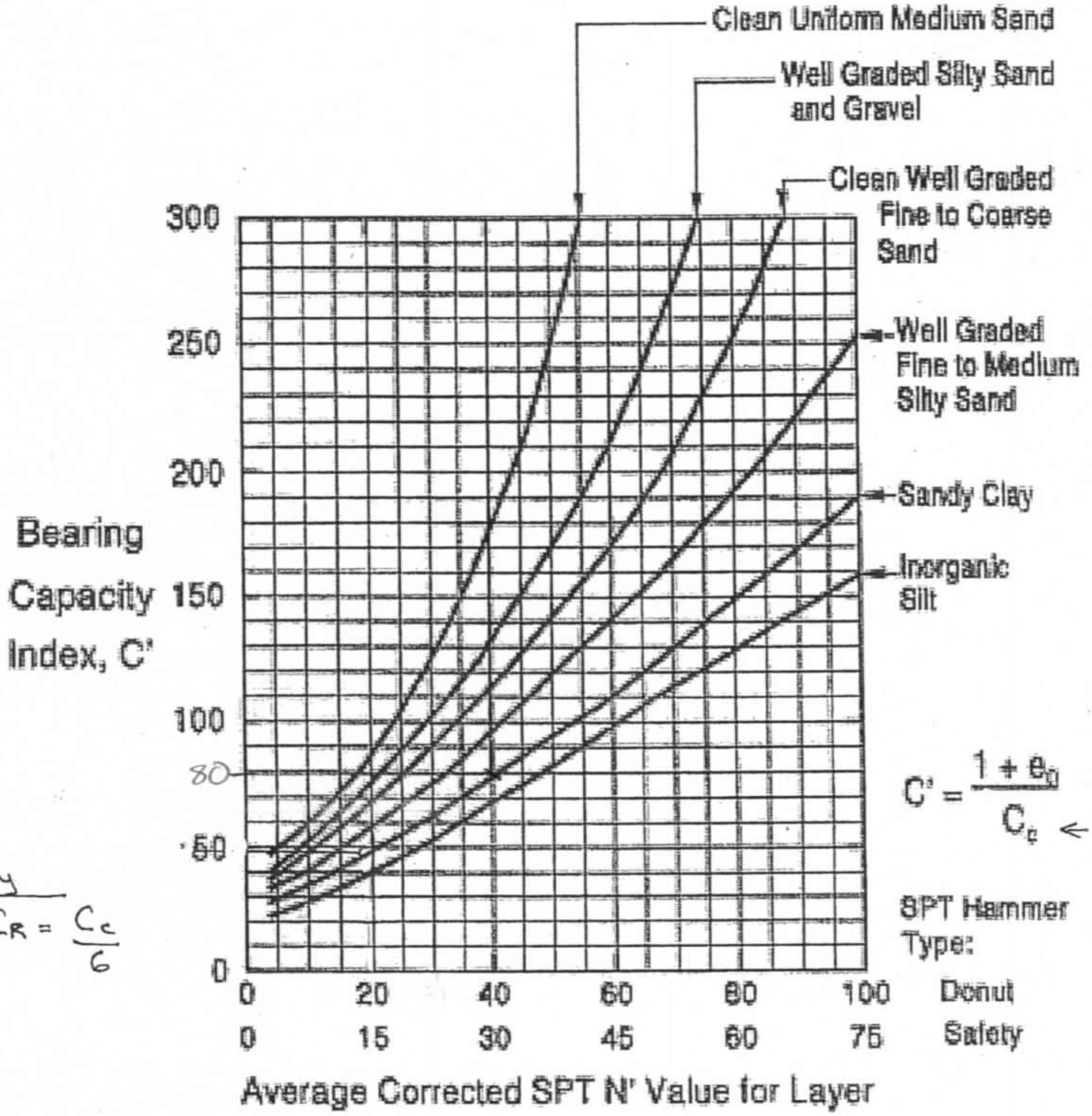
  Therefore: $E_{s(min)} = 80(1{,}500) = 60\ tsf$

  $E_{s(max)} = 300(1{,}500) = 225\ tsf$

From above, modulus of native fat clay is estimated to range from 60 to 1,170 tsf. For these analyses, the modulus will be taken as 100 tsf.

Form 112—5-93

(cmh)



$$C' = \frac{1 + e_0}{C_c} \leftarrow \text{FOR NC}$$

FOR OC CLAY

−ASSUME $C_R = \frac{C_c}{6}$

$C_R = C'$

$C_c \approx 6\, C_R$

$\approx 6(80)$

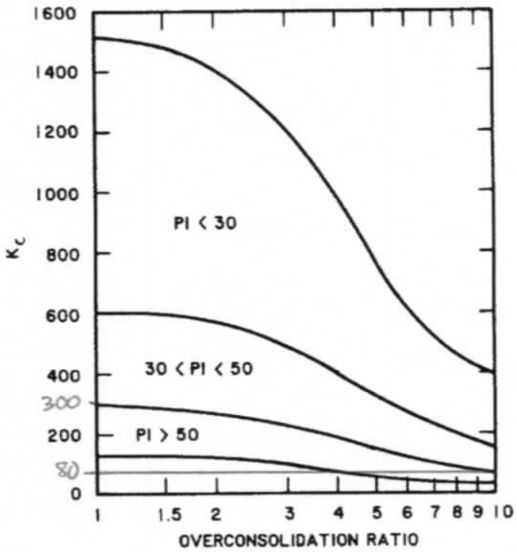
≈ 480

Figure 1. Bearing capacity index, C', for granular soil (after Cheney and Chassie, 1993)

Table D-2

Relationships Between Elastic Parameters

Parameter	Relationship
Shear modulus G, tsf	$\frac{E}{2(1+\nu)}$ ν = *Poisson's ratio*
Bulk Modulus K, tsf	$\lambda_L + \frac{2G}{3}$ λ_L = *Lames's constant*
Constrained modulus E_d, tsf	$\frac{E(1-\nu)}{(1+\nu)(1-2\nu)}$



For $\overline{PI} \approx 50$

$K_{c,min} = 80$

$K_{c,max} = 300$

Figure D-2. Chart for estimating constant K_c to determine the elastic modulus $E_s = K_c C_u$ from the undrained shear strength (after Figure 3-20, TM 5-818-1)

The values of K_c as a function of the overconsolidation ratio and plasticity index PI have been determined from field measurements and are therefore not affected by soil disturbance compared with measurements on undisturbed soil samples. Table D-3 illustrates some typical values for the elastic modulus.

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PROJECT: BCT 3 Page 9 of 12

JOB NO. B5105007 Date 5/13/10 Comp. By EMD CHECKED BY:

Range of Anticipated Settlement for BCOF:

We anticipate square footings with a minimum width of 8.4' and applied pressures of 1,770 to 3,000 psf.

Janbu method

$$\rho_i = \mu_o \mu_i \frac{qB}{E_s^*}$$ eq. 3.17 USACE EM-1904

q = footing pressure

B = footing width

E_s^* = Modulus of soil = 100 tsf

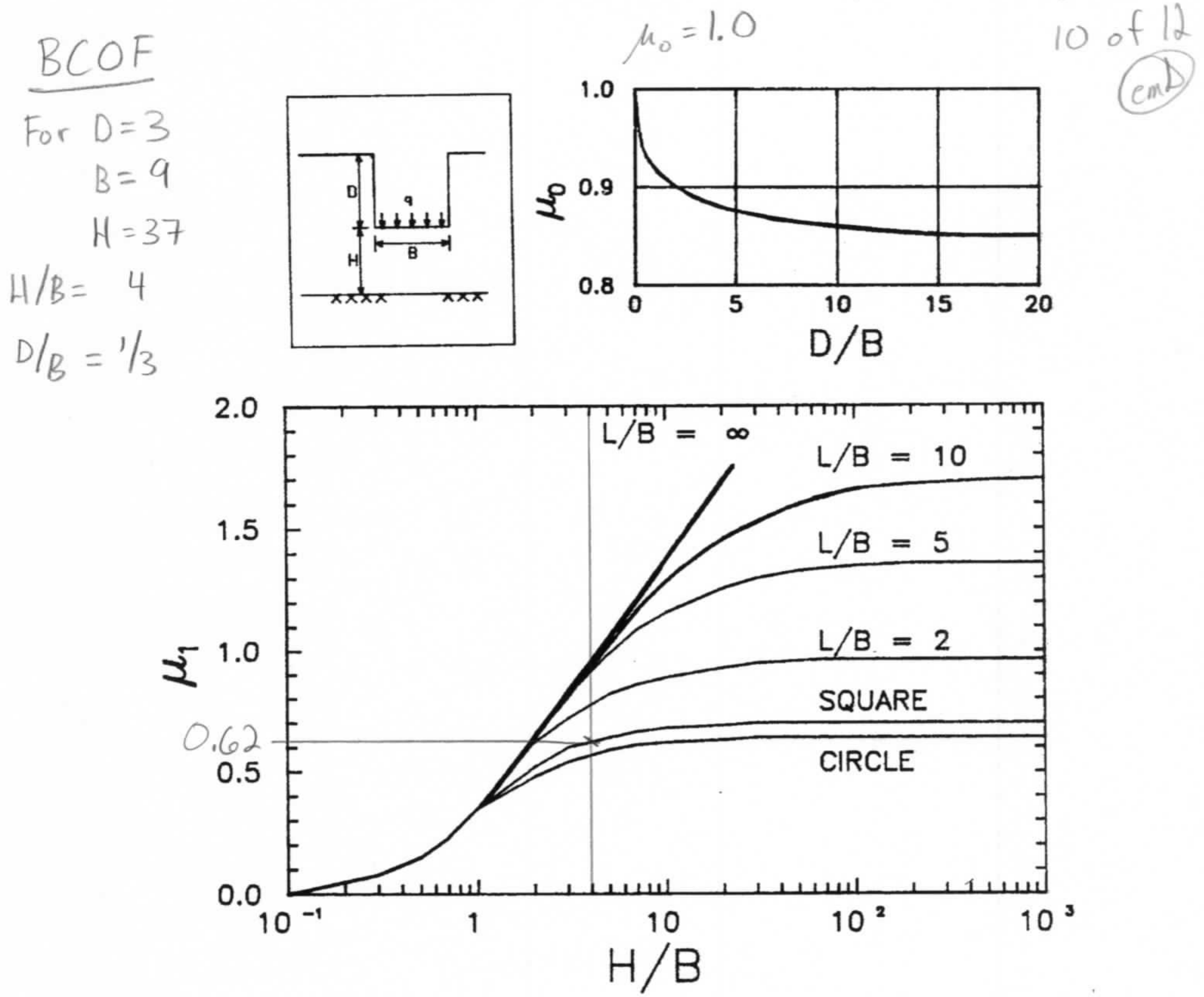
μ_o, μ_i = influence factors

For BCOF, $\mu_o = 1.0$, $\mu_i = 0.62$ (see attached)

$$\rho_{i\,(min)} = 1.0(0.62)\frac{(1770\text{ psf})(8.4\text{ ft})\left(\frac{1\text{ ton}}{2000\text{ lb}}\right)}{100\text{ tsf}}\left(\frac{12\text{ in}}{1\text{ ft}}\right) = 0.55\text{ in.}$$

$$\rho_{i\,(max)} = 1.0(0.62)\frac{(3000)(8.4)(12)}{100(2000)} = 0.94\text{ in.}$$

Form 112—5-93



$$\rho_i = \mu_o \cdot \mu_1 \cdot \frac{q \cdot B}{E_s^*}$$

L = LENGTH, FT

B = WIDTH, FT

E_s^* = EQUIVALENT YOUNG'S SOIL MODULUS, TSF

ν_s = POISSON'S RATIO, 0.5

Figure 3-8. Chart for estimating immediate settlement in cohesive soil. Reprinted by permission of the National Research Council of Canada from Canadian Geotechnical Journal, Vol 15, 1978, "Janbu, Bjerrum, and Kjaernsli's Chart Reinterpreted", by J. T. Christian and W. D. Carrier III, p 127.

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PROJECT: BCT 3 Page 11 of 12

JOB NO. B5105007 Date 5/14/10 Comp. By emb CHECKED BY:

Range of Anticipated Settlement for BNHQ and DFAC:

We anticipate square footings with a minimum width of 3.9' and applied pressures of 1,770 to 3,000 psf.

Janbu Method

$$\rho_i = \mu_o \mu_i \frac{q\,B}{E_s^*}$$

Eq. 3.17 USACE EM-1904

q = footing pressure

B = footing width

E_s^* = modulus of soil = 100 tsf

μ_o, μ_i = influence factors

For BNHQ and DFAC, $\mu_o = 0.92$, $\mu_i = 0.68$ (see attached)

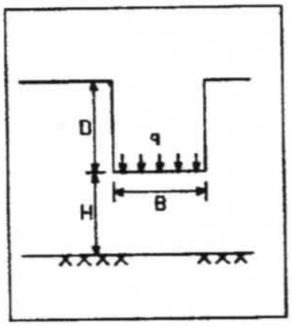
$$\rho_{i\,(min)} = (0.92)(0.68)\frac{(1,770\text{ psf})(3.9\text{ ft})}{100\text{ tsf}}\left(\frac{1\text{ ton}}{2000\text{ lb}}\right)\left(\frac{12\text{ in}}{1\text{ ft}}\right) = 0.26\text{ in.}$$

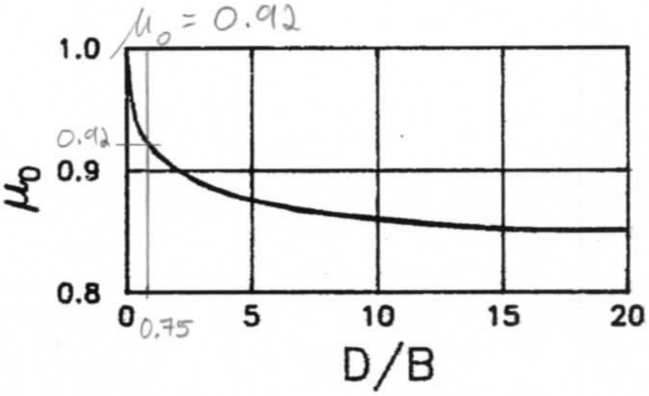
$$\rho_{i\,(max)} = 0.92(0.68)\frac{(3000)(3.9)(12)}{100(2000)} = 0.44\text{ in.}$$

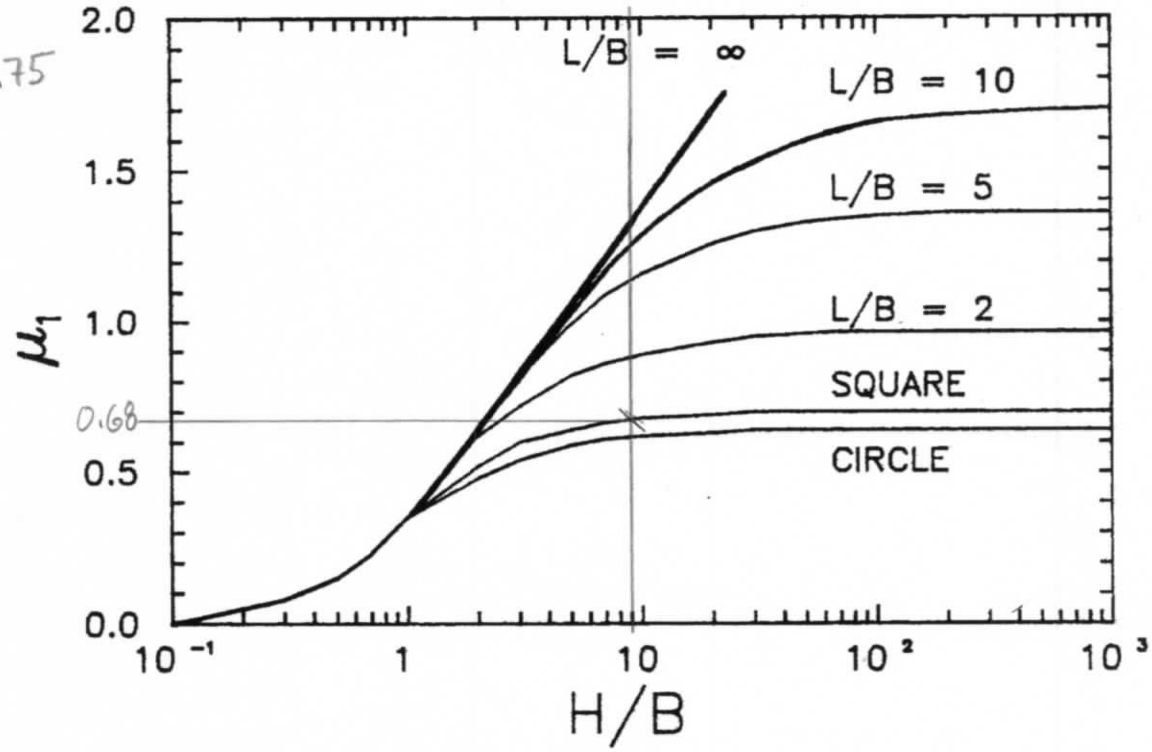
Form 112—5-93

BNHQ/DFAC

D=3
B=4
H=37
$\frac{H}{B}=9$
$\frac{D}{B}=0.75$







$$\rho_i = \mu_o \cdot \mu_1 \cdot \frac{q \cdot B}{E_s^*}$$

L = LENGTH, FT
B = WIDTH, FT
E_s^* = EQUIVALENT YOUNG'S SOIL MODULUS, TSF
ν_s = POISSON'S RATIO, 0.5

Figure 3-8. Chart for estimating immediate settlement in cohesive soil. Reprinted by permission of the National Research Council of Canada from Canadian Geotechnical Journal, Vol 15, 1978, "Janbu, Bjerrum, and Kjaernsli's Chart Reinterpreted", by J. T. Christian and W. D. Carrier III, p 127.

APPENDIX D
SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1-$^{3}/_{8}$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the “Standard Penetration” or “N-value”.

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 – 1	Very Soft
500 – 1,000	2 – 4	Soft
1,001 – 2,000	4 – 8	Medium Stiff
2,001 – 4,000	8 – 15	Stiff
4,001 – 8,000	15 – 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 – 10
Medium	11 – 30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification: Group Symbol	Soil Classification: Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]	GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]	SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G,H,I]
			Fines classify as CL or CH	SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]	CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]	ML	Silt [K,L,M]
		Organic:	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay [K,L,M,N]
					Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K,L,M]
			PI plots below "A" line	MH	Elastic Silt [K,L,M]
		Organic:	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay [K,L,M,P]
					Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.

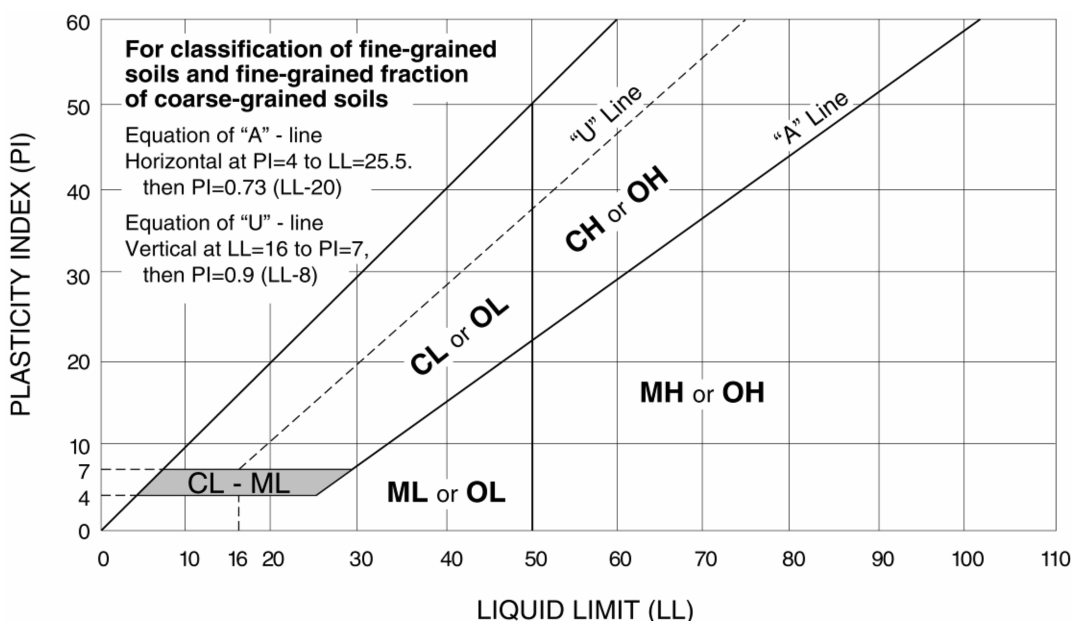
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



GENERAL NOTES

Description of Rock Properties

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding, and Foliation Spacing in Rock [a]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

a. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

Rock Quality Designator (RQD) a

RQD, as a percentage	Diagnostic description
Exceeding 90	Excellent
90 – 75	Good
75 – 50	Fair
50 – 25	Poor
Less than 25	Very poor

a. RQD (given as a percentage) = length of core in pieces 4 in. and longer/length of run.

Joint Openness Descriptors

Openness	Descriptor
No Visible Separation	Tight
Less than 1/32 in.	Slightly Open
1/32 to 1/8 in.	Moderately Open
1/8 to 3/8 in.	Open
3/8 in. to 0.1 ft.	Moderately Wide
Greater than 0.1 ft.	Wide

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

Appendix B

List of Drawings

Sheet	Description
G-001	COVER SHEET – FLW_BCOF_G-001.dgn
G-002	SHEET INDEX – FLW_BCOF_G-002.dgn
G-003	GENERAL LOCATION AND VICINITY MAP – FLW_BCOF_G-003.dgn
CD101	CIVIL SITE DEMOLITION PLAN – FLW_BCOF_CD101.dgn
CS101	CIVIL SITE IMPROVEMENT PLAN – FLW_BCOF_CS101.dgn
CG101	CIVIL SITE ROUGH GRADING PLAN – FLW_BCOF_CG101.dgn
CU101	CIVIL SITE UTILITY PLAN – FLW_BCOF_CU101.dgn

APPENDIX C

Utility Connections

FLW Gas Service Request Form

GENERAL INSTRUCTIONS

1. Form Shall be Prepared for each Service Location and type.
2. Please Fill-in Information in the Highlighted Areas.
3. Provide Site Plans with Final Grade Elevations and other services.
4. Provide Site Plans with Proposed service location.
5. Early Coordination is Required to verify Service will be available when needed. Delays due to insufficient time for service availability are not the responsibility of this agency.

Submitted By: **Name:**

Company:

Contract Number with Government:

Corps of Engineers or DPW Contract:

Contact Information including e-mail and telephone numbers:

Reason for Request:

New Permanent Service:	YES	NO
Upgrade Service:	YES	NO
Temporary Construction Service:	YES	NO
Service Part of Multiple requests for same contract:	YES	NO
(Attach all together when submitting)		of

General Service Information:

Project Name:

Project Locations:

Building Number

xxx

Square Footage:

x

(Please Check One)

Others:

Estimated Demand

FLW Electric Service Request Form

GENERAL INSTRUCTIONS

1. Form Shall be Prepared for each Service Location and type.
2. Please Fill-in Information in the Highlighted Areas.
3. Provide Site Plans with Final Grade Elevations and other services.
4. Provide Site Plans with Proposed service location.
5. Early Coordination is Required to verify Service will be available when needed. Delays due to insufficiant time for service availability is not the responsibility of this agency.

Submitted By:	**Name:**	
	Company:	
	Contract Number with Government:	
	Corps of Engineers or DPW Contract:	
	Contact Information including e-mail and telephone numbers:	

Reason for Request:

New Permanent Service:	YES		NO
Upgrade Service:	YES		NO
Temporary Construction Service:	YES		NO
Service Part of Multiple requests for same contract:	YES		NO
(Attach all together when submitting)		of	

General Service Information:

Project Name:	
Project Locations:	
Building Number	
Occupancy Type **(NEC 220.12)**	
Square Footage:	

Service Voltage	120		120/240		208Y/120	
(Please Check One)	480Y/277		480		240	
	Others:					
Phase	Single		Poly			
Estimated Demand KVA						

FLW Electric Service Request Form

Connected Load Breakout Information:

Largest Motor:

Horsepower:		**LRA:**	
Voltage:		**FLA:**	
Phase:		**Starting PF:**	
Starting Method:		**Running PF:**	
VFD controlled / Style:		**NEMA Code:**	

Cooling Load:	**KVA**		**Power Factor**	
Heating Load:	**KVA**		**Type:**	
Interior Lighting:	**KVA**		**Power Factor**	
Exterior Lighting	**KVA**		**Type:**	
Receptacle Load:	**KVA**			
Kitchen Load:	**KVA**			
General Load:	**KVA**			
Total Connected Load:	**KVA**			

Below Information is required for Installation Coordination

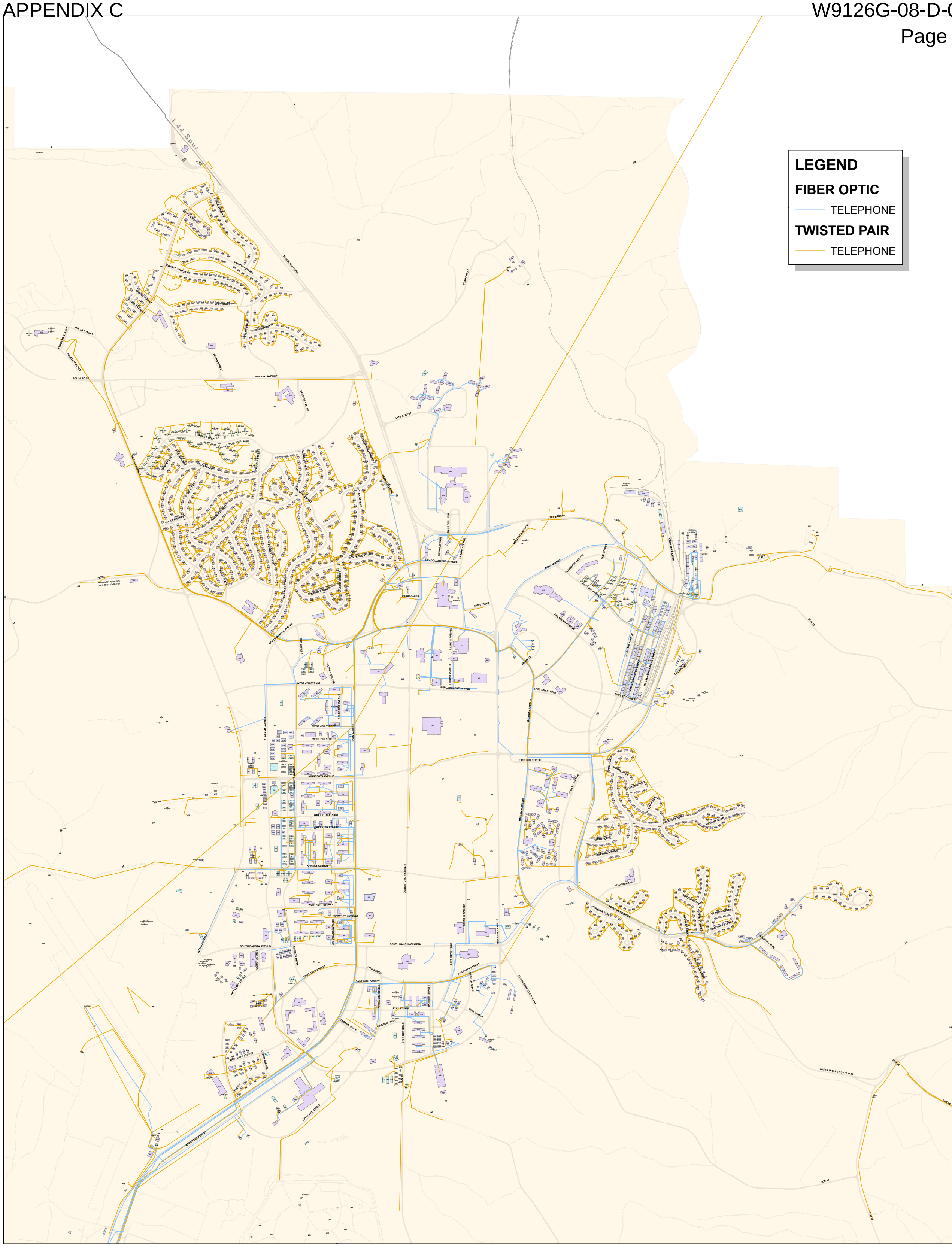
Service Type	Underground		
(Please Check One)	Overhead		With DPW APPROVAL ONLY

Service

Raceway Size				
Number of Raceway Sets			Spares	
Conductors Size			Insulation Type	
Number of Conductors				
Conductor Type	AL		CU	

Service Equipment Type

NEMA TYPE				
Switchboard	CB		Fuse	
Panelboard	CB		Fuse	
Safety Switch (SE Rated)	CB		Fuse	
Over Current Protection Device Ampacity				
AVG Motor and other Equipment Efficiency				
Ground Fault Protection	Yes		No	



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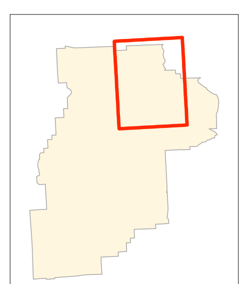
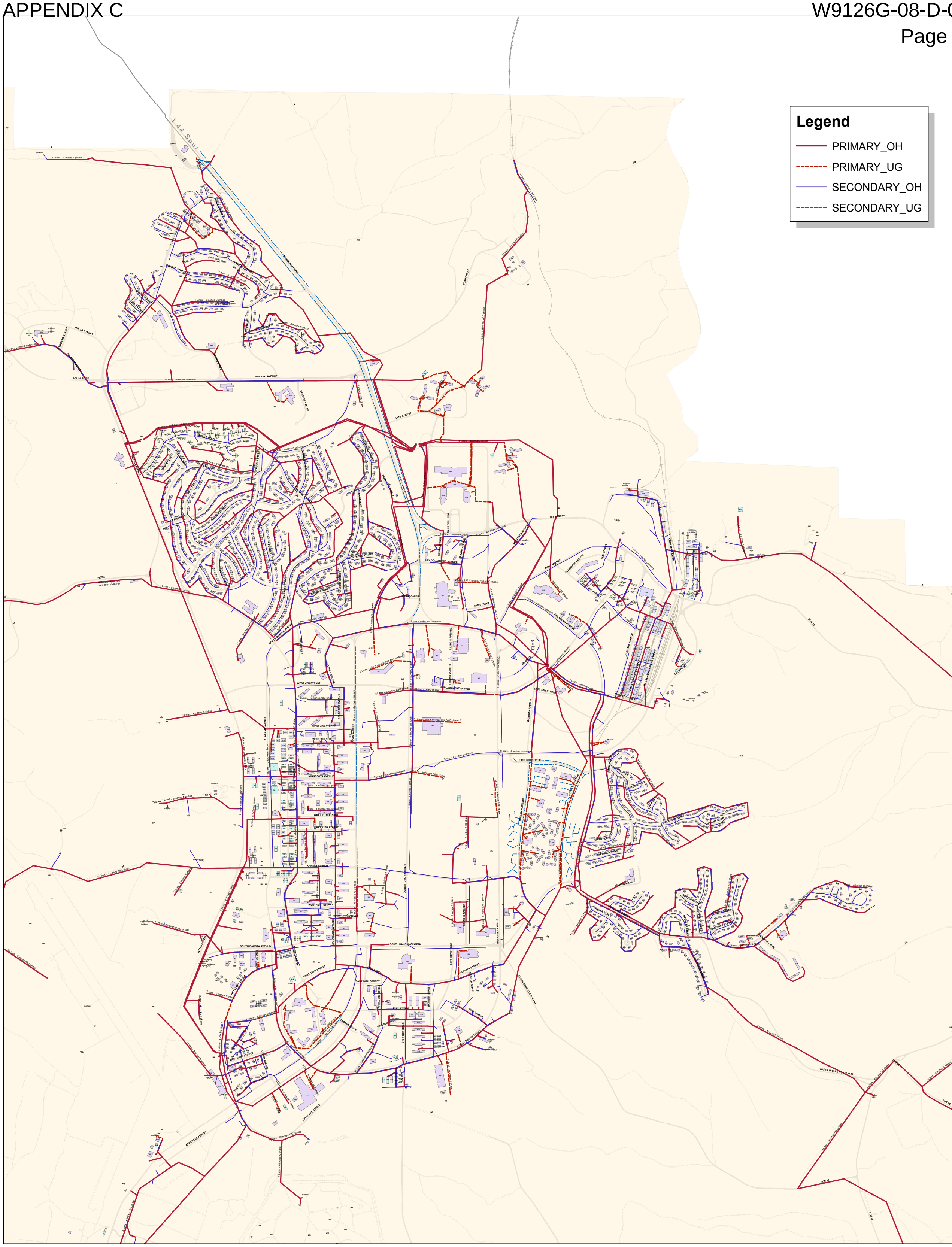
FORT LEONARD WOOD, MISSOURI
BASE INFORMATION MAPPING
COMMUNICATION UTILITY PLAN

JULY 2007 SHEET 2 OF 8





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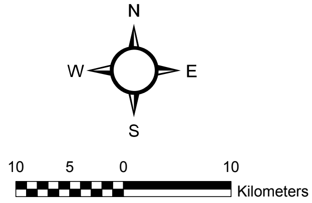
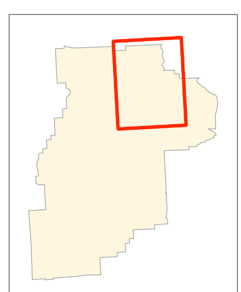
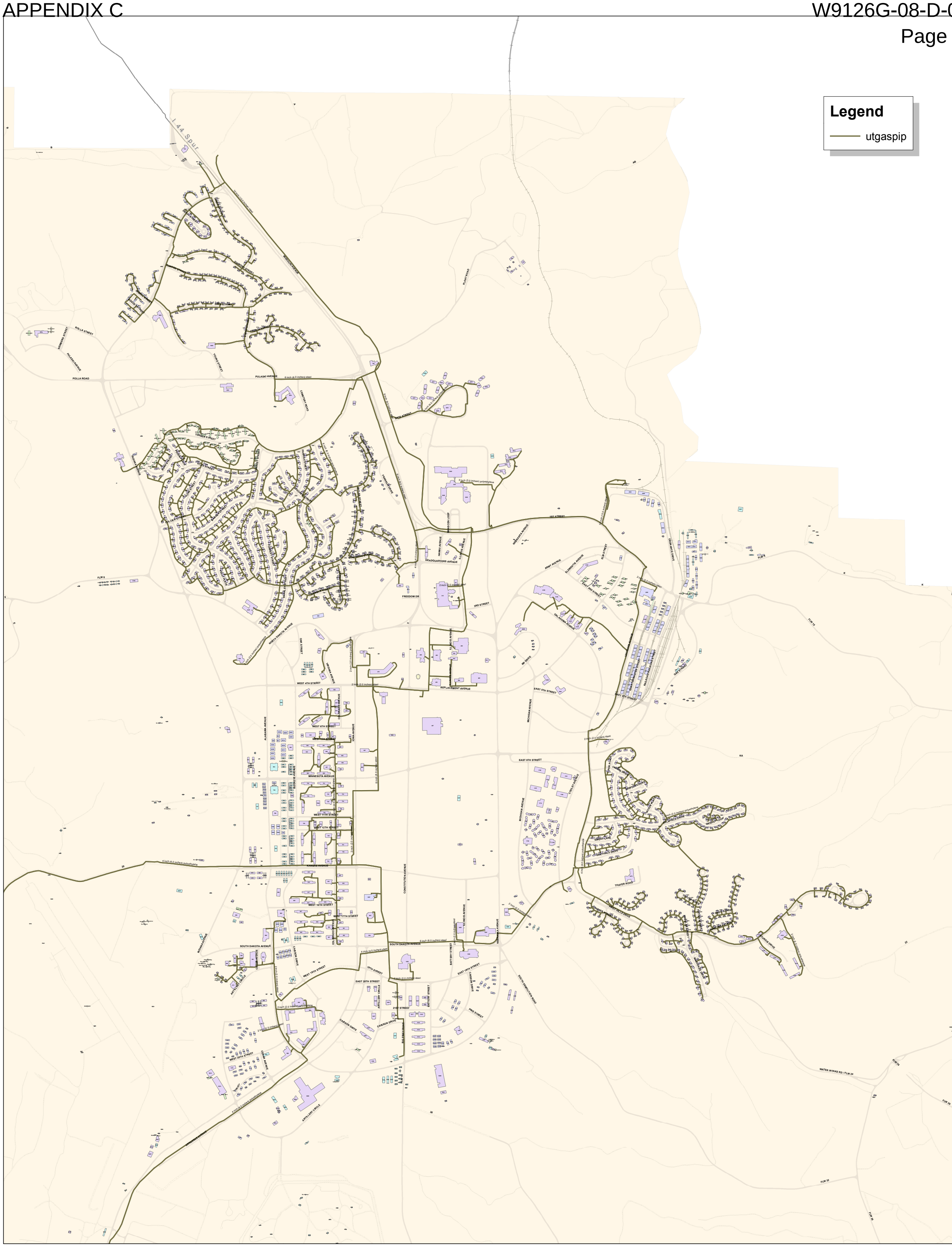


FORT LEONARD WOOD, MISSOURI
BASE INFORMATION MAPPING
ELECTRIC UTILITY PLAN

JULY 2007 SHEET 3 OF 8





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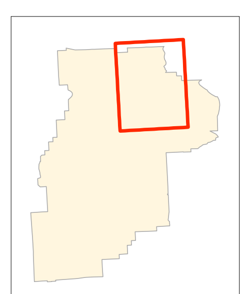
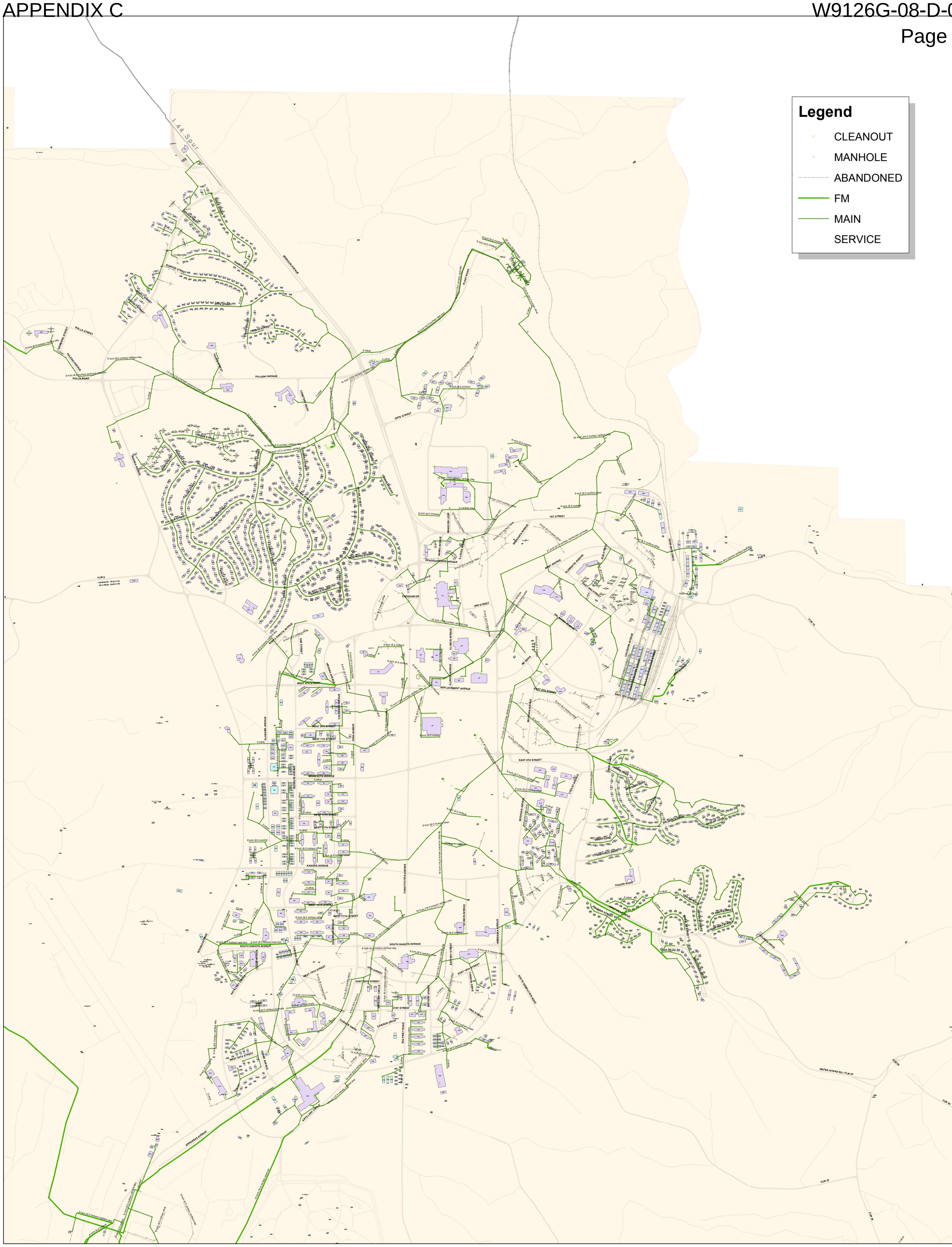
FORT LEONARD WOOD, MISSOURI
BASE INFORMATION MAPPING
NATURAL GAS UTILITY PLAN

JULY 2007

SHEET 4 OF 8





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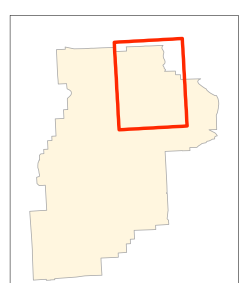
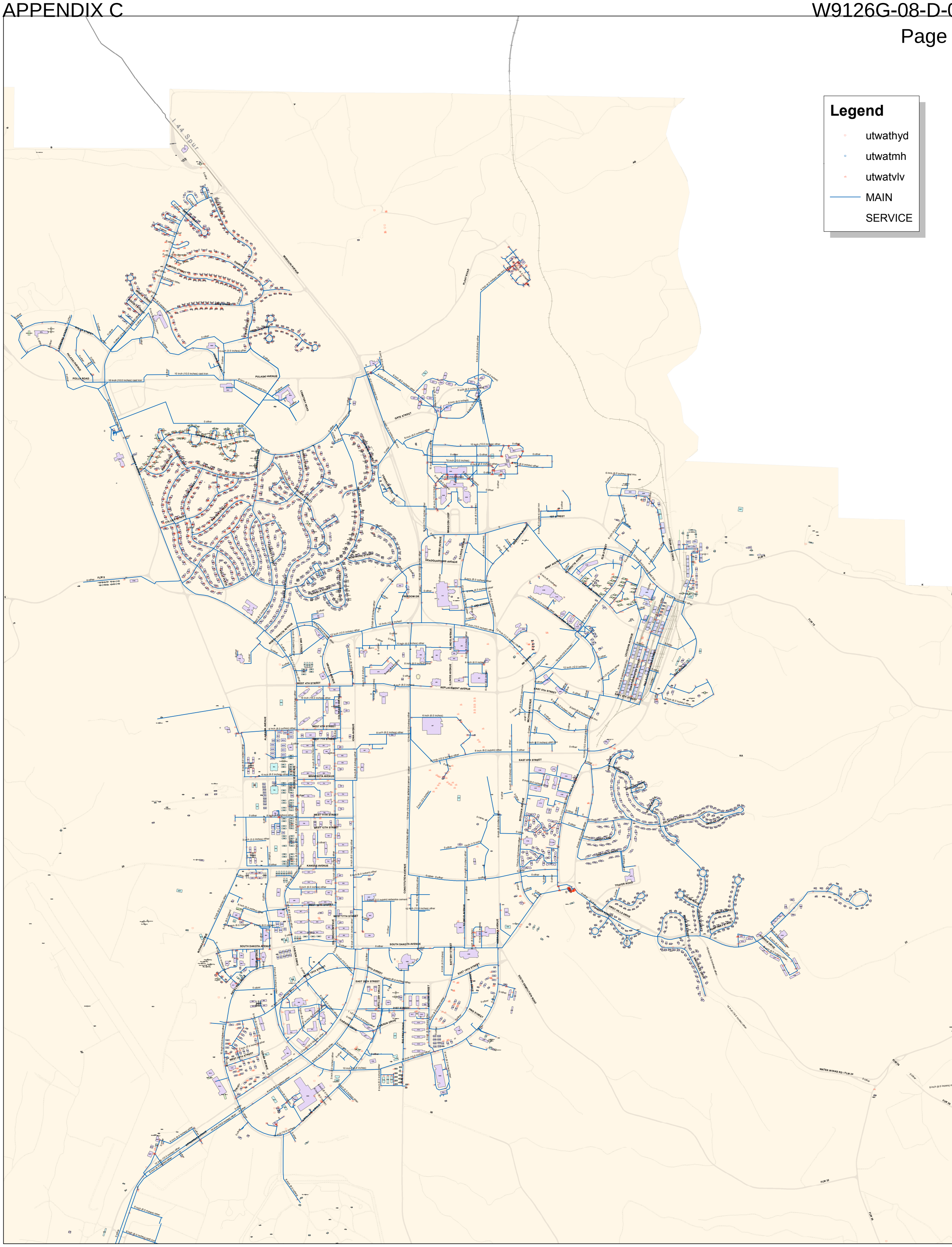
FORT LEONARD WOOD, MISSOURI
BASE INFORMATION MAPPING
WASTEWATER UTILITY PLAN

JULY 2007 SHEET 7 OF 8





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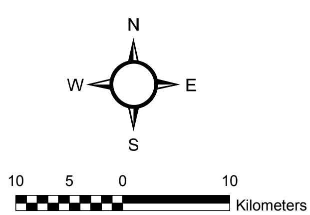

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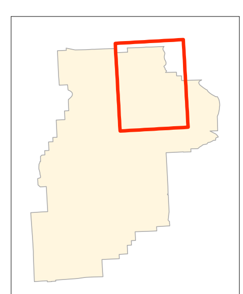
BASE INFORMATION MAPPING
WATER UTILITY PLAN

JULY 2007 SHEET 8 OF 8



APPENDIX D

Pump Station Drawings

Section:

US Army Corps of Engineers
Kansas City District
You Matter - We Care

#78

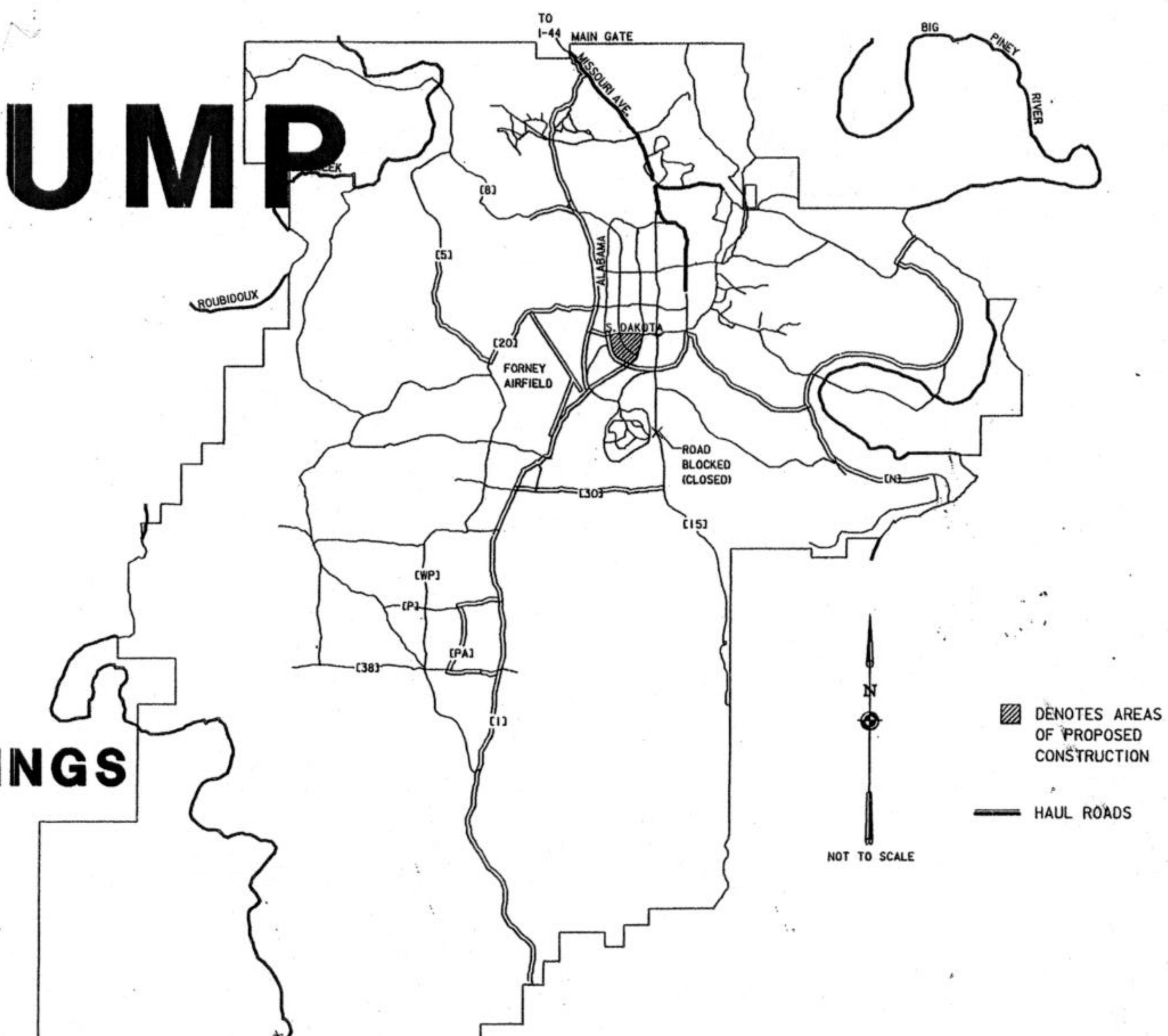
VOLUME 6

BASIC COMBAT TRAINEE COMPLEX

Fort Leonard Wood, Missouri

BOOSTER PUMP STATION

941



CONSTRUCTION CONTRACT DRAWINGS

JULY 2001

Section:

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2-	G1.0	INDEX OF DRAWINGS
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4-	G~~1.2~~ 3	LEGEND

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5-	C1	PUMP STATION AND STORAGE TANK SITE PLAN
6-	C2	PUMP STATION PAVING PLAN
7-	C3	24-INCH MAIN DISCHARGE LINE PLAN AND PROFILE
8-	C4	STRUCTURE NO. 1 (FLOWMETER)
9-	C5	DISTRIBUTION LINES PLAN
10-	C6	LINE "A" PLAN AND PROFILE
11-	C7	LINE "B" PLAN AND PROFILE
12-	C8	LINE "C" PLAN AND PROFILE
13-	C9	LINE "C" PLAN AND PROFILE
14-	C10	LINE "D" PLAN AND PROFILE
15-	C11	LINE "E" PLAN AND PROFILE
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17-	C13	LINES "H" AND "J" PLAN AND PROFILE
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21-	A2.1	BUILDING ELEVATIONS
22-	A3.1	BUILDING SECTIONS
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24-	A4.2	WALL SECTIONS
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30-	S0.4	STANDARD FOUNDATION DETAILS
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46-	E2	ONE-LINE DIAGRAM
47-	E3	ELECTRICAL SITE PLAN
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49-	E5	PUMP STATION WIRING PLAN
50-	E6	CONTROL DIAGRAMS
51-	E7	CONTROL DIAGRAMS
52-	E	INSTRUMENTATION DIAGRAMS
53-	E9	ELECTRICAL PLAN DETAILS

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
1	REVISED INDEX	8/18/01	
2	ADDED AND/OR CHANGE SHEETS	8/31/01	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group
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FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
INDEX OF DRAWINGS

Sheet reference

Section:

ABBREVIATIONS

A

AB	ANCHOR BOLT
ABV	ABOVE
AC	ALTERNATING CURRENT OR ABOVE CEIL.
ACC	ACCESS
A/C	AIR CONDITIONING
ACFM	ACTUAL CUBIC FEET PER MINUTE
ACI	AMERICAN CONCRETE INSTITUTE
ACST	ACOUSTIC
ACT	ACOUSTICAL TILE CEILING
AFF	ABOVE FINISH FLOOR
AFMP	AIR FLOW MEASURING PRIMARY
AGG	AGGREGATE
AHU	AIR HANDLING UNIT
A.I.	AREA INLET
AISC	AMERICAN INSTITUTE of STEEL CONSTRUCTION
AL	ALUMINUM
AMP	AMPERE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX.	APPROXIMATE
ARCH	ARCHITECTURAL OR ARCHITECT
A.R.I.	AMERICAN REFRIGERATION INSTITUTE
ASPH	ASPHALT
ATC	ACOUSTICAL TILE CEILING
AUTO	AUTOMATIC
AVG	AVERAGE
AWC	ACOUSTICAL WALL COVERING
AWG	AMERICAN WIRE GAUGE

B

B	BASELINE
BATT INSUL	BATT INSULATION
BDY	BOUNDARY
BEJ	BRICK EXPANSION JOINT
BIT	BITUMINOUS
BLDG	BUILDING
BLK	BLOCK
BLK'G	BLOCKING
BM	BEAM
B.M.	BENCH MARK
BOTT.	BOTTOM
BRDG	BRIDGING
BRG	BEARING
BK or BRICK	BRICK
BTU	BRITISH THERMAL UNIT
BTUH	BTU PER HOUR
BUR	BUILT-UP ROOFING

C

C or CND	CONDUIT (FOR RACEWAY - ELEC. SHTS.)
CAL	CALIPER
CAP	COMPOSITE ALUMINUM PANEL
cc or c to c	CENTER TO CENTER
CB	CATCH BASIN (OR CIRCUIT BREAKER)
CBB	CONCRETE BACKER BOARD
CFM	CUBIC FEET PER MINUTE
CFMF	COLD FORMED METAL FRAMING
CG	CORNER GUARD
C.I.	CURB INLET
CI	CAST IRON
C.J.	CONSTRUCTION JOINT (STR SHTS.)
CIR	CIRCULAR
CCT	CIRCUIT
CCT BKR or CB	CIRCUIT BREAKER
℄ or CL	CENTER LINE
CLG	CEILING
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNITS
C.O.	CLEANOUT
COL	COLUMN
COMP	COMPRESSIBLE
CONC.	CONCRETE
CONN	CONNECTION
CONSTR or CONST.	CONSTRUCTION
CONSTR JT.	CONSTRUCTION JOINT
CONT.	CONTINUOUS
COR	CORNER
CORR	CORRIDOR
CP	CARPET
CPT	CARPET TILE
C.R.L.	CONSTRUCTION REFERENCE LINE
CT	CERAMIC TILE or CURRENT TRANSFORMER
CTR	CENTER
CH	CABINET HEATER
CU YD	CUBIC YARD
CIGP	CAST IRON GUTTER PLATE
CULV.	CULVERT
CSP	CONDENSER SPRAY
CRAC	COMPUTER RM. AIR COND. UNIT
CY	CUBIC YARD
CRU	COMPUTER ROOM UNIT
CWA	CONSTANT WATTAGE AUTO TRANSFORMER

D

D	DATUM
DB	DRY BULB
DEG	DEGREE
DET	DETAIL
DHW	DOMESTIC HOT WATER
DIA or ⌀	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DIP	DUCTILE IRON PIPE
DN	DOWN
DP	DEMOUNTABLE PARTITION
DTB	DATA TERMINAL BOARD
DTL	DETAIL

E

E	EAST
EA.	EACH
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EIFS	EXTERIOR INSUL. FINISH SYSTEM
EJ	EXPANSION JOINT
EL or ELEV.	ELEVATION - GRADE OR BUILDING
ELEC.	ELECTRIC or ELECTRICAL
EPT	EPOXY PAINT
EQ.	EQUAL
EQUIP.	EQUIPMENT
E.W.	EACH WAY/EYE WASH
EWC	ELECTRIC WATER COOLER
EWT	ENTERING WATER TEMPERATURE
EXC	EXCAVATE
EXH	EXHAUST
EXIST.	EXISTING
EXP	EXPOSED OR EXPANSION
EXT	EXTERIOR

F

F	FAHRENHEIT
F. D.	FIRE DAMPER
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FEB	FIRE EXTINGUISHER BRACKET
FEC	FIRE EXTINGUISHER CABINET
FH	FIRE HYDRANT
F.H.F.W.	FULL HEIGHT, FULL WIDTH
FIN.	FINISH
F.G.	FINISH GRADE
FG	FOOTGRILLE
FL OR ℄	FLOW LINE or FLOOR
FL	FLOOD
FLR	FLOOR
FLUOR	FLUORESCENT
FP	FOLDING PARTITION
FPM	FEET PER MINUTE
FT.	FEET
FTG.	FOOTING
FTR	FLUE THRU ROOF
FWC	FABRIC WALL COVERING

G

G	GAS
GA	GYPSUM ASSOCIATION / GAGE or GAUGE
GAL	GALLON
GALV	GALVANIZED
GFE/CI	GOVERNMENT FURNISHED EQUIPMENT CONTRACTOR INSTALLED
GFE/GI	GOVERNMENT FURNISHED EQUIPMENT GOVERNMENT INSTALLED
GFE	GOVERNMENT FURNISHED EQUIPMENT
G.F.I. or GFI	GROUND FAULT INTERRUPTER
GI	GALVANIZED IRON
GLS	GLASS
GND or GRND	GROUND
GOVT.	GOVERNMENT
GPM	GALLONS PER MINUTE
GR	GRADE / GRANITE
GRTG	GRATING
GWB	GYPSUM WALLBOARD
GWT	GLAZED WALL TILE
GYP	GYPSUM

H

HC	HANDICAPPED
HDRL	HANDRAIL
HID	HIGH INTENSITY DISCHARGE
HM	HOLLOW METAL
HP	HORSEPOWER
HIP	HIGH PRESSURE
H.PT.	HIGH POINT
HORIZ.	HORIZONTAL
HB	HOSE BIB
HPL	HIGH PRESSURE PLASTIC LAMINATE
HR	HOUR
HT	HEIGHT
HW	HOT WATER
HWR	HEATING WATER RETURN
HWS	HEATING WATER SUPPLY
Hz	HERTZ

I

IAW	IN ACCORDANCE WITH
I.D.	INNER DIAMETER
IE or I.E.	INVERT ELEVATION
IN	INCH
INSUL.	INSULATION / INSULATED
INT.	INTERIOR
INV.	INVERT or INVERTOR

J

JB or J-BOX	JUNCTION BOX
JCT	JUNCTION
JST	JOIST
JT.	JOINT

K

kcmil or KCM	KILO CIRCULAR MIL
KIP	KILOPOUND (1000 LBS)
kV	KILOVOLTS
KVA	KILOVOLT AMPERES
kW	KILOWATT

L

LAT	LEAVING AIR TEMPERATURE
LAV	LAVATORY
LBS / LB	POUNDS / POUND
LF	LINEAL FEET
LG	LENGTH
LIN	LINEAR
LONG	LONGITUDINAL
LP	LOW POINT
LT.	LIGHT
LTG	LIGHTING
LT.WT.	LIGHT WEIGHT
LVG	LEAVING
LWT	LEAVING WATER TEMPERATURE

M

M	THOUSAND
MAS.	MASONRY
MAT. or MAT'L.	MATERIAL
MAX.	MAXIMUM
MBH	1000 BTUH
MD	MANUAL DAMPER
ECH.	MECHANICAL
MET.	METAL
MFR.	MANUFACTURE
MFGR	MANUFACTURER
MH	MANHOLE
MIN.	MINIMUM
MIR	MIRROR
MJ	MECHANICAL JOINT
MLDG.	MOLDING
MPH	MILES PER HOUR
MTD.	MOUNTED
MTR	MOTOR

N

N	NORTH
N.C.	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NU OR NO.	NUMBER
N.O.	NORMALLY OPEN
NPT	NOMINAL PIPE THREAD
N.R.	NOT REQUIRED
NRS	NON RISING STEM
NTS	NOT TO SCALE

O

OA	OUTSIDE AIR
O.C.	ON CENTERS
OCEW	ON CENTER EACH WAY
OD	OUTSIDE DIAMETER
OFF.	OFFICE
OPNG	OPENING
OPP	OPPOSITE
ORD	OVERFLOW ROOF DRAIN
OTS	OPEN TO STRUCTURE
OZ.	OUNCES

P

P.C.	PORTLAND CEMENT OR POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVE
PERIM.	PERIMETER
⌀	PHASE
PHAR	PHARMACY
PI	POINT OF INTERSECTION
PLAS.	PLASTIC
PLBG	PLUMBING
PLY. WD.	PLYWOOD
PNL	PANEL
P.O.C.	POINT ON CURVE
P.O.T.	POINT ON TANGENT
PRC	POINT OF REVERSE CURVE
PRV	PRESSURE REGULATING VALVE
PSF	POUNDS/SQUARE FOOT
PSI	POUNDS/SQUARE INCH
P.T.	POINT OF TANGENCY
PT	PAINT (FINISH)
PTD.	PAINTED
PVC	POLYVINYL-CHLORIDE
PVMT	PAVEMENT
PW	PASS WINDOW

Q

(NOT USED)

R

R or RSR	RISER
RA	RETURN AIR
RAD or R	RADIUS
RAG	RETURN AIR GRILLE
RB	RESILIENT BASE
RCB	REINFORCED CONCRETE BOX
RCG	RECESSED CORNER GUARD
RCP	REINFORCED CONCRETE PIPE
RD or R.D.	ROOF DRAIN
RDHW	RECIRCULATED DOMESTIC HOT WATER
RE	RIM ELEVATION
RE:	REFERENCE
REF.	REFERENCE
REINF	REINFORCEMENT
REL.	RELIEF AIR
REQ'D	REQUIRED
RGSC	RIGID GALVANIZED STEEL CONDUIT
RH	RELATIVE HUMIDITY
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
RR	RADIAL RUBBER FLOORING
R/W	RIGHT OF WAY

S

S	SOUTH
SAFB	SOUND ATTENUATION FIRE BLANKETS
SCFM	STANDARD CUBIC FEET PER MINUTE
SCHED	SCHEDULE
SD	STORM DRAIN / SMOKE DAMPER
SDI	STEEL DECK INSTITUTE
SHT.	SHEET
SIM	SIMILAR
S.J.	SAW JOINT
SJI	STEEL JOIST INSTITUTE
SP	STATIC PRESSURE
SPEC.	SPECIFICATIONS
SPKR	SPEAKER
SQ or □	SQUARE
SQ.FT.	SQUARE FEET
SSM	SOLID SURFACING MATERIAL
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STR	STRUCTURAL
STR.	STRUCTURE
SUSP.	SUSPENDED
SW	SWITCH
SYN.	SYNTHETIC

T

T	TREAD
TAN.	TANGENT
TB	TERMINAL BOX
TC	TOP OF CURB (CIVIL)
T.D. or ΔT	TEMPERATURE DIFFERENCE
TEL	TELEPHONE
TEMP	TEMPERATURE
TG	TOP OF GRATE
THRES.	THRESHOLD
TOC	TOP OF CURB (ARCH)
T.O.S.	TOP OF STEEL
TOPO	TOPOGRAPHY
TR	TOP OF RIM
TRANSF	TRANSFER BOOT
TRTD	TREATED
T-STAT	THERMOSTAT
TV	TELEVISION
TW	TOP OF WALL
TYP.	TYPICAL

U

U.F.	UNDER FLOOR
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORY
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTABLE POWER SYSTEM
UR	URINAL
UT	UTILITY

V

V	VENT or VOLT
V.C.	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VEST	VESTIBULE
VTR	VENT THRU ROOF
VWC	VINYL WALL COVERING

W

W	WEST or WASTE or WATTS
W/	WITH
WB	WET BULB
WC	WATER CLOSET
W.C.	WATER COLUMN
WD	WOOD
WF	WIDE FLANGE
WH	WALL HYDRANT OR WATER HEATER
WHA	WATER HAMMER ARRESTOR
W/O	WITHOUT
WP	WEATHERPROOF
W.P.D.	WATER PRESSURE DROP
WT	WEIGHT
WWF	WELDED WIRE FABRIC

X

XFMR	TRANSFORMER

Y

YD	YARD

Z

(NOT USED)

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
NEW SHEET		8/8/01	

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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
ABBREVIATIONS

Sheet reference number:

CIVIL LEGEND

EXISTING	NEW	
		BUILDINGS
		ROADS
		CURBS AND GUTTER
		WALKS
--12--	—12—	CONTOURS
+77.2	•77.2	SPOT GRADE ELEVATIONS
		DIRECTION OF DRAINAGE
—SD—	—SD—	STORM DRAIN
	—R.D.—	ROOF DRAIN
—W—	—W—	WATER LINE
	—FW—	FIRE LINE
—SS—	—SS—	SANITARY SEWER
		MANHOLE SELF EXPLANATORY DEPENDING ON TYPE OF UTILILTY LINE
		CURB INLET
		AREA INLET
		FIRE HYDRANT
		GATE VALVE AND VALVE BOX
	oDH-2	BORE HOLE
PIV	PIV	POST INDICATOR VALVE
		HEADWALL
		REMOVAL OF ITEM LISTED
		LIMITS OF DEMOLITION
	BM	CONTROL POINT
	•CO	CLEANOUT
		FLOOR DRAIN
		EXTERIOR SIGN
		GUARDPOST
		ASPHALT PAVING
		CONCRETE PAVING

N

STANDARD NORTH ARROW

LANDSCAPE

- QUICK COUPLER AIR AND VALVE
- LIMITS OF SOD
- DRIP IRRIGATION

ARCHITECTURAL LEGEND

- NON-EXPANSIVE FILL
- COMPACTED SUBGRADE
- CONCRETE
- CRUSHED ROCK
- CAPILLARY WATER BARRIER
- CONCRETE MASONRY UNITS (PLAN)
- CONCRETE MASONRY UNITS (SECTION)
- CERAMIC TILE-AS INDICATED
- ACOUSTIC CEILING TILE
- BRICK
- WOOD (ROUGH)
- WOOD (FINISH)
- BLANKET INSULATION
- PERIMETER INSULATION
- METAL
- GYPSUM WALL BOARD-AS INDICATED
- RIGID INSULATION
- MINERAL FIBER INSULATION
- GLASS
- METAL STUD PARTITION

ARCHITECTURAL REFERENCE SYMBOLS

X
XXXX XXXX

SECTION NUMBER

SHEET NUMBER OF DRAWING WHERE SECTION IS SHOWN.*

SHEET NUMBER OF DRAWING WHERE SECTION IS CUT.*

* SHEET NUMBERS OMITTED IF SECTION IS CUT AND DETAILED ON SAME DRAWING.

SECTION IDENTIFICATION

X
XXXX XXXX

SECTION NUMBER

SHEET NUMBER OF DRAWING WHERE SECTION IS SHOWN.*

SHEET NUMBER OF DRAWING WHERE SECTION IS CUT.*

MILLWORK ELEVATION

ELEVATION IDENTIFICATION

N

STANDARD NORTH ARROW

- PARTITION TYPE
- DOOR NUMBER
- ROOM NAME AND NUMBER (ROOM NO.)

MECHANICAL LEGEND

REFER SHEET M1100

ELECTRICAL LEGEND

REFER SHEET ????

GENERAL NOTES

1. THESE LEGENDS ARE COMPOSED OF STANDARD SYMBOLS AND ARE PERTINENT TO THE CONDITIONS ON THIS SET OF DRAWINGS TO THE ECTAENT APPLICABLE.
2. ADDITIONAL LEGENDS AND/OR ANOTHER LEGEND SHEET MAY APPEAR IN THIS SET OF DRAWINGS TO INDICATE SPECIFIC CONDITIONS IN LIEU OF SYMOLS SHOWN ON THIS SHEET.
3. EXISTION GACILITIES TO BE REMOVED ARE INDICATED BY USE OF THESE SYMBOLS AND HACHURED THUSLY.
4. DESIGN AND PROVIDE A CATHODIC PROTECTION (CP) SYSTEM FOR THE WATER AND GAS SYSTEMS IN ACCORDANCE WITH SPECIFICATION
5. THE CONTRACTOR SHALL DESIGN AND PROVIDE THE COMPLETE LIGHTNING PROTECTION SYSTEM.
6. LETTERS "WP" ADJACENT TO ANY SYMBOL INDICATES WEATHERPROOF ENCLOSURE.
7. FOR ANY STRUCTURE INSTALLED IN NEW OR EXISTING RIGID PAVEMENT, THE PAVEMENT SLAB SHALL BE REINFORCED WITH WWF PROVIDING A MINIMUM OF 0.06% STEEL IN BOTH DIRECTIONS.
8. ELECTRIC LIGHT FIXTURES ARE IDENTIFIED BY A CAPITAL LETTER OR FIXTURE DESIGNATION INSIDE OR ADJACENT TO SYMBOL TO INDICATE FIXTURE TYPE FOR EACH FIXTURE PER FIXTURE SCHEDULE.
9. GWB PARTITIONS ARE DIMENSIONED TO THE FACE OF GYP WALL BOARD.
10. DOORS ARE NUMBERED ALPHABETICALLY BY ROOM OR SPACE INTO WHICH THEY SWING. FOR OUT-SWINGING EXTERIOR DOORS, DOORS ARE NUMBERED ALPHABETICALLY BY THE ROOM OR SPACE FROM WHICH THEY SWING.
11. HORIZONTAL JOINT REINFORCEMENT AND OTHER MASONRY ANCHORS ARE NOT SHOWN ON THE DRAWINGS FOR CLARITY.

US Army Corps of Engineers
Kansas City District

NEW SHEET 8/18/01

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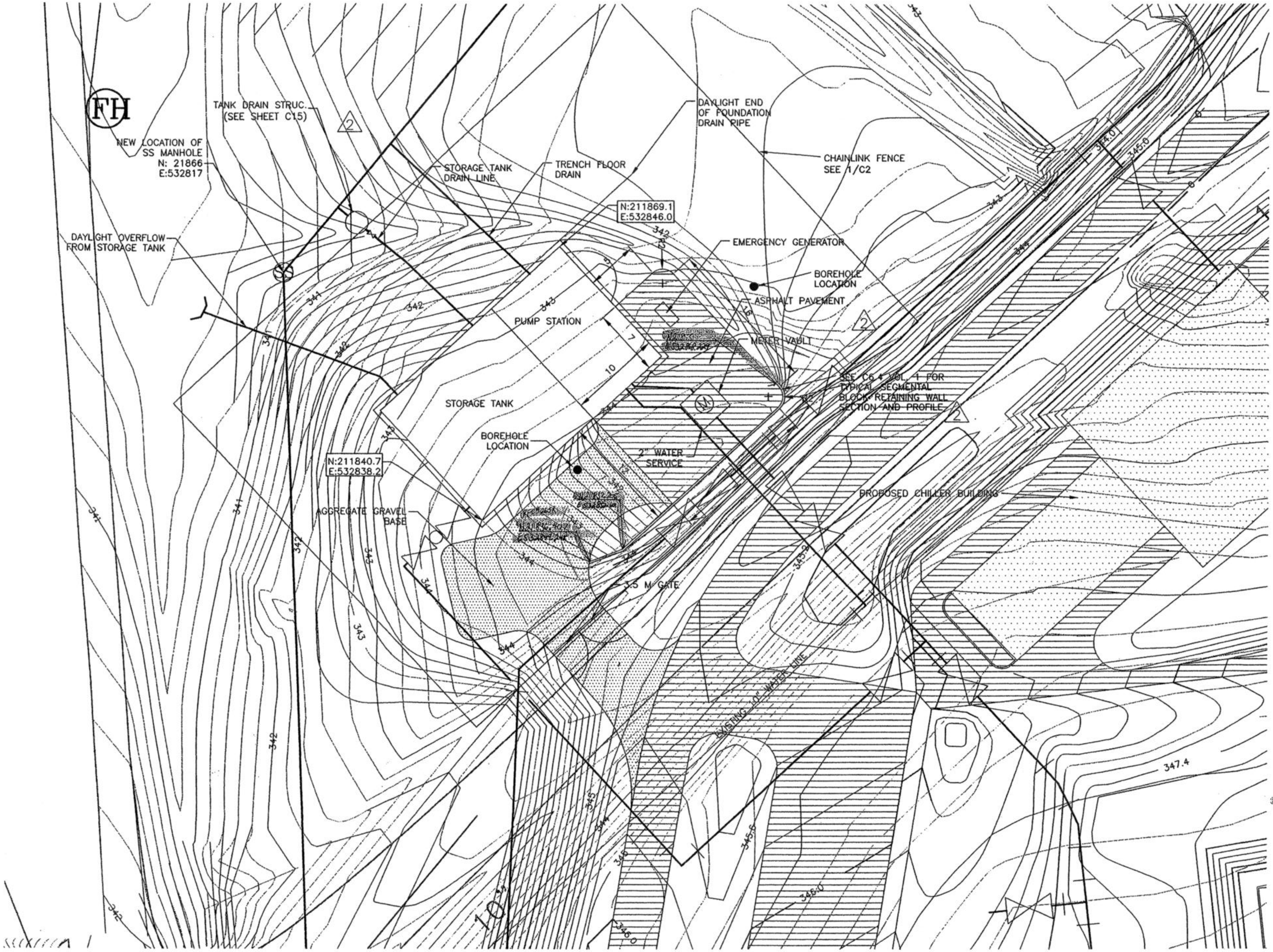
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
LEGEND



A PUMP STATION AND STORAGE TANK SITE GRADING PLAN

⚠ RFI #152 DRAWING REVISIONS
SEE PRECEDING PAGE.
~~RFI #... Retaining Wall ...~~
⚠ RFI #438 SEE PRECEDING PAGE.

US Army Corps of Engineers
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Symbol	Description	Date	Appr.
2	REVISED DRAINAGE STRUCTURES	8/31	

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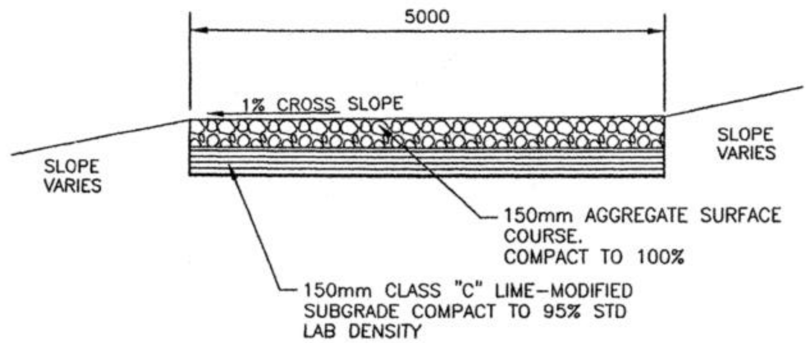
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION

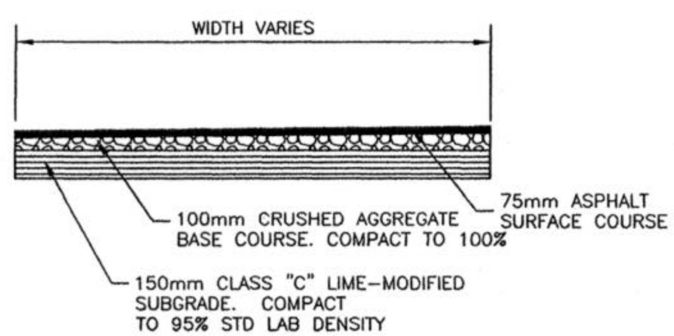
PUMP STATION AND STORAGE TANK
SITE PLAN

Sheet
reference
number:

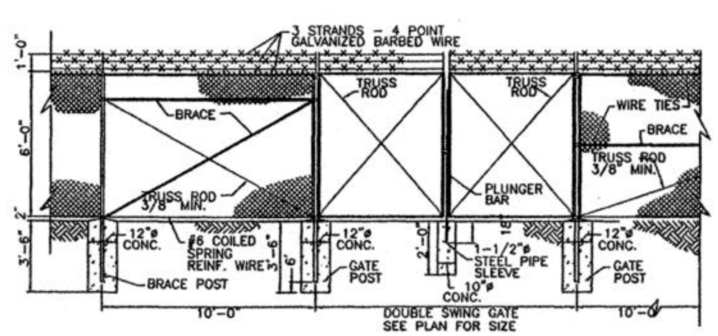
Section:

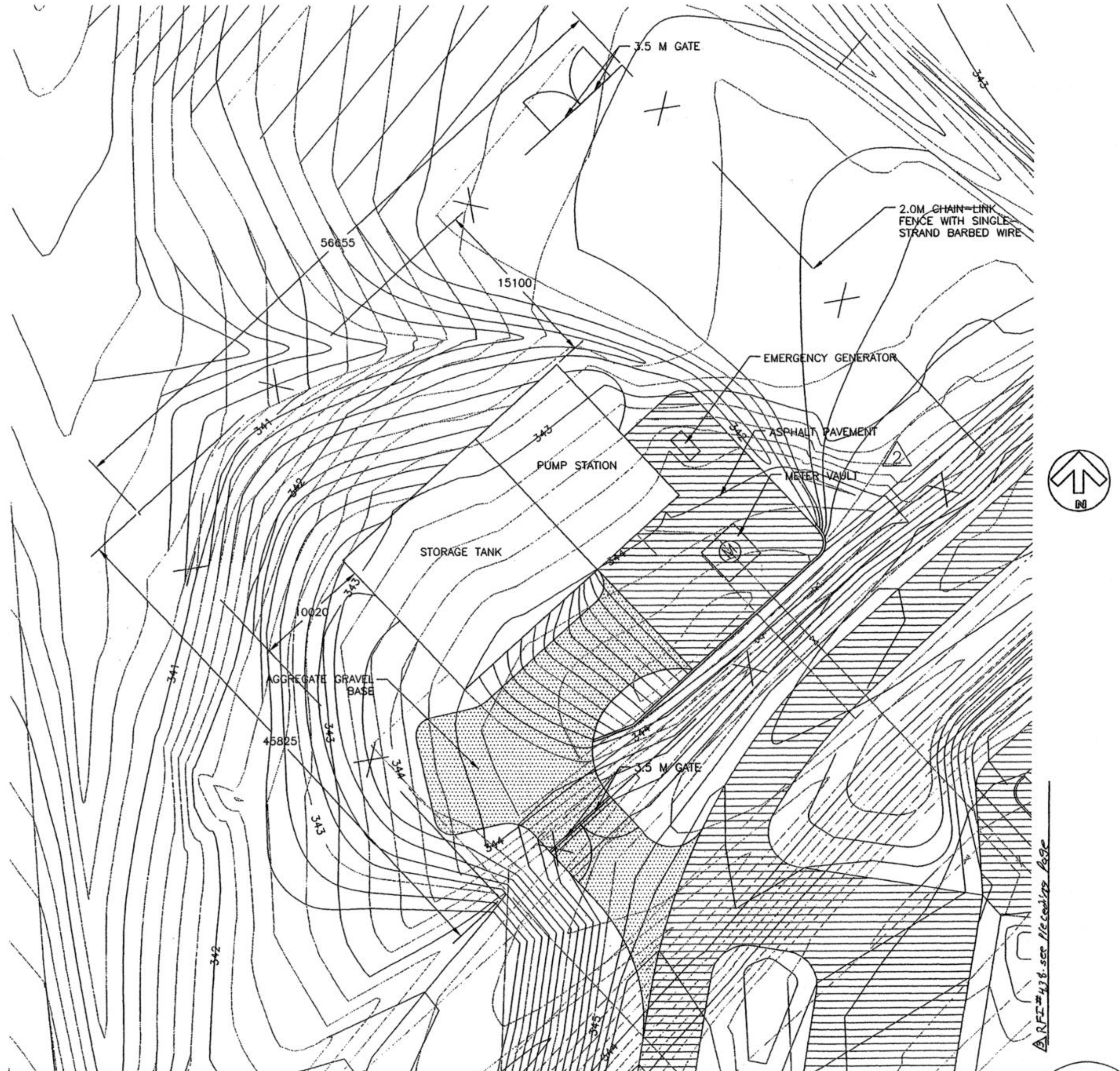


2/C2 ACCESS ROAD PAVEMENT TYPICAL SECTION
NO SCALE



3/C2 ASPHALT PAVEMENT TYPICAL SECTION
NO SCALE





1 PUMP STATION PAVING PLAN

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	REVISED METER VAULT	8/31	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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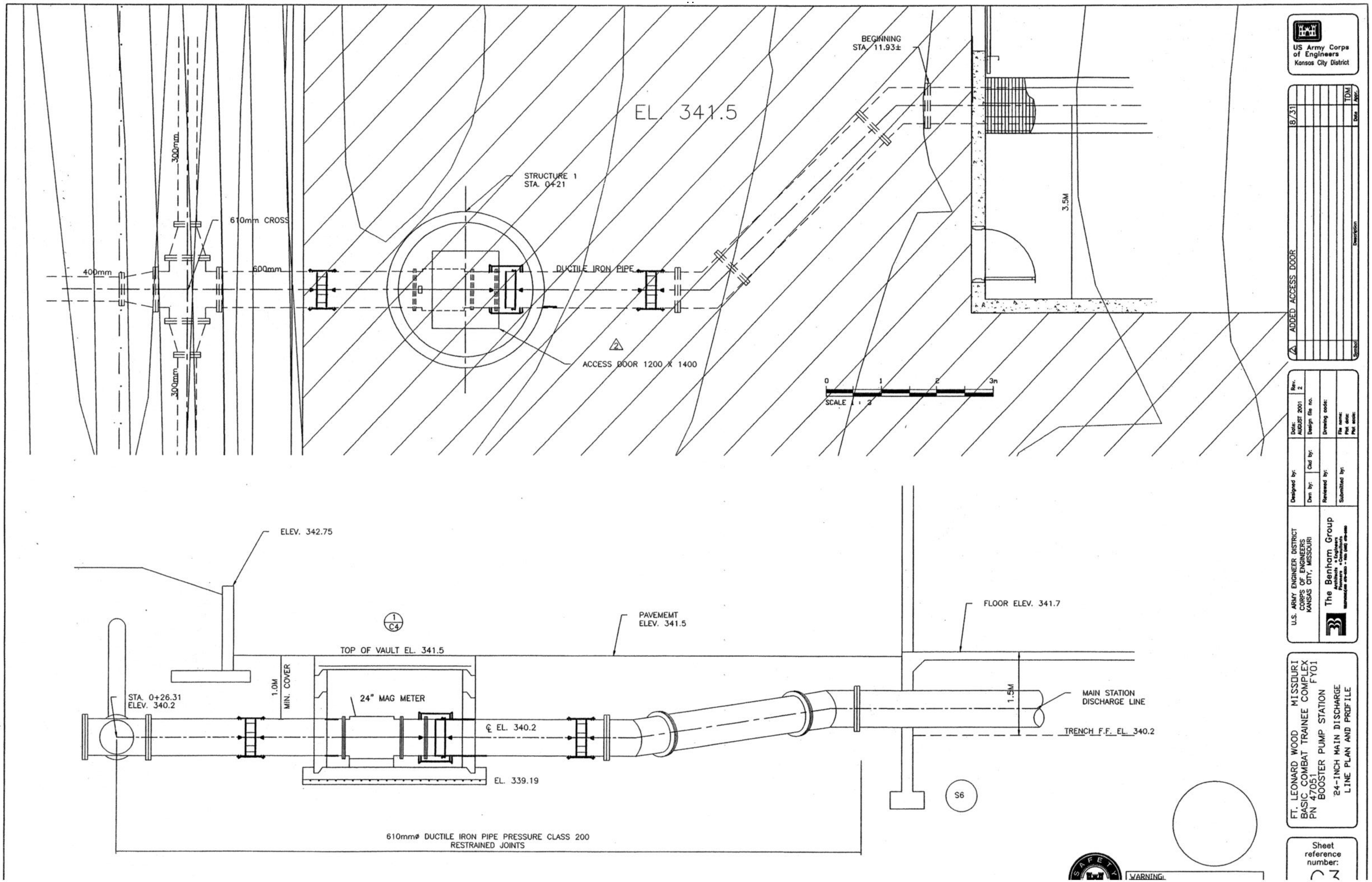
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
PUMP STATION PAVING PLAN

Sheet reference number:

Section:


EL. 341.5
BEGINNING
STA. 11.93±
300mm
300mm
610mm CROSS
400mm
600mm
STRUCTURE 1
STA. 0+21
DUCTILE IRON PIPE
ACCESS DOOR 1200 X 1400
3.5M
0 1 2 3m
SCALE 1 : 3
ELEV. 342.75
PAVEMEMT
ELEV. 341.5
FLOOR ELEV. 341.7
TOP OF VAULT EL. 341.5
1.0M MIN. COVER
24" MAG METER
STA. 0+26.31
ELEV. 340.2
℄ EL. 340.2
1.5M
MAIN STATION
DISCHARGE LINE
TRENCH F.F. EL. 340.2
EL. 339.19
S6
610mmø DUCTILE IRON PIPE PRESSURE CLASS 200
RESTRAINED JOINTS
WARNING:
US Army Corps of Engineers
Kansas City District
ADDED ACCESS DOOR
8/31
TDM
Symbol
Description
Date
Appr.
Date: AUGUST 2001
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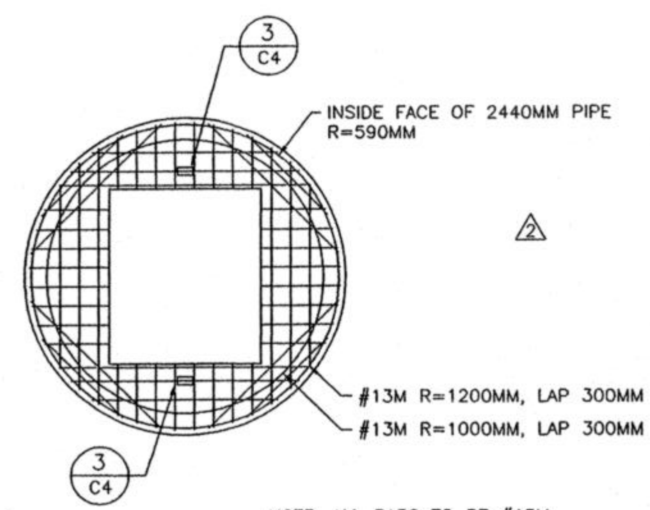
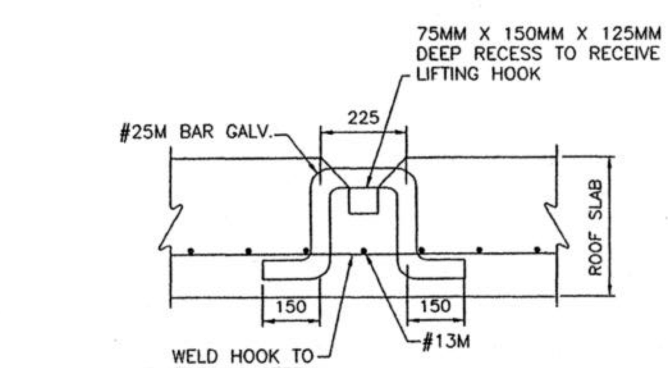
KANSAS CITY, MISSOURI
The Benham Group
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
24-INCH MAIN DISCHARGE
LINE PLAN AND PROFILE
Sheet reference number:
C3

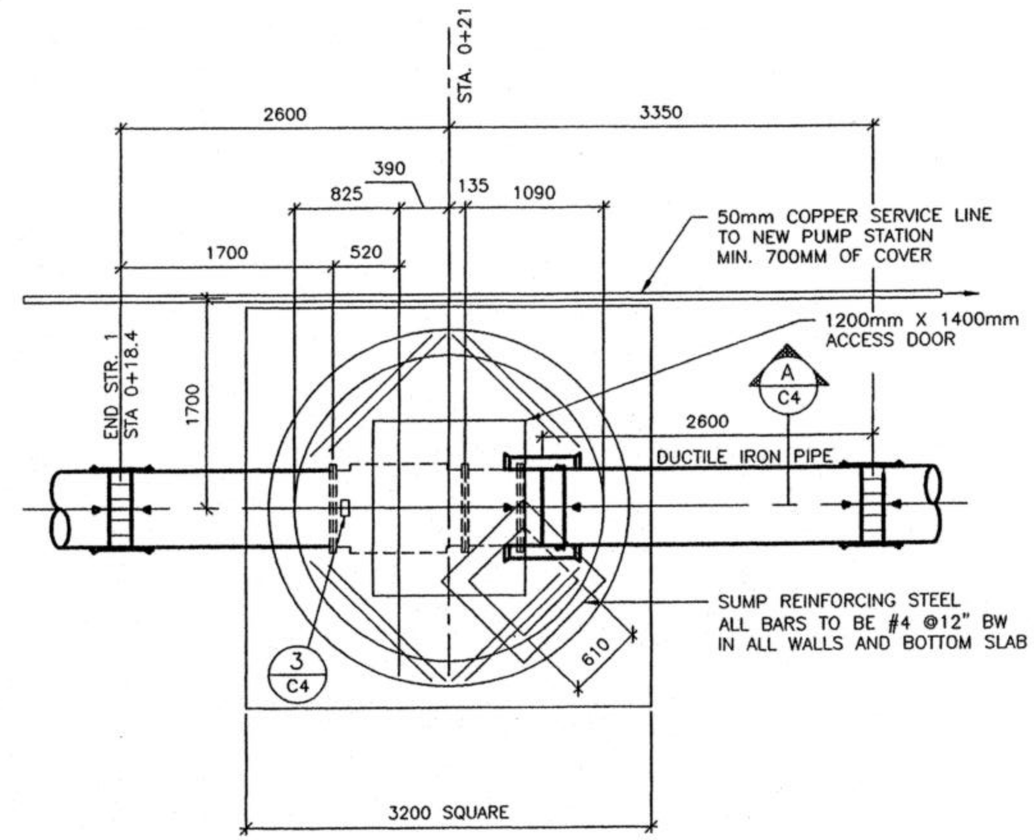
Section:



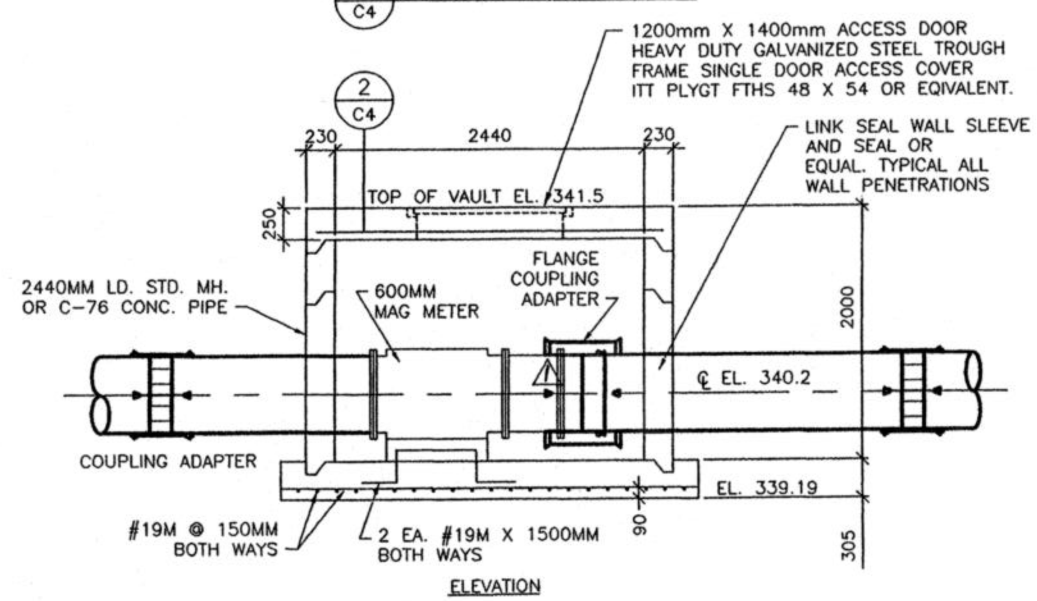
2 C4 VAULT TOP REINFORCING PLAN
SCALE: 1:30



3 C4 LIFTING HOOK DETAIL
SCALE: 1:10



1 C4 PLAN



A C4 STRUCTURE NO.1–FLOWMETER VAULT
SCALE: 1:30

0 1 2 3M

RFI #207

The intention of the drawing was to depict a mag meter connected to a flanged to plain end spool, which in turn would be connected by means of the coupling shown to the pipe penetrating the vault wall. The idea was to permit the installation and placement of the entry and exit pipes through the structure walls and make the final adjustments and connections in the structure rather than outside.

Intent is to construct a vault that would permit the mag meter to be removed and replaced without having to fabricate new fittings.

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	REVISED VAULT COVER	8/31	

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KANSAS CITY, MISSOURI

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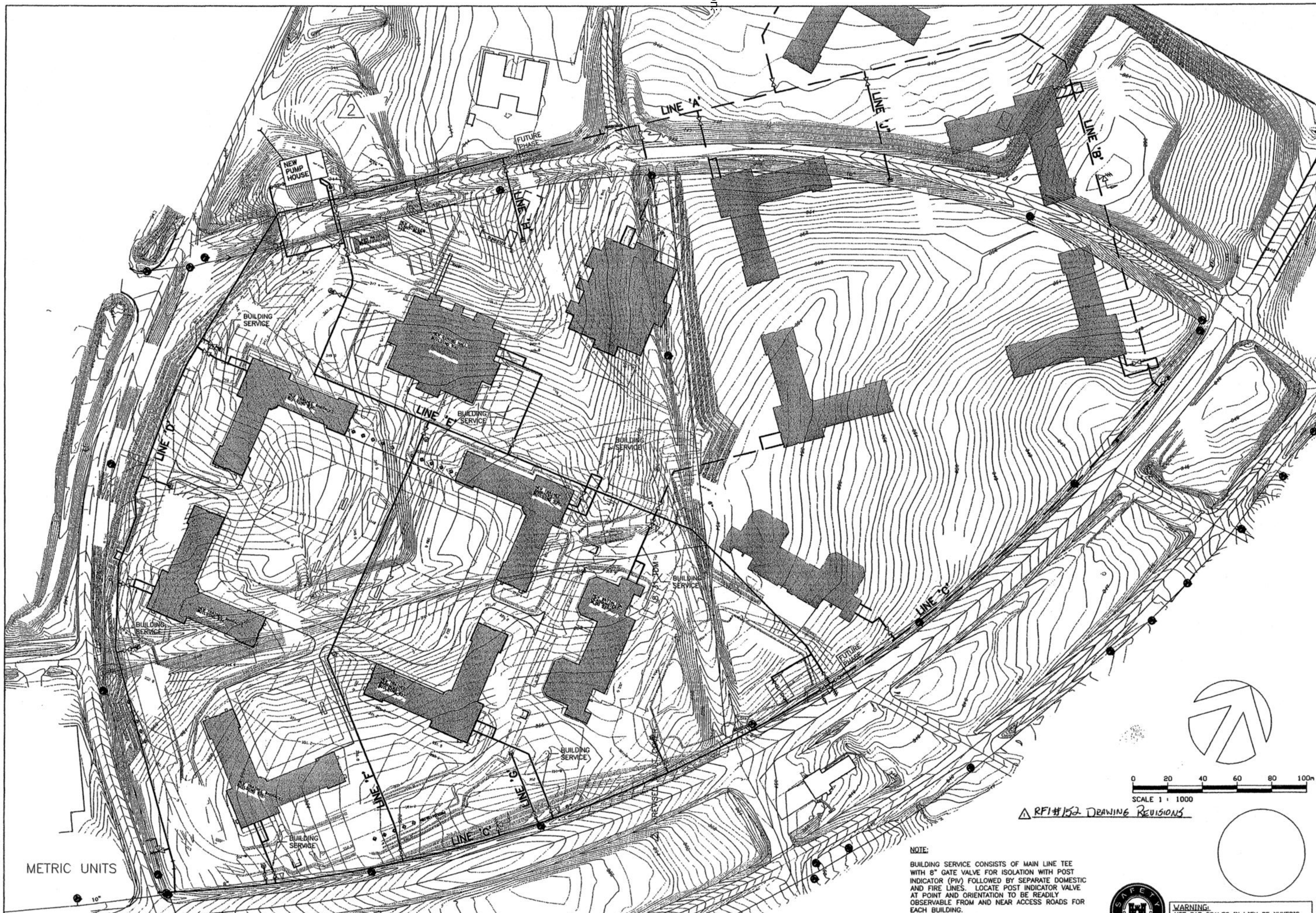
Reviewed by:		Drawing code:	
Submitted by:		File name: Plot date: Plot scale:	

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
STRUCTURE NO. 1 (FLOWMETER)

Sheet reference



NOTE:

BUILDING SERVICE CONSISTS OF MAIN LINE TEE WITH 8" GATE VALVE FOR ISOLATION WITH POST INDICATOR (PIV) FOLLOWED BY SEPARATE DOMESTIC AND FIRE LINES. LOCATE POST INDICATOR VALVE AT POINT AND ORIENTATION TO BE READILY OBSERVABLE FROM AND NEAR ACCESS ROADS FOR EACH BUILDING.

WARNING:
USE BAR SCALES IN LIEU OF NUMERIC SCALES ON REDUCED SIZE SHEETS

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	REVISED VALVE LOCATION	8/31	

Designed by: | Dwn by: | Ckd by: | Reviewed by: | Submitted by:

Date: AUGUST 2001 | Rev. 2 | Design file no. | Drawing code: | File name: | Plot date: | Plot scale:

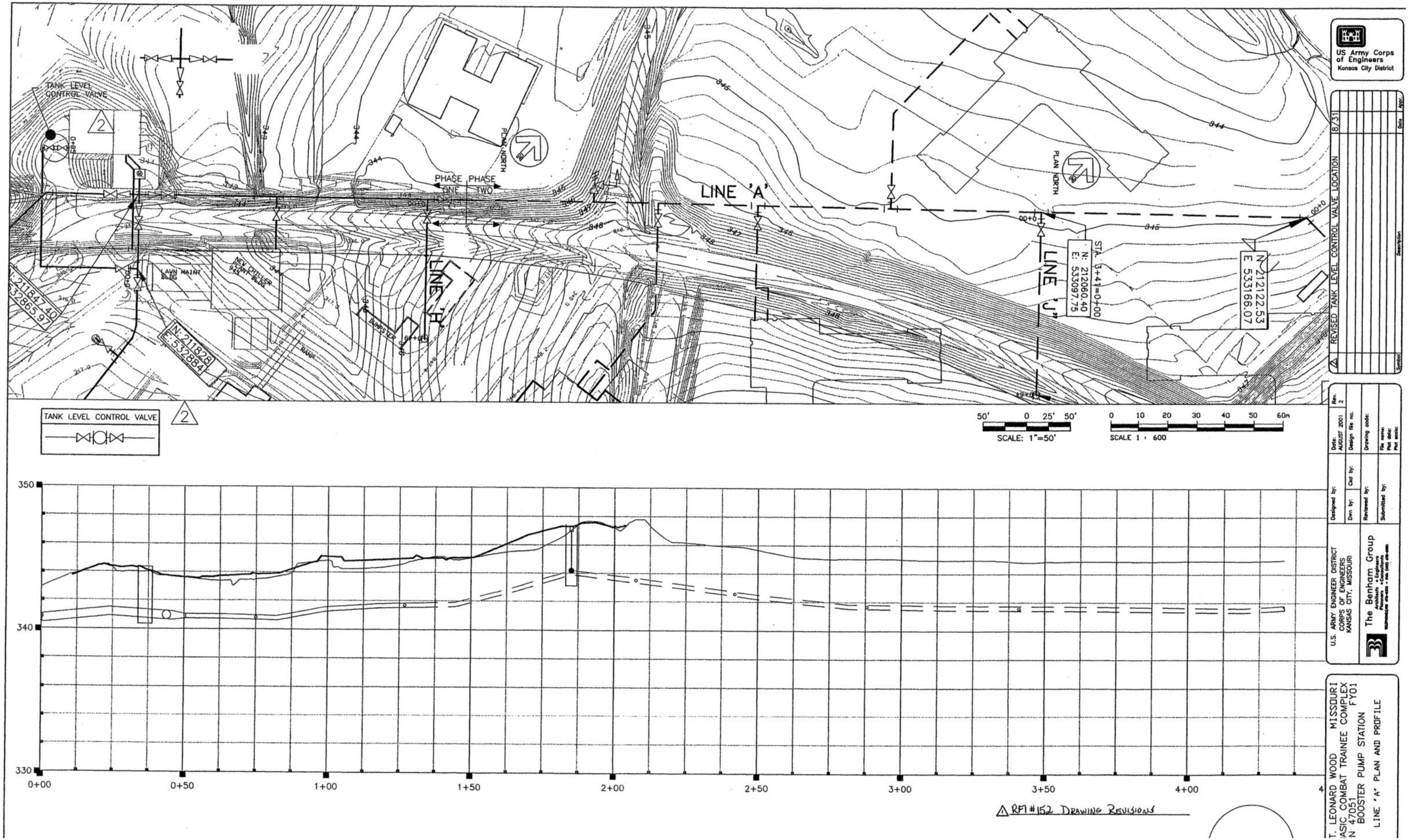
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051 BOOSTER PUMP STATION
DISTRIBUTION LINES PLAN

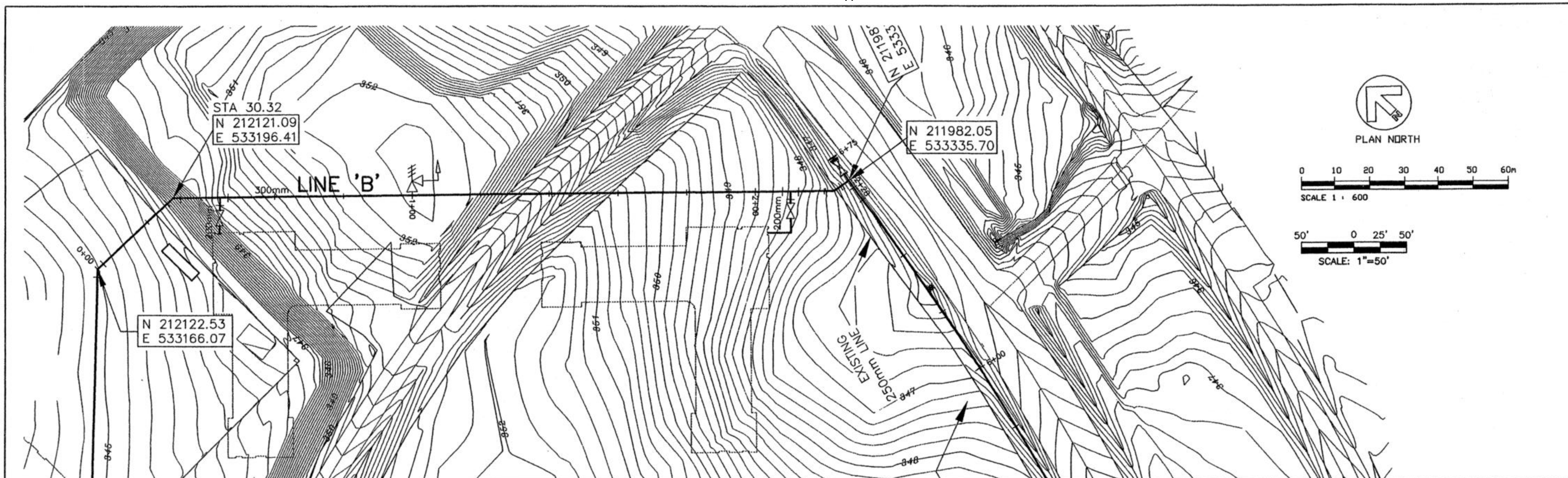
Sheet reference number:
C5

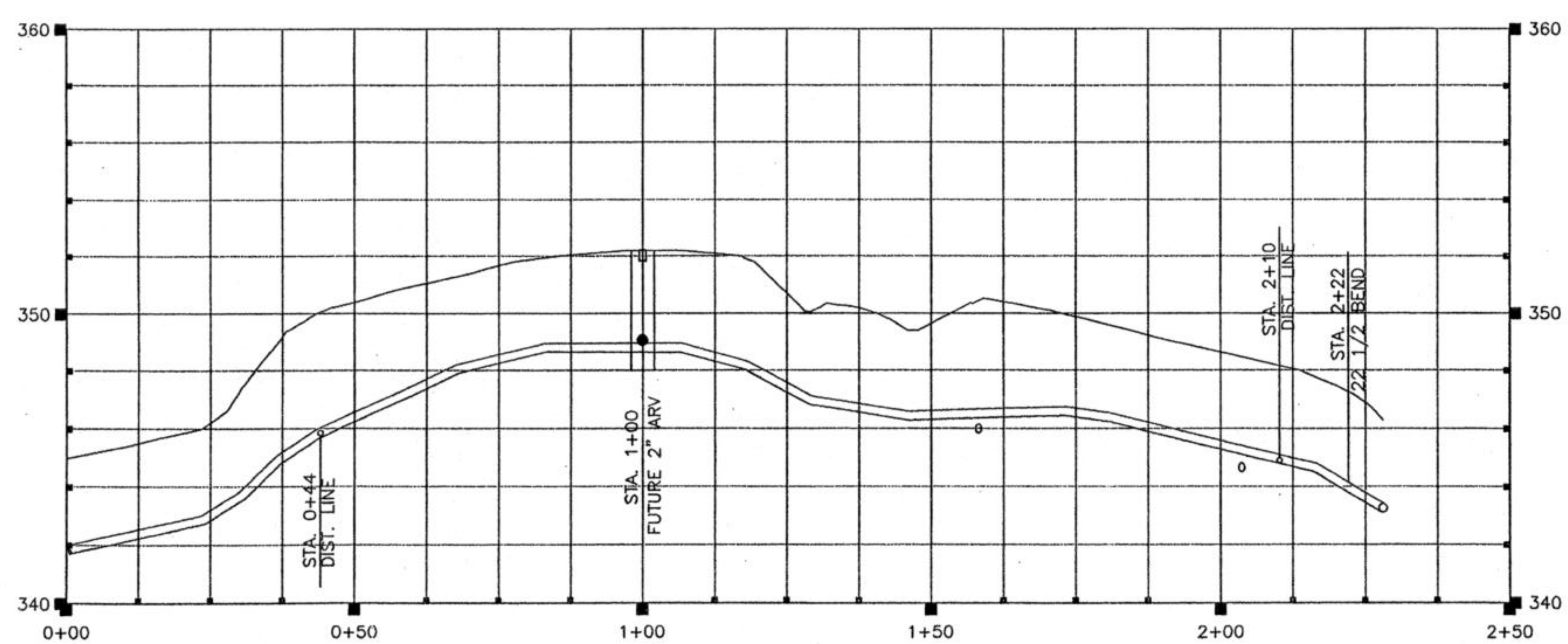
Section:



TANK LEVEL CONTROL VALVE
LINE 'A'
LINE 'H'
LINE 'J'
PHASE ONE
PHASE TWO
PLAN NORTH
LAWN MAINT BLDG
NEW CHILLER PLANT BLDG
DUMPSTER
RAMP
STA. 3+41=0+00
N: 212060.40
E: 533097.75
N: 212122.53
E: 533166.07
N: 211828
E: 532884
N: 211847.40
E: 532865.97
TANK LEVEL CONTROL VALVE
SCALE: 1"=50'
SCALE 1 : 600
350
340
330
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
RFI #152 DRAWING REVISIONS
US Army Corps of Engineers
Kansas City District
REVISED TANK LEVEL CONTROL VALVE LOCATION
8/31
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI
The Benham Group
Date: AUGUST 2001
T. LEONARD WOOD MISSOURI
ASIC COMBAT TRAINEE COMPLEX FY01
N 47051
BOOSTER PUMP STATION
LINE 'A' PLAN AND PROFILE

Section:





US Army Corps of Engineers
Kansas City District

Date: JULY 2001

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

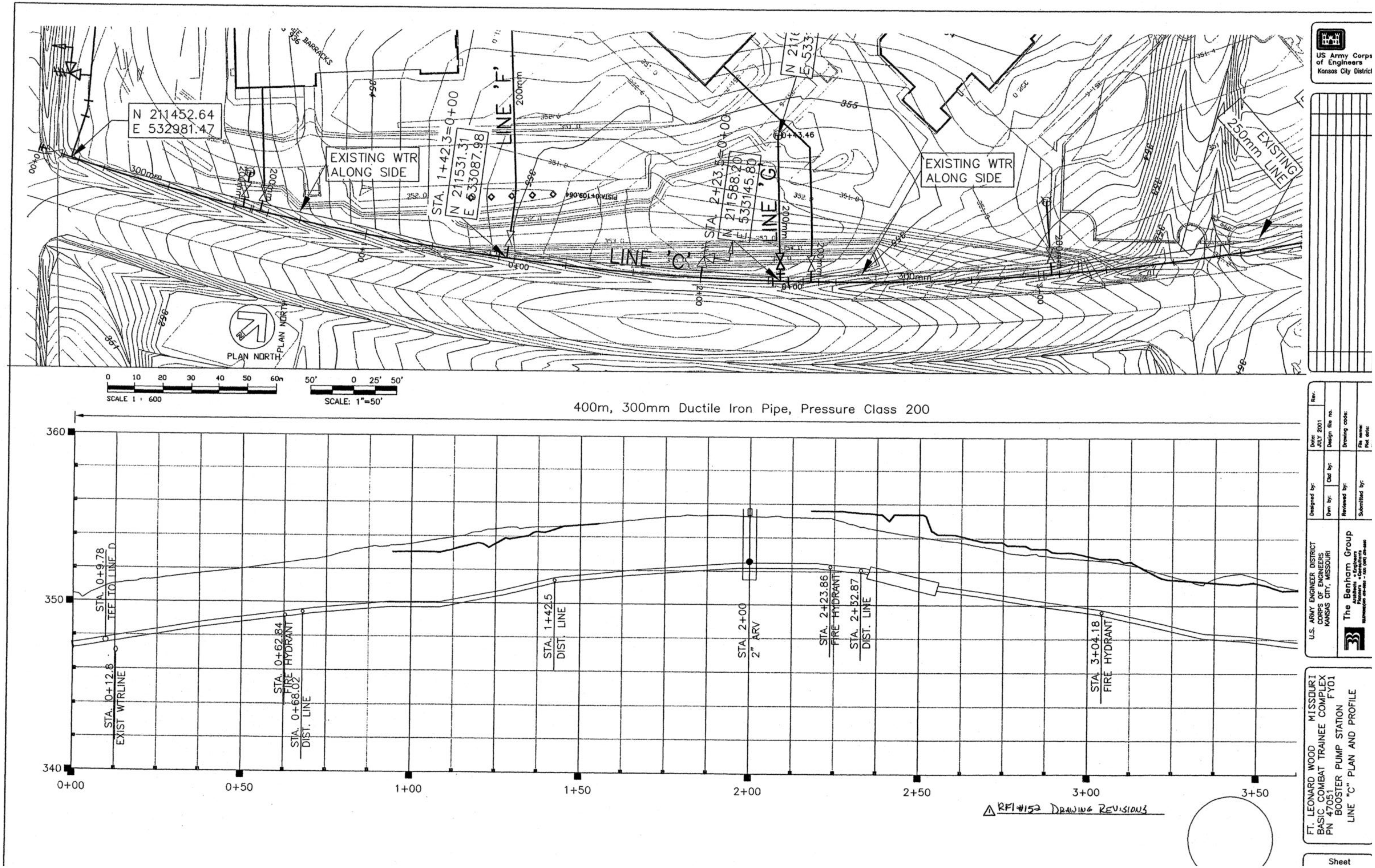
The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
LINE "B" PLAN AND PROFILE

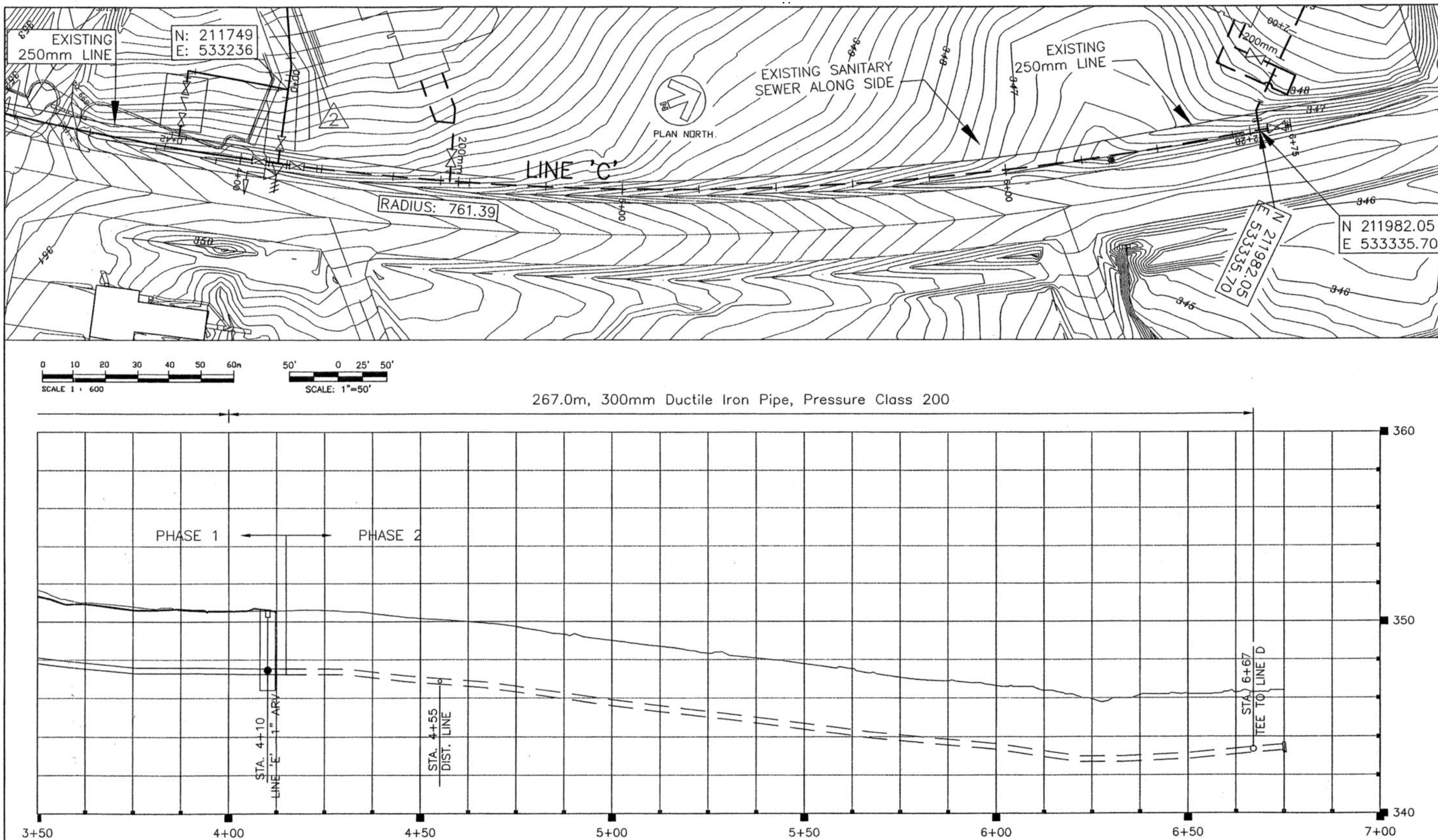
Sheet reference number:

WARNING

Section:


N 211452.64
E 532981.47
EXISTING WTR
ALONG SIDE
STA. 1+42.3=0+00
N 211531.31
E 533087.98
LINE 'F'
200mm
STA. 2+23.5=0+00
N 211588.20
E 533145.80
LINE 'G'
EXISTING WTR
ALONG SIDE
250mm LINE
EXISTING
LINE 'C'
300mm
PLAN NORTH
SCALE 1 : 600
SCALE: 1"=50'
400m, 300mm Ductile Iron Pipe, Pressure Class 200
360
350
340
STA. 0+9.78
TEE TO LINE D
STA. 0+12.8
EXIST WTRLINE
STA. 0+62.84
FIRE HYDRANT
STA. 0+68.02
DIST. LINE
STA. 1+42.5
DIST. LINE
STA. 2+00
2" ARV
STA. 2+23.86
FIRE HYDRANT
STA. 2+32.87
DIST. LINE
STA. 3+04.18
FIRE HYDRANT
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
RFI #152 DRAWING REVISIONS
US Army Corps of Engineers
Kansas City District
Date: JULY 2001
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI
The Benham Group
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
LINE "C" PLAN AND PROFILE
Sheet

Section:



US Army Corps of Engineers
Kansas City District

REVISED VALVE LOCATION 8/31

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

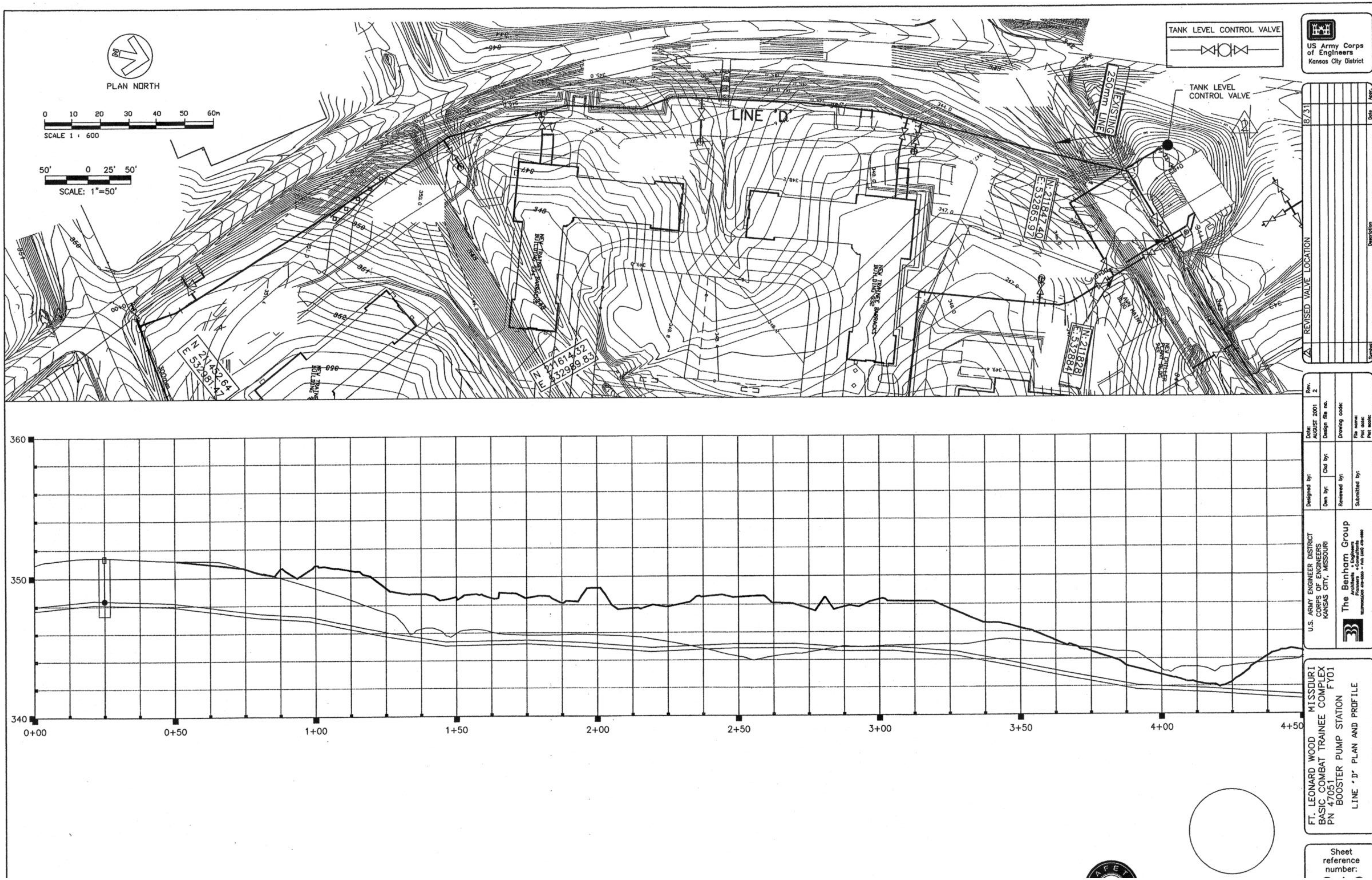
Date: AUGUST 2001
Rev. 2

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
LINE 'C' PLAN AND PROFILE

Sheet reference number:

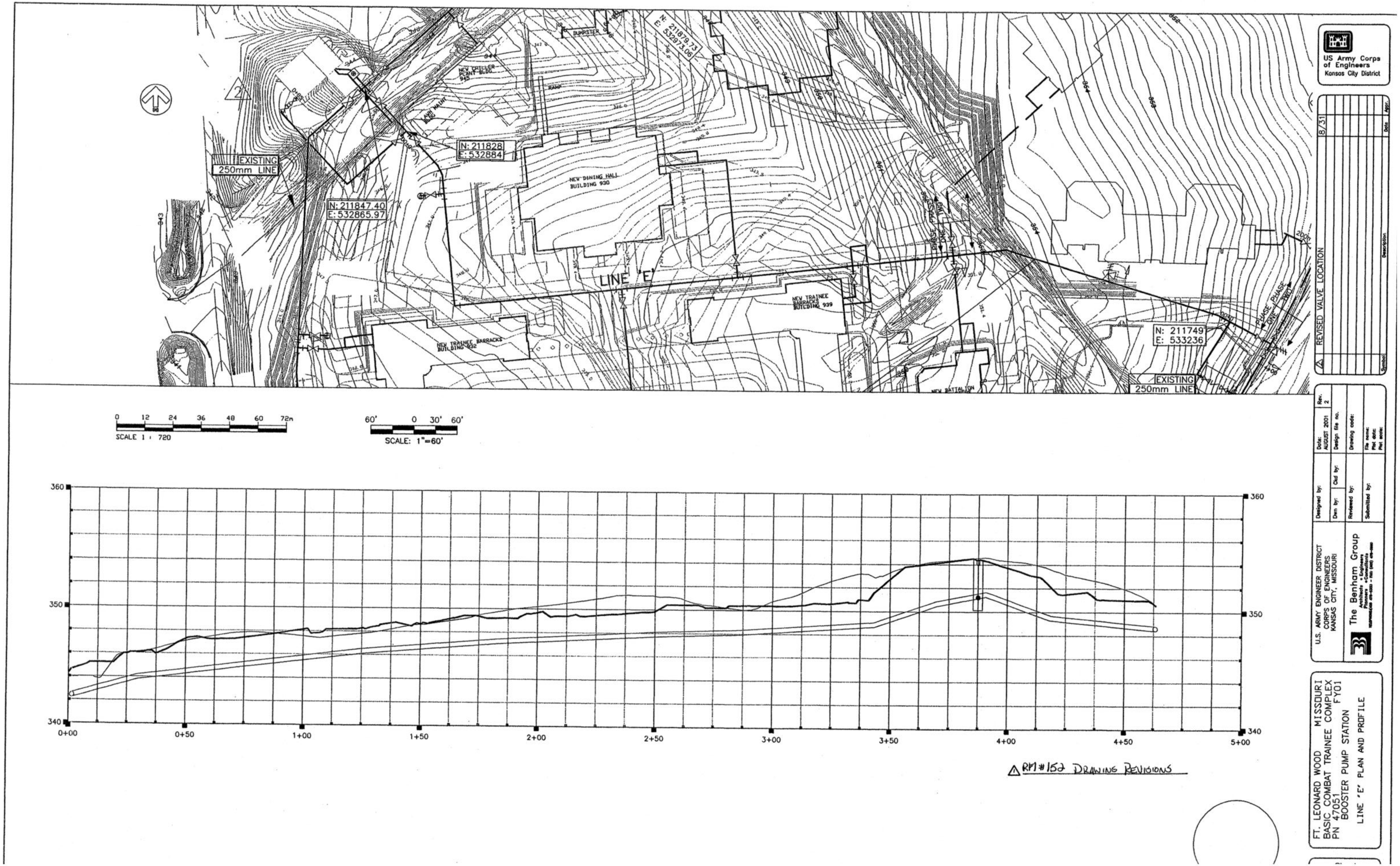
WARNING:

Section:

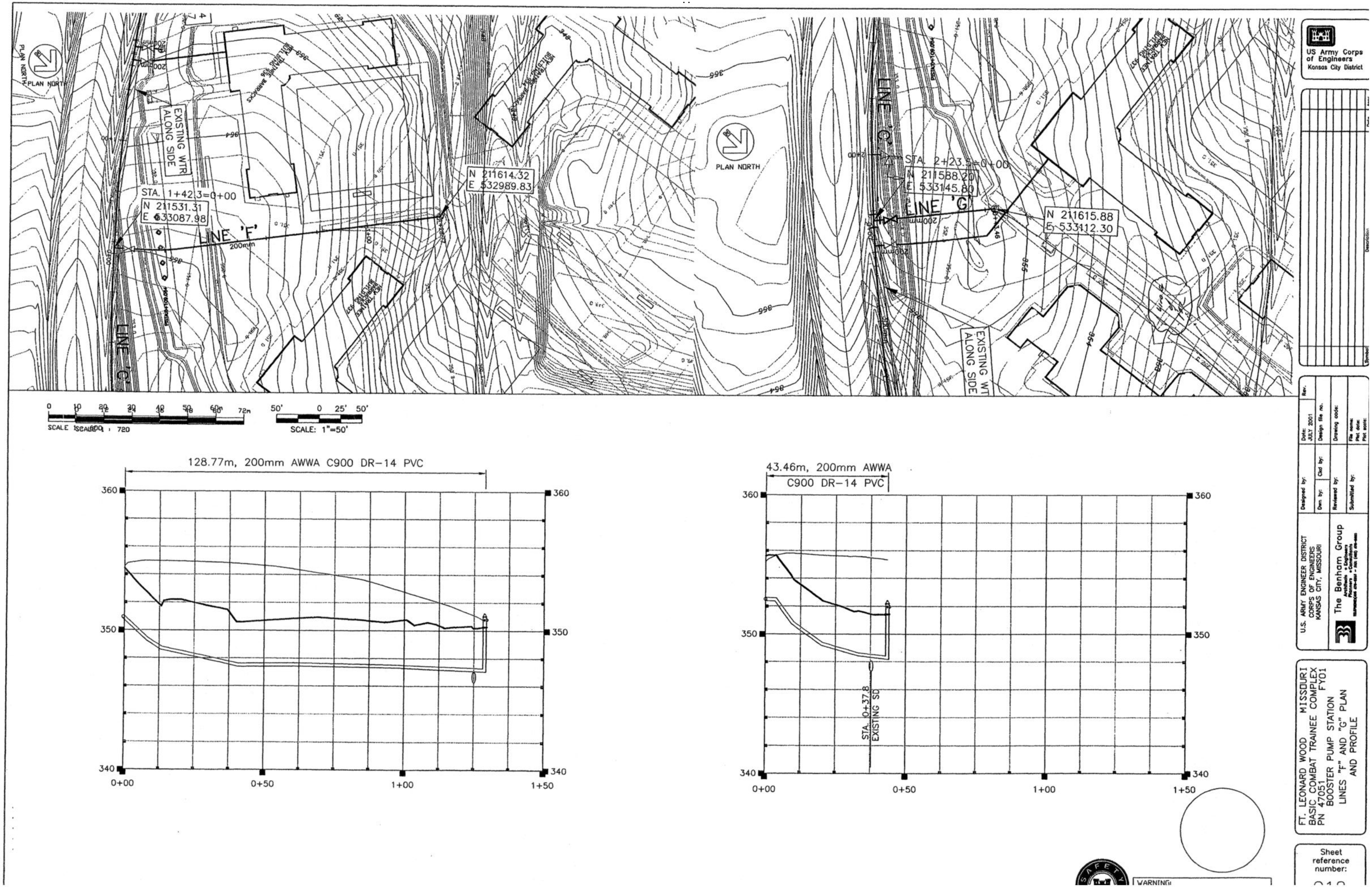


PLAN NORTH
SCALE 1 : 600
SCALE: 1"=50'
TANK LEVEL CONTROL VALVE
TANK LEVEL CONTROL VALVE
EXISTING 250mm LINE
LINE 'D'
N 211452.64 E 532081.47
N 211614.32 E 532989.83
N 211847.40 E 532865.97
N 211828 E 532684
NEW TRAINEE BARRACKS
US Army Corps of Engineers Kansas City District
REVISED VALVE LOCATION
8/31
Rev. 2
Date: AUGUST 2001
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
LINE 'D' PLAN AND PROFILE
Sheet reference number:
360
350
340
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50

Section:

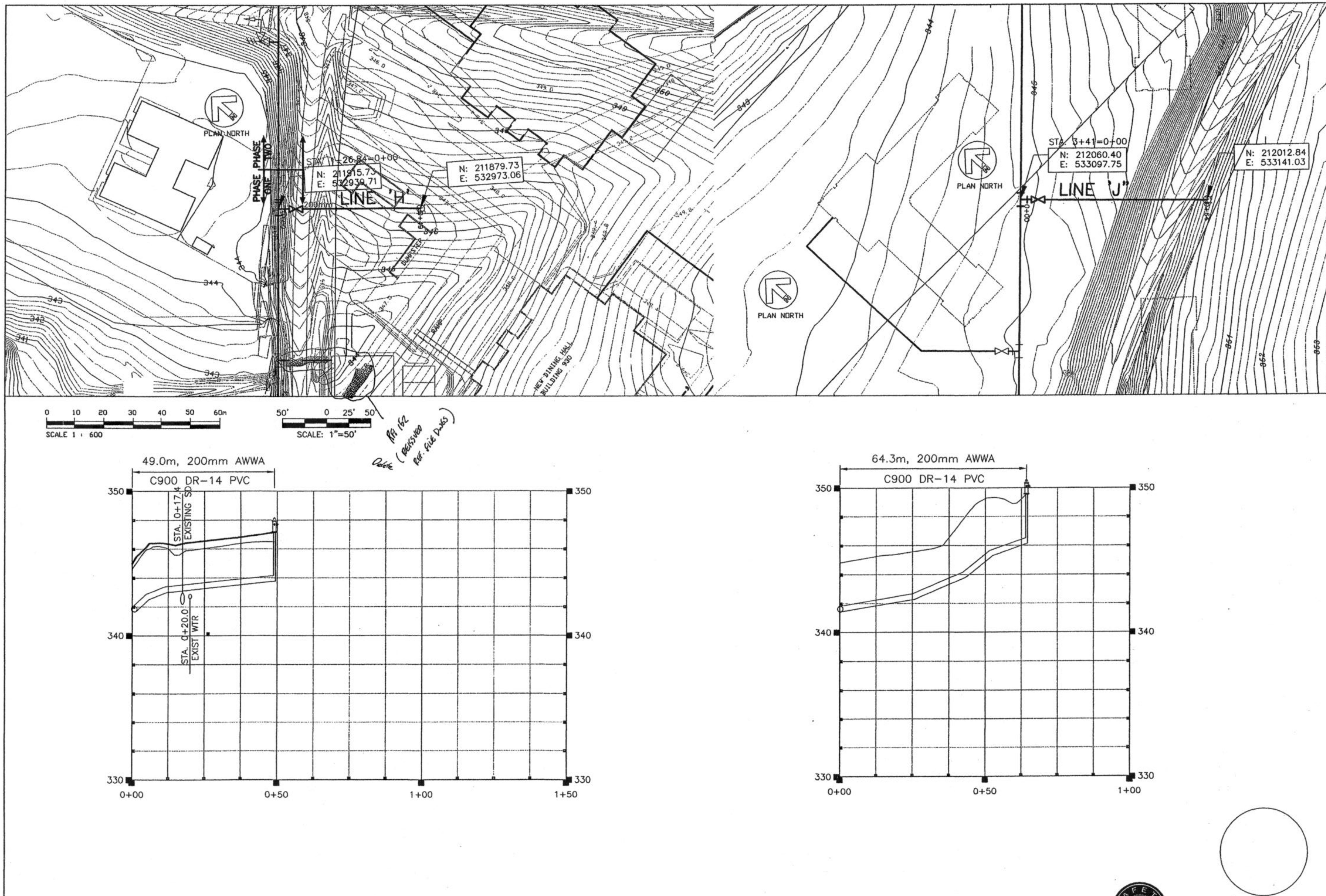

EXISTING 250mm LINE
N: 211828
E: 532884
N: 211847.40
E: 532865.97
N: 211879.73
E: 532973.06
NEW DINING HALL BUILDING 930
LINE 'E'
NEW TRAINEE BARRACKS BUILDING 939
NEW TRAINEE BARRACKS BUILDING 932
N: 211749
E: 533236
EXISTING 250mm LINE
PHASE ONE
PHASE TWO
0 12 24 36 48 60 72m
SCALE 1 : 720
60' 0 30' 60'
SCALE: 1"=60'
360
350
340
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
RM #152 DRAWING REVISIONS
US Army Corps of Engineers Kansas City District
REVISED VALVE LOCATION
8/31
Symbol
Description
Date
Appr.
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
Designed by:
Dwn by:
Ckd by:
Reviewed by:
Submitted by:
Date: AUGUST 2001
Rev. 2
Design file no.
Drawing code:
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
LINE 'E' PLAN AND PROFILE

Section:



PLAN NORTH
EXISTING WTR ALONG SIDE
STA. 1+42.3=0+00
N 211531.31
E 533087.98
LINE 'F'
200mm
LINE 'C'
N 211614.32
E 532989.83
STA. 2+23.5=0+00
N 211588.20
E 533145.80
LINE 'G'
N 211615.88
E 533112.30
LINE 'C'
SCALE 1:720
SCALE: 1"=50'
128.77m, 200mm AWWA C900 DR-14 PVC
43.46m, 200mm AWWA C900 DR-14 PVC
STA. 0+37.8 EXISTING SD
360
350
340
0+00
0+50
1+00
1+50
US Army Corps of Engineers Kansas City District
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
Date: JULY 2001
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
LINES "F" AND "G" PLAN AND PROFILE
Sheet reference number:
WARNING:

Section:



US Army Corps of Engineers
Kansas City District

Date: JULY 2001

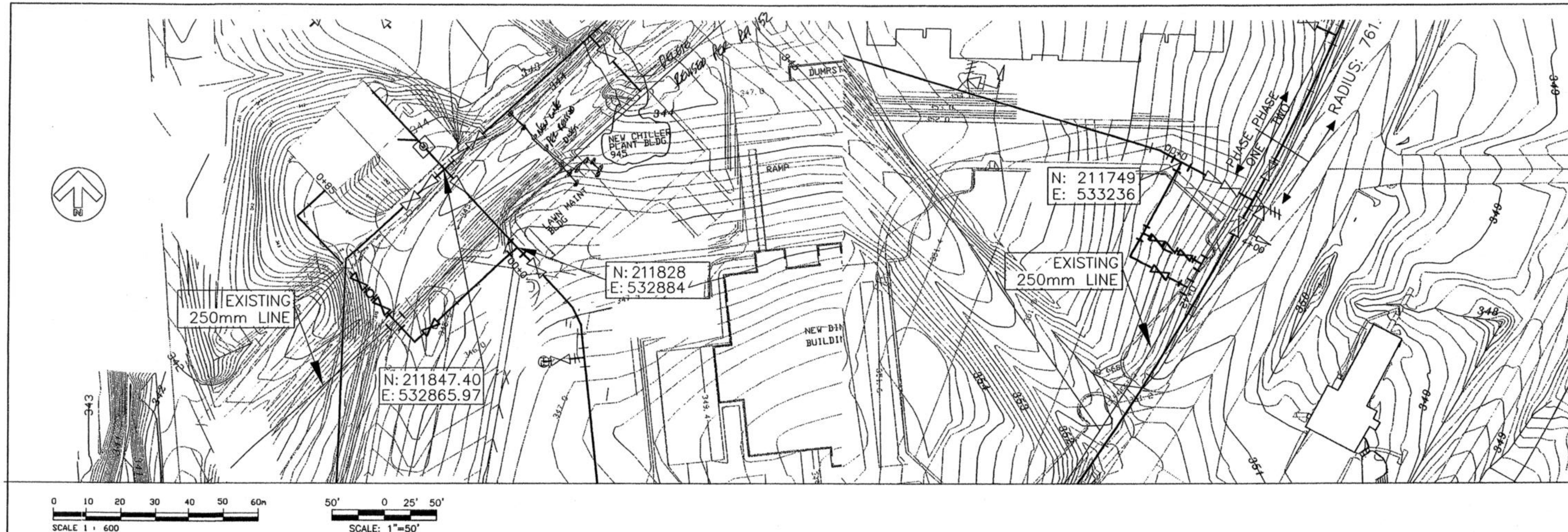
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

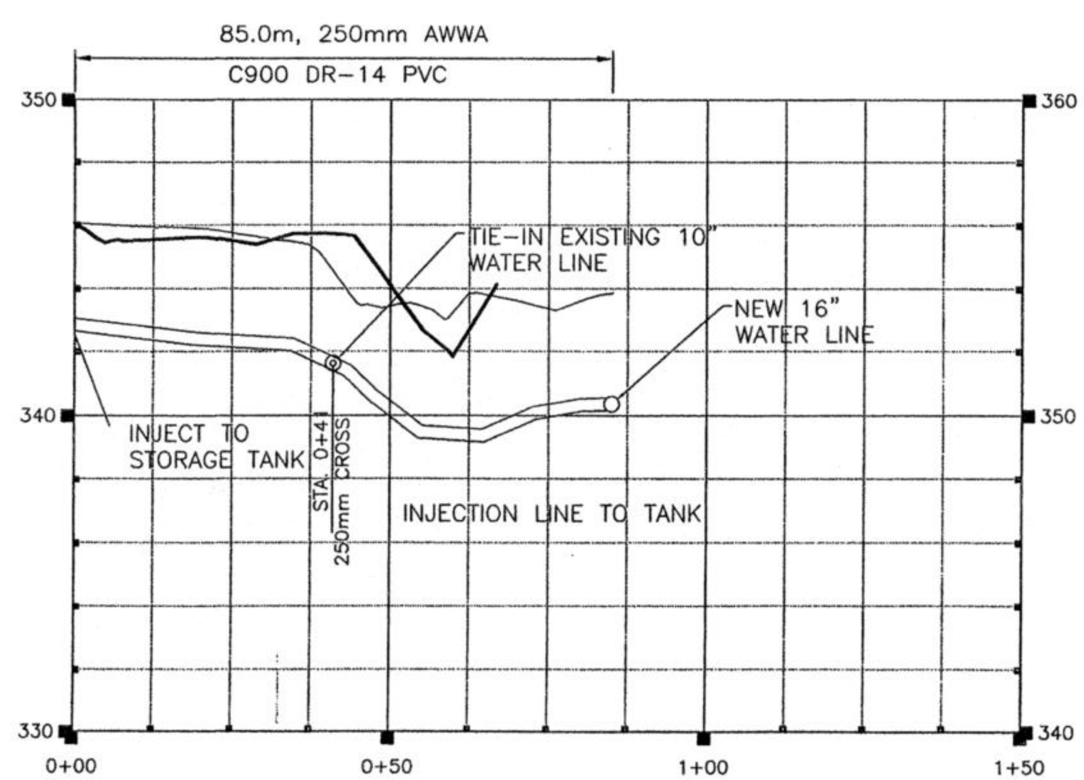
The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
LINES "H" AND "J" PLAN
AND PROFILE

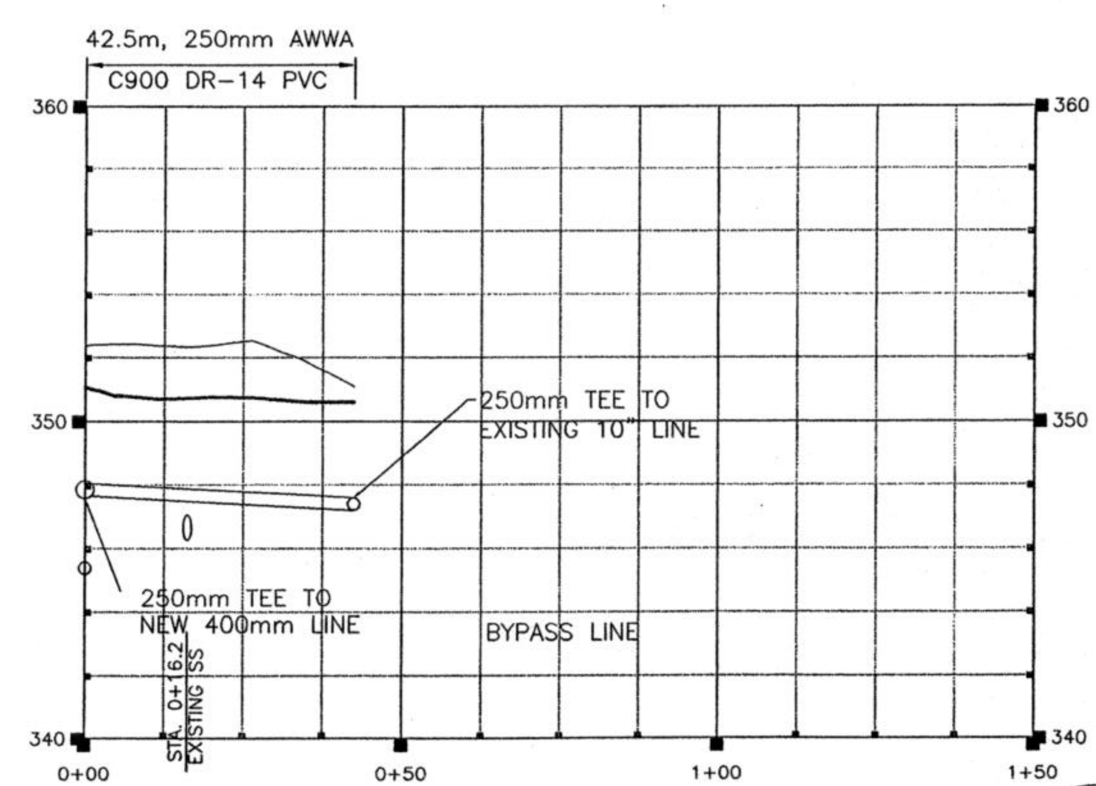
Sheet reference number:

Section:





SUPPLY LINE TO STORAGE TANK
PLAN AND PROFILE
250mm LINE FROM EXISTING 10-INCH
LINE TO STORAGE TANK



CONNETCTION TO IOWA LINE
PLAN AND PROFILE
250mm LINE FROM EXISTING 10-INCH
LINE TO NEW SYSTEM

US Army Corps of Engineers
Kansas City District

Date: JULY 2001

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CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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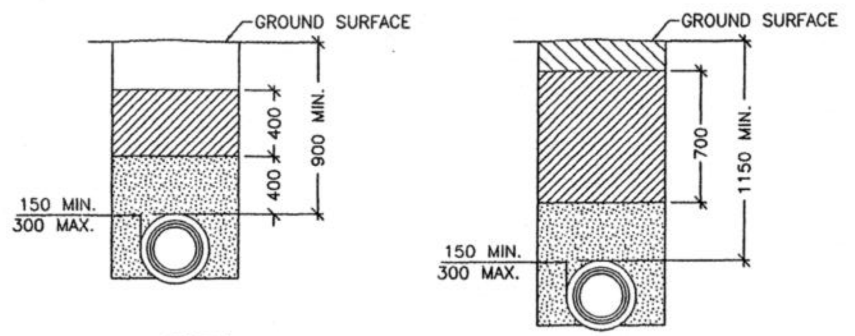
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
LINES "K" AND "M"
PLAN AND PROFILE

Sheet reference number:

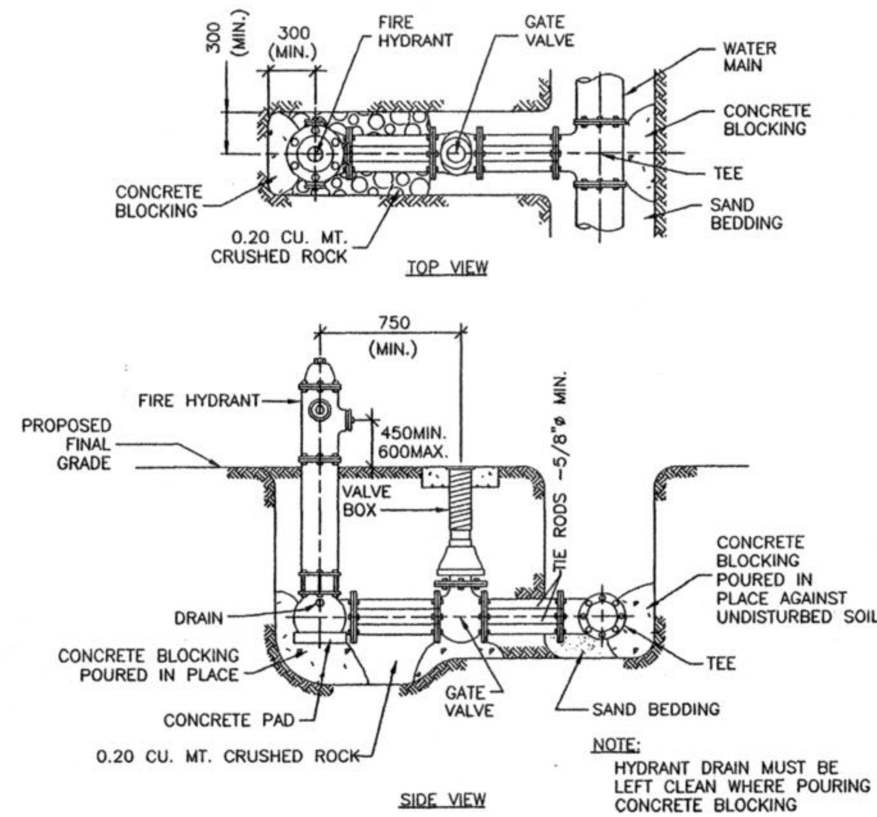
Section:



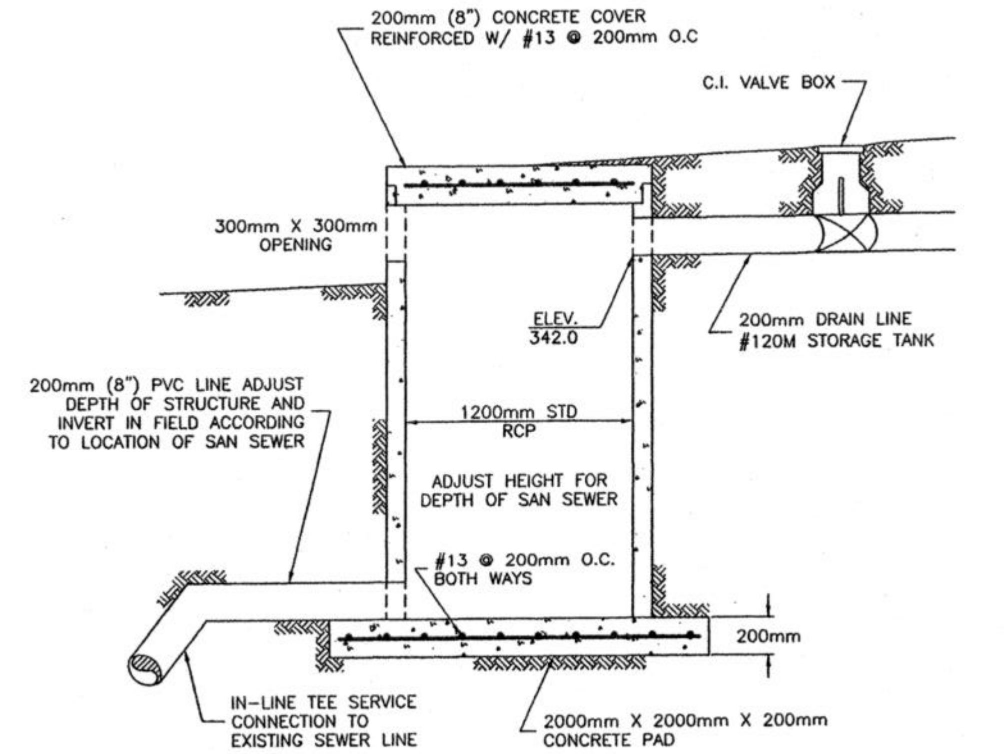
LEGEND

- PAVEMENT
- TOP SOIL
- COMPACTED GRANULAR MATERIAL, CONSISTING OF SAND OR FINE GRAVEL.
- HAND TAMPED BACKFILL, FREE FROM STONES AND DEBRIS, FINELY GRADED.

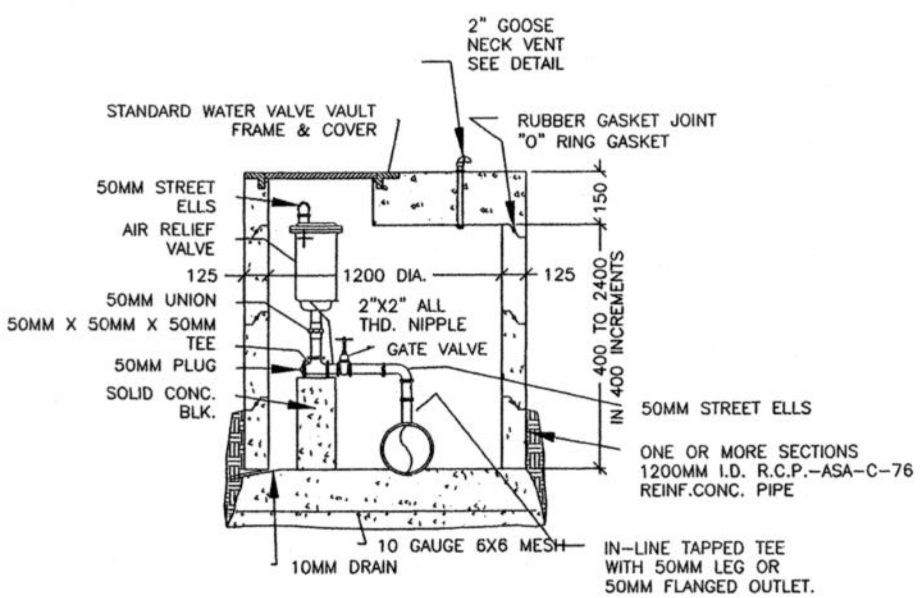
TRENCH CROSS-SECTION



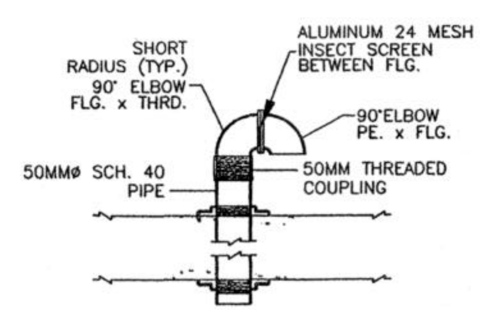
FIRE HYDRANT AND GATE VALVE
NOT TO SCALE



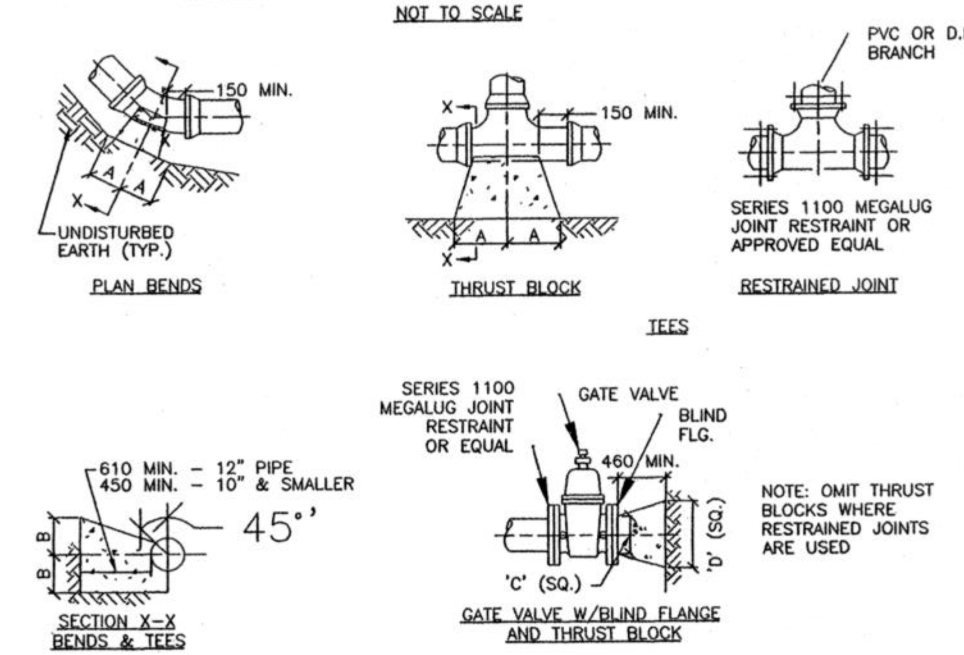
STORAGE TANK AND DRAIN LINE STRUCTURE
NOT TO SCALE



TYPICAL COMBINATION AIR/VACUUM RELIEF VALVE



GOOSE NECK VENT
NOT TO SCALE



SIZE	1/4" BENDS		1/8" BENDS		1/16" BENDS		TEES		PLUGS	
	A	B	A	B	A	B	A	B	C	D
6"	16"	10"	9"	10"	6"	8"	10"	12"	10"	21"
8"	22"	13"	12"	13"	8"	10"	13"	16"	12"	29"
10"	26"	17"	14"	17"	10"	13"	16"	20"	14"	36"
12"	36"	24"	18"	24"	16"	20"	24"	30"	18"	49"

THRUST BLOCKS
FOR USE ON SMALLER DIAMETER UNRESTRAINED PIPAGE
NOT TO SCALE

3 RFI # 415

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	ADDED DRAINAGE STRUCTURES	8/31	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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Date: AUGUST 2001 | Rev. 2
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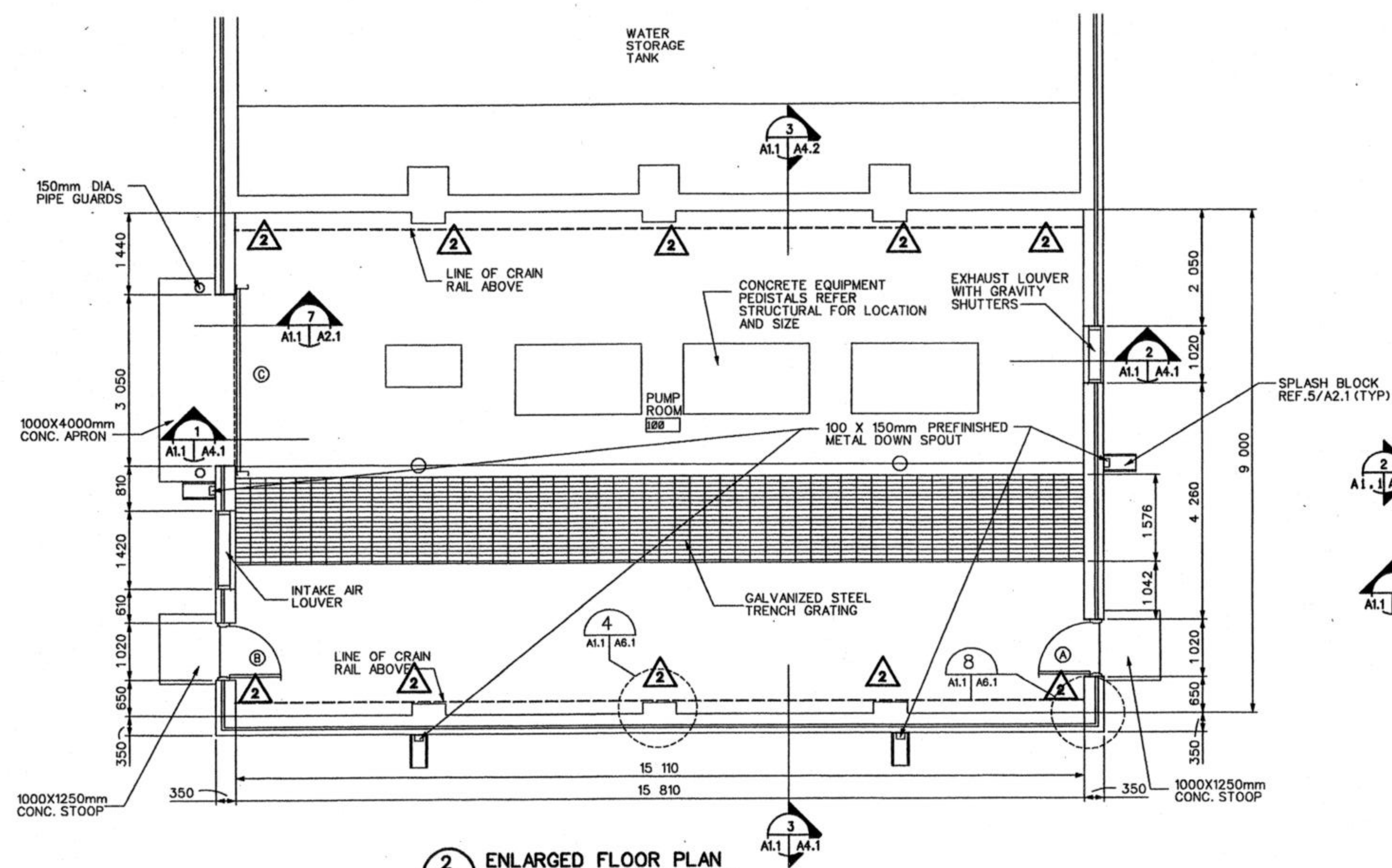
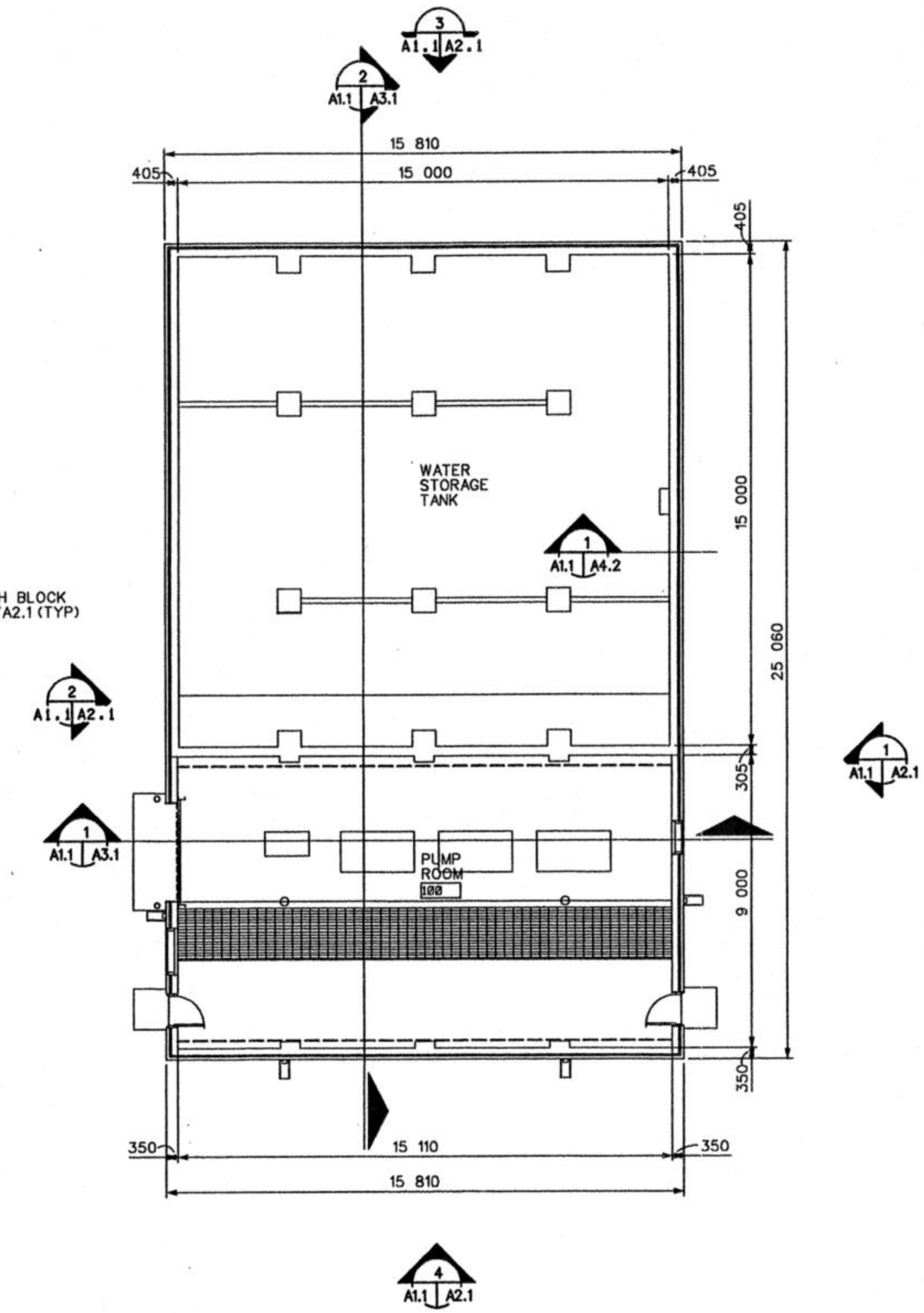
Drawing code:
File name:
Plot date:
Plot scale:

. LEONARD WOOD MISSOURI
SIC COMBAT TRAINEE COMPLEX
47051 FY01
BOOSTER PUMP STATION
DISTRIBUTION LINES
MISCELLANEOUS DETAILS

Section:



2 ENLARGED FLOOR PLAN
A1.1 A1.1 SCALE: 1:50



1 COMPOSITE FLOOR PLAN
A1.1 A1.1 SCALE: 1:100

ROOM FINISH SCHEDULE - BOOSTER PUMP STATION

ROOM NO.	ROOM NAME	FLOOR	BASE	WALLS				WALL FINISH				CEILING			COLOR SCHEME	NOTES
				NORTH	EAST	SOUTH	WEST	NORTH	EAST	SOUTH	WEST	MATL.	FINISH	HEIGHT		
100	PUMP ROOM	CONC.	CMU	CMU	CMU	CMU	CMU	-	-	-	-	CONC	EXP	-		1

KEYED NOTES:

1. CONCRETE FLOOR WILL BE SEALED WITH INCRETE SYSTEMS THREE COAT SYSTEM, COLOR-CRETE.

INTERIOR FINISH CODES	
CMU	CONCRETE MASONRY UNIT
EXP	EXPOSED STRUCTURE
CONC	CONCRETE

0 500mm 1m
SCALE 1:10
0 1 2 3 4 5m

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
1	REVISED PLASTER LAYOUT	8/31/01	

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Date: AUGUST 2001 | Rev.
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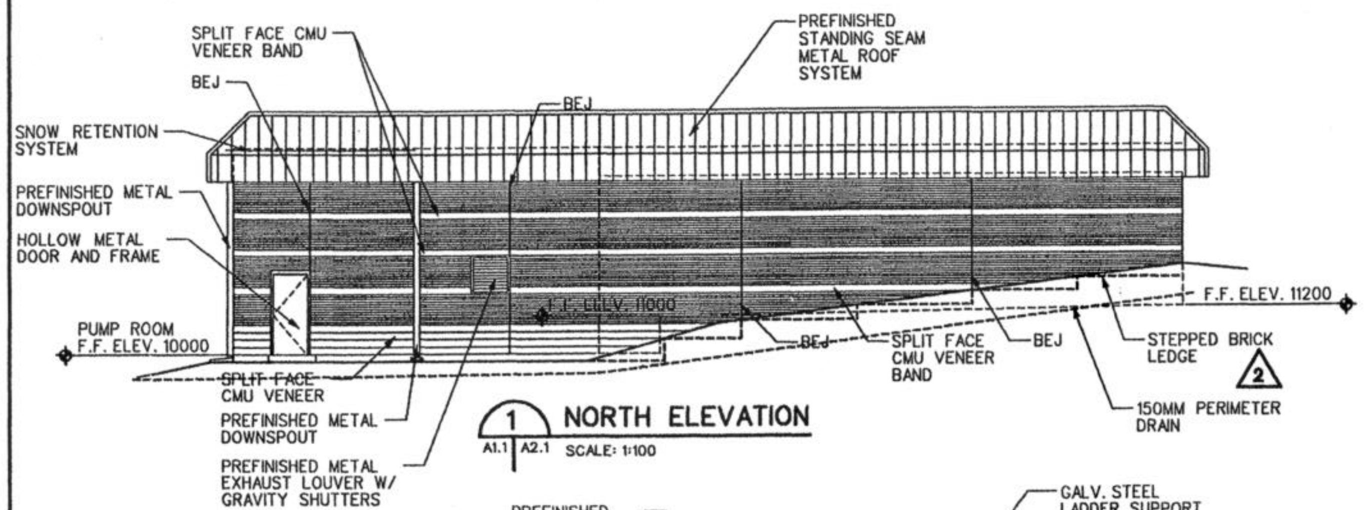
File name: Plot date: Plot scale:

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION

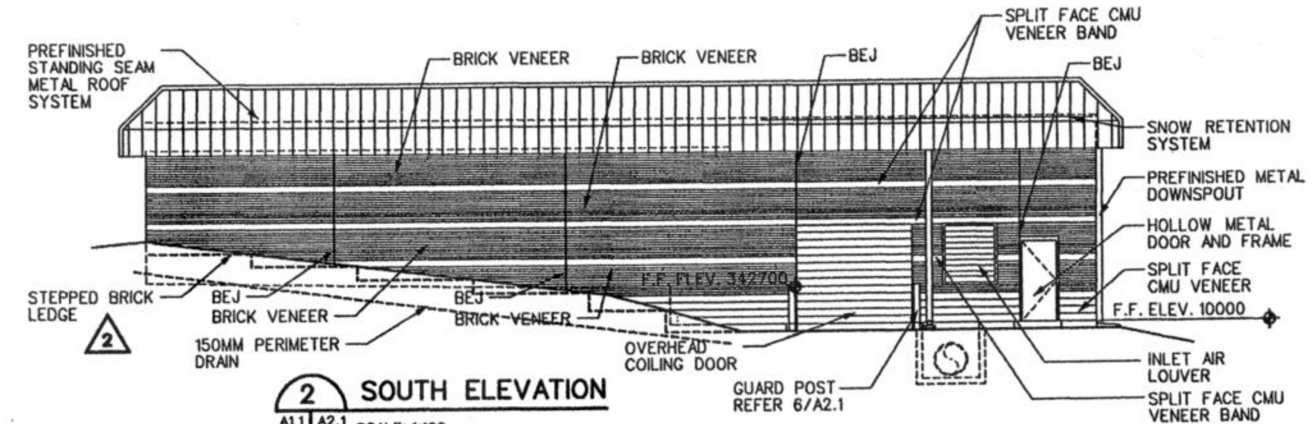
COMPOSITE FLOOR PLAN

Sheet reference

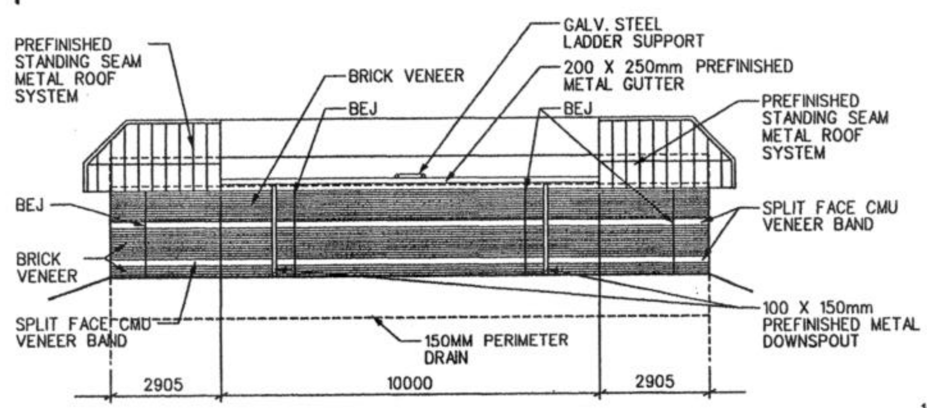
Section:



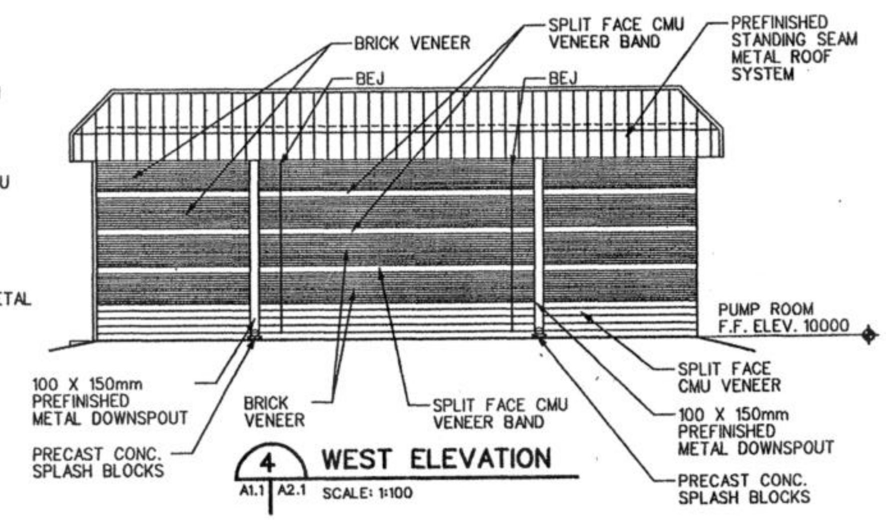
1 NORTH ELEVATION
A1.1 A2.1 SCALE: 1:100



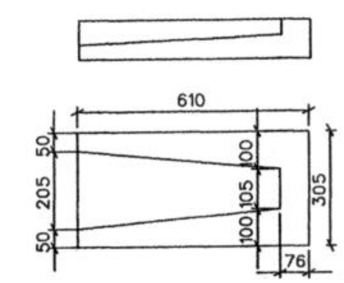
2 SOUTH ELEVATION
A1.1 A2.1 SCALE: 1:100



3 EAST ELEVATION
A1.1 A2.1 SCALE: 1:100



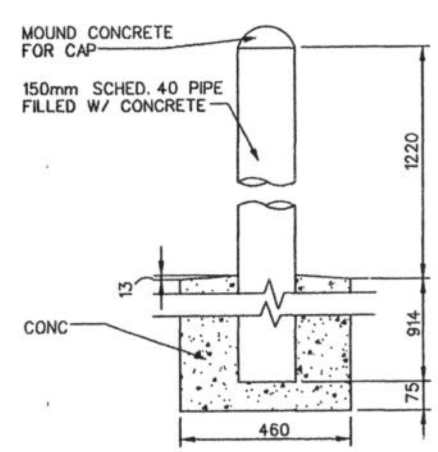
4 WEST ELEVATION
A1.1 A2.1 SCALE: 1:100



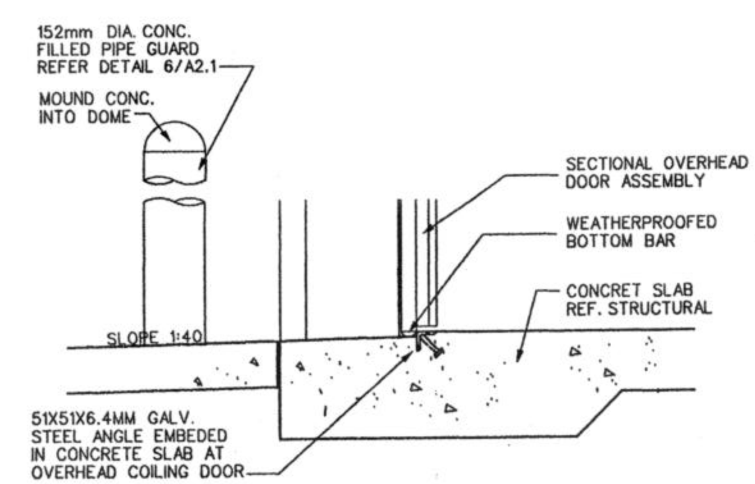
5 SPLASH BLOCK DETAIL
A2.1 A2.1 SCALE: 1:10

EXTERIOR FINISH AND COLOR SCHEDULE 2

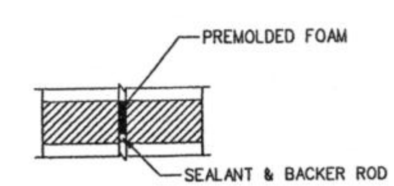
ITEM	MANUFACT.	NAME/COLOR
STANDING SEAM ROOF AND ACCESSORIES	METAL	KYNAR 500 DARK BRONZE
GUTTER, DOWNSPOUTS, LOUVERS, & FASCIA	METAL	KYNAR 500 DARK BRONZE
METAL SOFFIT AND ACCESSORIES-PERFORATED PANELS	METAL	KYNAR 500 COLOR TO MATCH FSC 23578
ALUMINUM ENTRANCE DOOR	ANODIZED ALUMINUM	KAWNEER-ANODIZED, #40 DARK BRONZE
HOLLOW METAL DOOR AND FRAMES	METAL	FACTORY FINISHED: FSC X0045 DARK BROWN
OVERHEAD DOORS AND FRAMES	METAL	FACTORY FINISHED: FSC X0045 DARK BROWN
ALUMINUM WINDOWS	ANODIZED ALUMINUM	DARK BRONZE
SPANDREL WINDOW GLASS	GLAZED GLASS	HEAT STRENGTHENED 6MM BRONZE ANNEALED GLASS WITH OPACIFIER COATING
INSULATED WINDOW GLASS	GLAZED GLASS	LAMINATED 6MM BRONZE ANNEALED GLASS WITH INTERIOR LAMINATED OR TEMPERED CLEAR TRANSLUCENT PATTERNED GLASS
EXTERIOR PARKING LAMP POSTS	METAL	DARK BRONZE
MECHANICAL WALL LOUVERS	ALUMINUM	KYNAR 500 DARK BRONZE
MECHANICAL EQUIPMENT AND EXTERIOR HANDRAILS	STEEL	DARK BRONZE
MECHANICAL ROOF VENTILATORS	ALUMINUM	KYNAR 500 DARK BRONZE
ELECTRICAL TRANSFORMER HOUSING	STEEL	DARK BRONZE
FACE BRICK	BRICK	ACME-EUREKA BRICK #240 VELOUR MODULAR
SOLDIER COURSE BRICK	BRICK	ACME-EUREKA BRICK #240 VELOUR MODULAR
METAL COPING ABOVE BRICK	METAL	KYNAR 500 DARK BRONZE
BRICK MORTAR	MORTAR MIX	LIGHT GREY TO MATCH CAST STONE
CAST STONE	STONE	LIGHT GRAY, MATCH FSC 36622, SUBMIT SAMPLES FOR APPROVAL
SEALANT	SEE SPEC 07900	MATCH DARKEST ADJACENT SURFACE COLOR
BRICK LINTELS (EXPOSED PART OF ANGLE)	STEEL	PAINT COLOR TO MATCH BRICK COLOR
ROOF FLASHING, VENTS, PIPING, ACCESSORIES	METAL	KYNAR 500 DARK BRONZE TO MATCH SSMR
STEEL PIPE BOLLARDS	STEEL	SAFETY YELLOW
EXTERIOR FINISH INSULATING SYSTEM	EIFS	DRYVIT 109 EGGSHELL, TO MATCH FSC 23722, SUBMIT SAMPLES



6 GAURD POST DETAIL
A2.1 A2.1 SCALE: 1:10



7 THRESHOLD AT OVERHEAD COILING DOOR
A2.1 A2.1 SCALE: 1:10



8 BRICK EXPANSION JOINT DETAIL
A2.1 A2.1 SCALE: 1:10

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	REVISE ELEVATIONS/ADD EXTERIOR FINISH AND COLOR SCHEDULE	8/31/01	

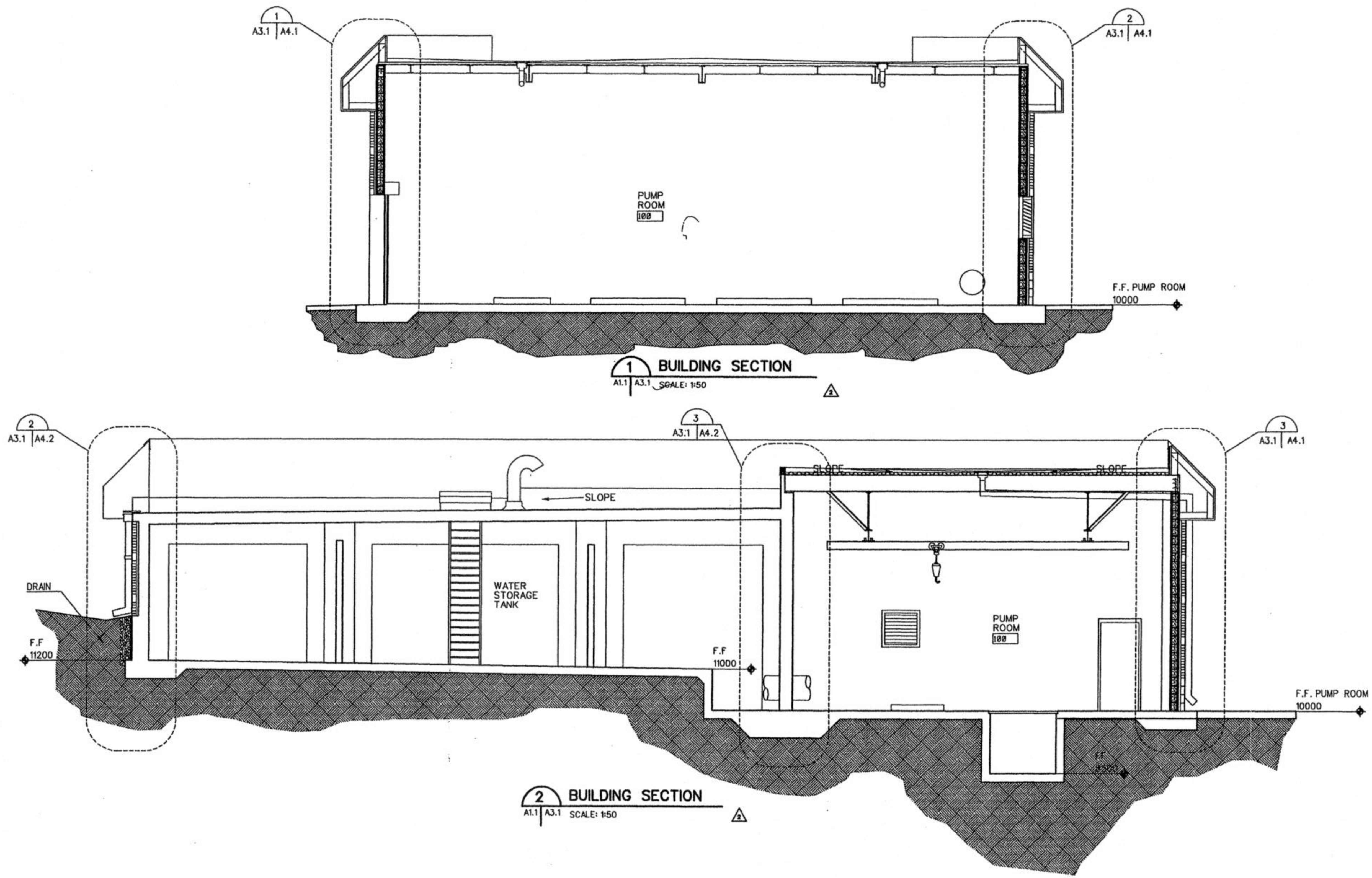
Designed by: | Date: AUGUST 2001 | Rev.
Dwn by: | Ckd by: | Design file no.
Reviewed by: | Drawing code:
Submitted by: | File name: | Plot date: | Plot scale:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group
Architects • Engineers • Planners • Consultants

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
BUILDING ELEVATIONS

Section:



RFI # 645

Turn the 80mm pipe down, provide 150mm nipple on elbow, slide 100mm X 150mm metal downspout up over pipe as high as possible.

US Army Corps of Engineers
Kansas City District

REVISE ROOF STRUCTURE 8/31/01

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

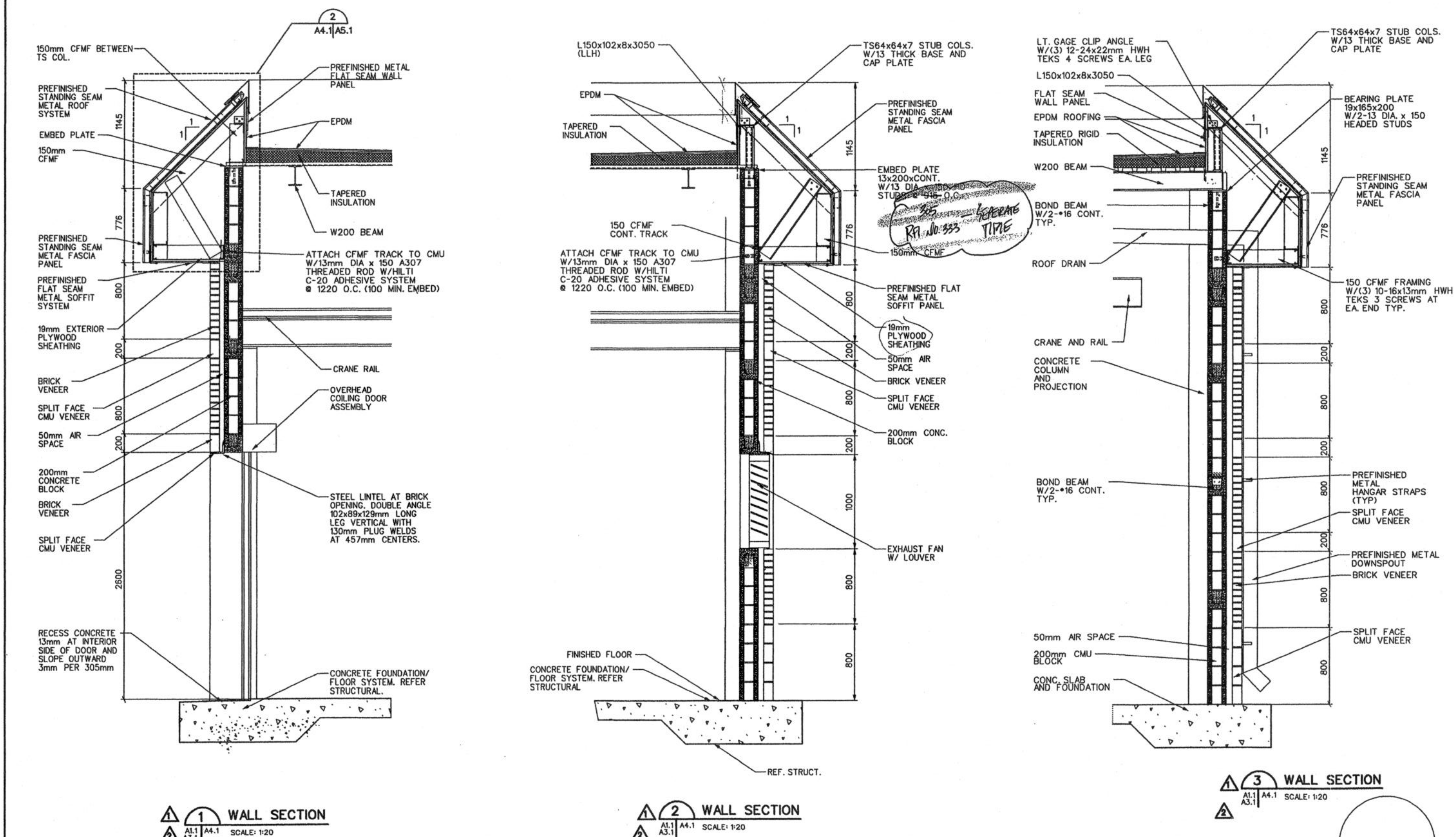
Designed by: | Dwn by: JSH | Ckd by: | Reviewed by: | Submitted by:

Date: AUGUST 2001 | Design file no. | Drawing code:

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
BUILDING SECTIONS

Sheet reference

Section:



1 WALL SECTION
A1.1 A3.1 | A4.1 SCALE: 1:20

2 WALL SECTION
A1.1 A3.1 | A4.1 SCALE: 1:20

3 WALL SECTION
A1.1 A3.1 | A4.1 SCALE: 1:20

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
1	REVISED ROOF STRUCTURE	8/18/01	
2	REVISED DETAIL	8/31/01	

Designed by: | Date: AUGUST 2001 | Rev.
Dwn by: | Ckd by: | Design file no.
Reviewed by: | Drawing code:
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CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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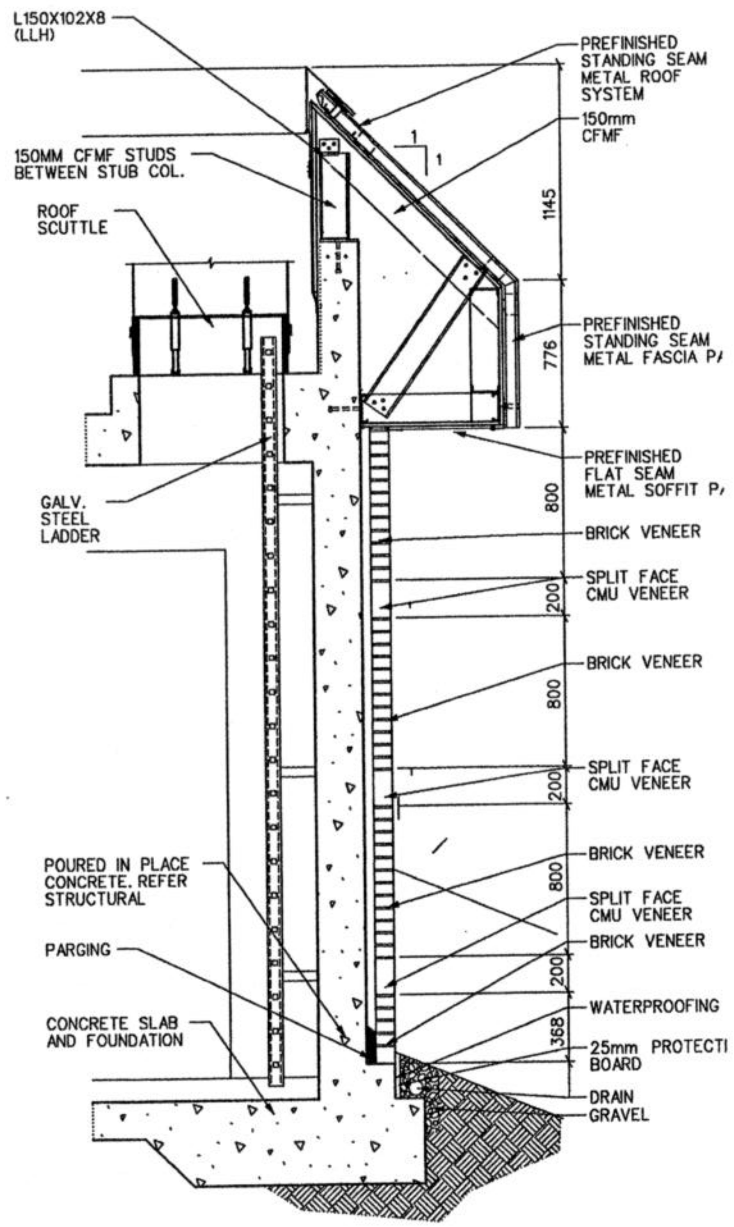
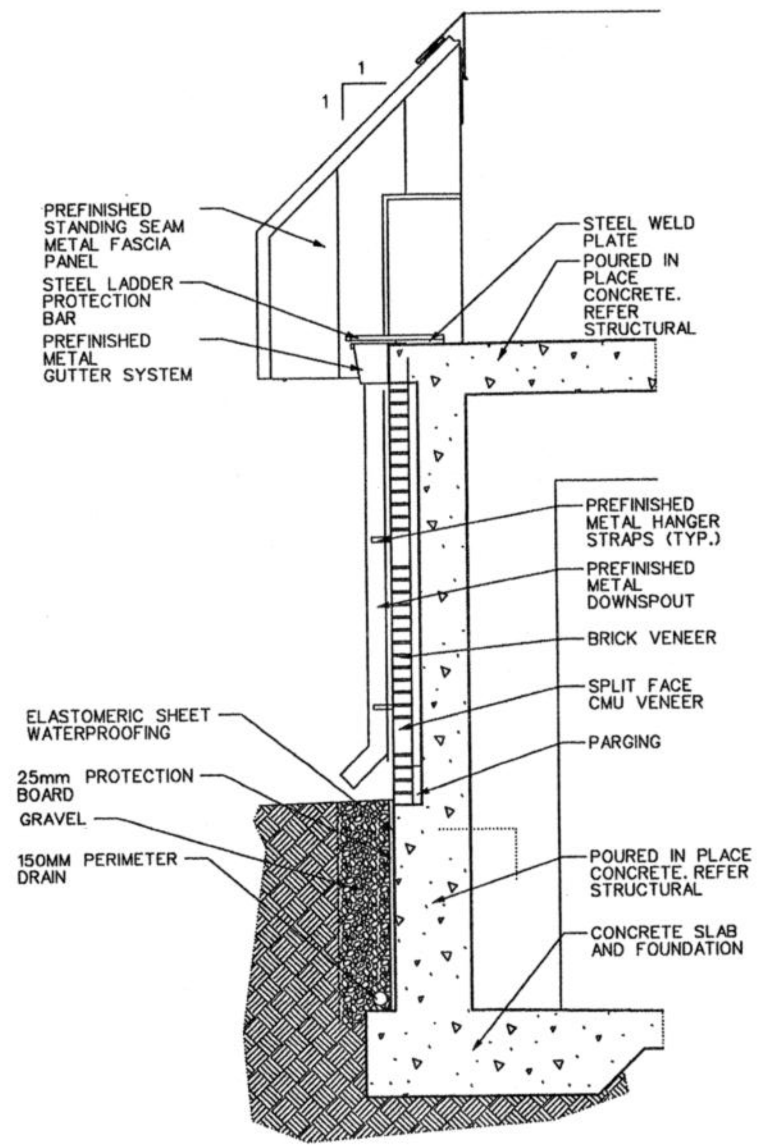
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
WALL SECTIONS

Sheet reference number:

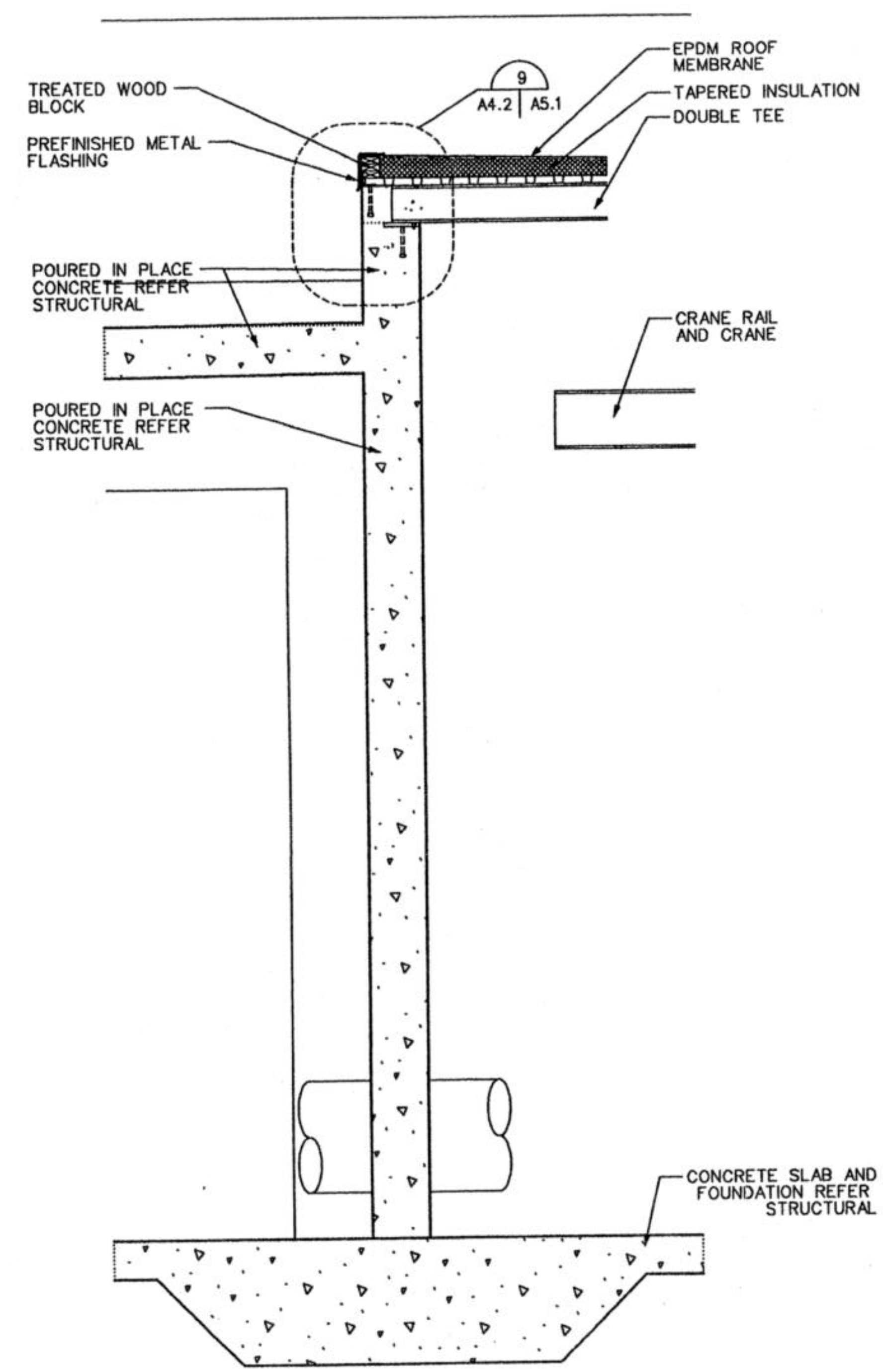
Section:



1 WALL SECTION A1.1 A4.2 SCALE: 1:20



2 WALL SECTION A1.1 A3.1 A4.2 SCALE: 1:20



3 WALL SECTION A1.1 A3.1 A4.2 SCALE: 1:20

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
1	REVISED DETAIL	8/18/01	
2	REVISED ROOF STRUCTURE	8/31/01	

Designed by: | Dwn by: | Ckd by: | Reviewed by: | Submitted by:
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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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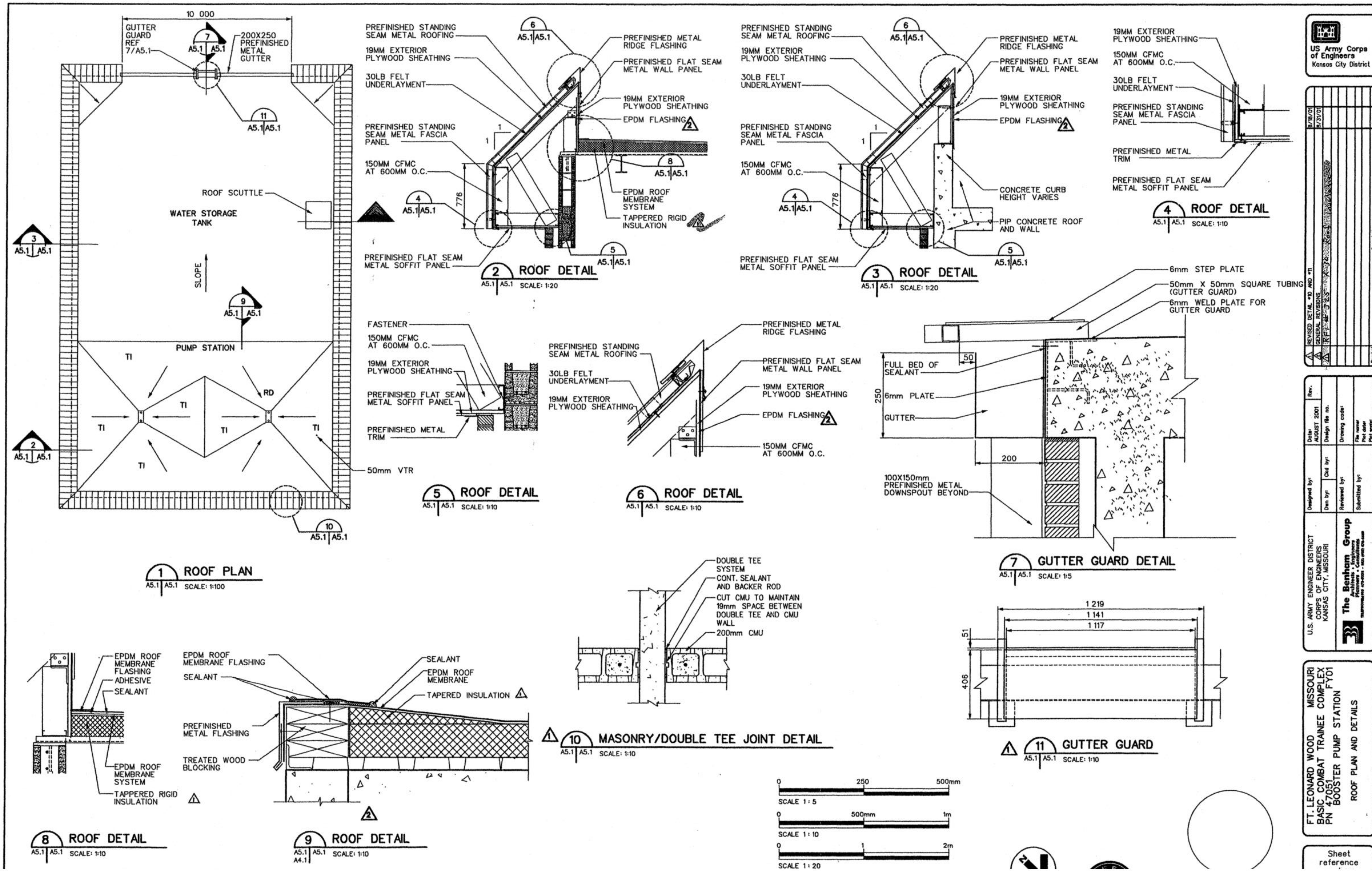
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
WALL SECTIONS

Sheet reference

Section:


10 000
GUTTER GUARD REF 7/A5.1
200X250 PREFINISHED METAL GUTTER
ROOF SCUTTLE
WATER STORAGE TANK
SLOPE
PUMP STATION
TI
RD
50mm VTR
1 ROOF PLAN A5.1 A5.1 SCALE: 1:100
PREFINISHED STANDING SEAM METAL ROOFING
19MM EXTERIOR PLYWOOD SHEATHING
30LB FELT UNDERLAYMENT
PREFINISHED STANDING SEAM METAL FASCIA PANEL
150MM CFMC AT 600MM O.C.
PREFINISHED FLAT SEAM METAL SOFFIT PANEL
PREFINISHED METAL RIDGE FLASHING
PREFINISHED FLAT SEAM METAL WALL PANEL
EPDM FLASHING
EPDM ROOF MEMBRANE SYSTEM
TAPERED RIGID INSULATION
776
2 ROOF DETAIL A5.1 A5.1 SCALE: 1:20
CONCRETE CURB HEIGHT VARIES
PIP CONCRETE ROOF AND WALL
3 ROOF DETAIL A5.1 A5.1 SCALE: 1:20
19MM EXTERIOR PLYWOOD SHEATHING
150MM CFMC AT 600MM O.C.
30LB FELT UNDERLAYMENT
PREFINISHED STANDING SEAM METAL FASCIA PANEL
PREFINISHED METAL TRIM
PREFINISHED FLAT SEAM METAL SOFFIT PANEL
4 ROOF DETAIL A5.1 A5.1 SCALE: 1:10
FASTENER
150MM CFMC AT 600MM O.C.
19MM EXTERIOR PLYWOOD SHEATHING
PREFINISHED FLAT SEAM METAL SOFFIT PANEL
PREFINISHED METAL TRIM
5 ROOF DETAIL A5.1 A5.1 SCALE: 1:10
PREFINISHED STANDING SEAM METAL ROOFING
30LB FELT UNDERLAYMENT
19MM EXTERIOR PLYWOOD SHEATHING
PREFINISHED METAL RIDGE FLASHING
PREFINISHED FLAT SEAM METAL WALL PANEL
19MM EXTERIOR PLYWOOD SHEATHING
EPDM FLASHING
150MM CFMC AT 600MM O.C.
6 ROOF DETAIL A5.1 A5.1 SCALE: 1:10
6mm STEP PLATE
50mm X 50mm SQUARE TUBING (GUTTER GUARD)
6mm WELD PLATE FOR GUTTER GUARD
FULL BED OF SEALANT
6mm PLATE
GUTTER
50
250
200
100X150mm PREFINISHED METAL DOWNSPOUT BEYOND
7 GUTTER GUARD DETAIL A5.1 A5.1 SCALE: 1:5
DOUBLE TEE SYSTEM
CONT. SEALANT AND BACKER ROD
CUT CMU TO MAINTAIN 19mm SPACE BETWEEN DOUBLE TEE AND CMU WALL
200mm CMU
10 MASONRY/DOUBLE TEE JOINT DETAIL A5.1 A5.1 SCALE: 1:10
1 219
1 141
1 117
51
406
11 GUTTER GUARD A5.1 A5.1 SCALE: 1:10
EPDM ROOF MEMBRANE FLASHING
ADHESIVE
SEALANT
EPDM ROOF MEMBRANE SYSTEM
TAPPERED RIGID INSULATION
8 ROOF DETAIL A5.1 A5.1 SCALE: 1:10
EPDM ROOF MEMBRANE FLASHING
SEALANT
PREFINISHED METAL FLASHING
TREATED WOOD BLOCKING
EPDM ROOF MEMBRANE
TAPERED INSULATION
9 ROOF DETAIL A5.1 A5.1 A4.1 SCALE: 1:10
0 250 500mm SCALE 1:5
0 500mm 1m SCALE 1:10
0 1 2m SCALE 1:20
US Army Corps of Engineers Kansas City District
REVISED DETAIL #10 AND #11
GENERAL REVISIONS
Symbol
Description
Date
Appr.
Designed by:
Dwn by:
Ckd by:
Reviewed by:
Submitted by:
Date: AUGUST 2001
Design file no.
Drawing code:
File name:
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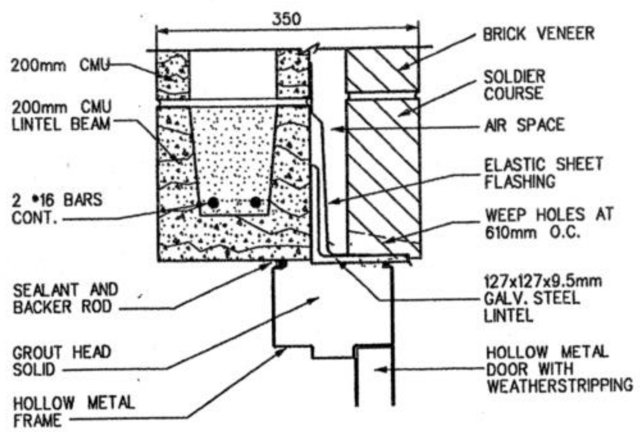
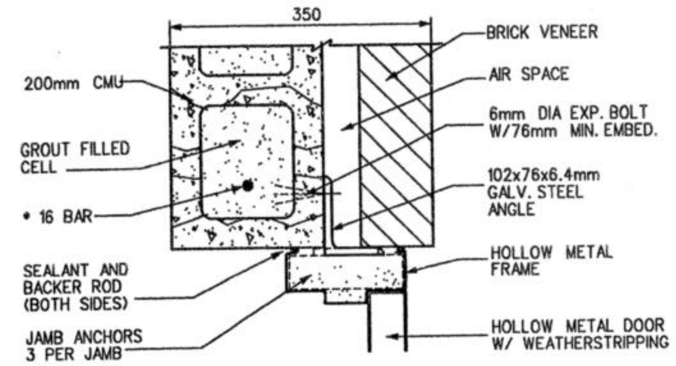
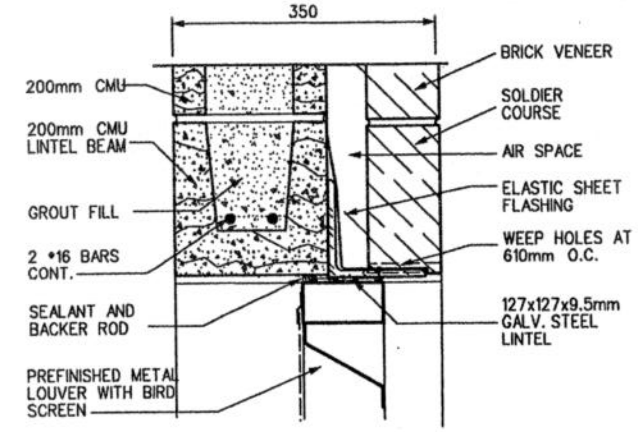
Rev.
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
ROOF PLAN AND DETAILS
Sheet reference



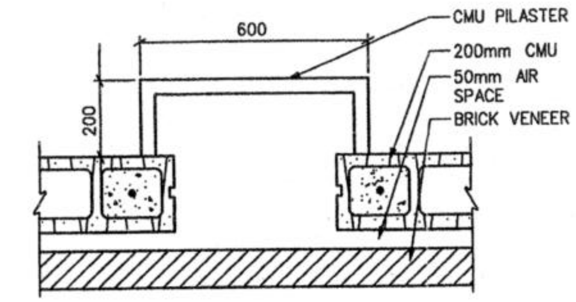
1 HEAD DETAIL
A6.1 | A6.1 SCALE: 1:5



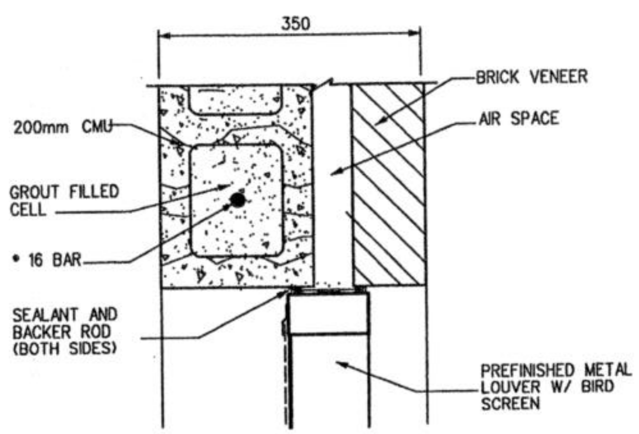
2 JAMB DETAIL
A6.1 | A6.1 SCALE: 1:5



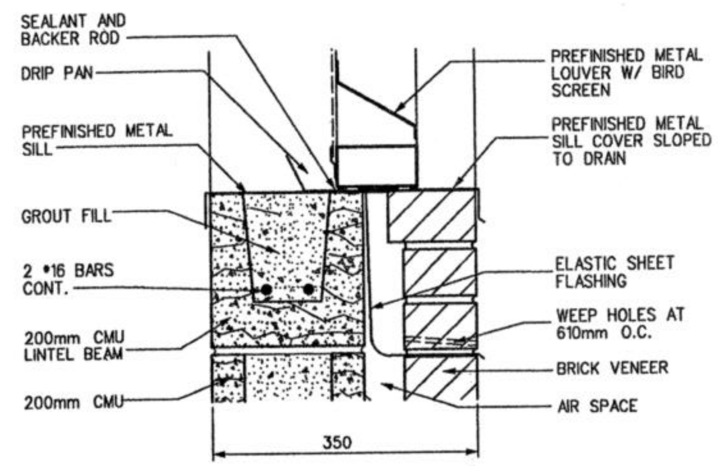
3 HEAD DETAIL
A6.1 | A6.1 SCALE: 1:5



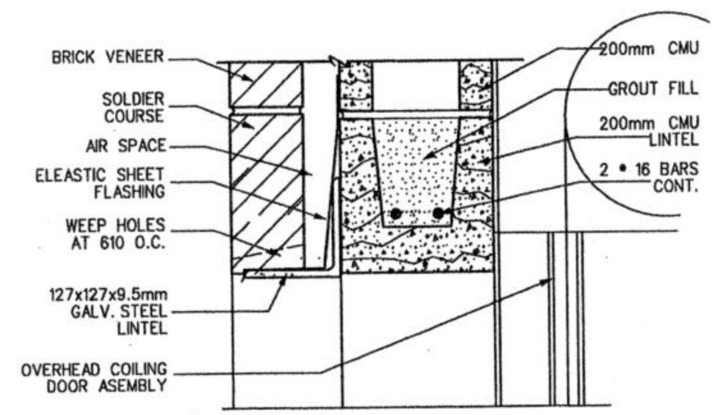
4 COLUMN DETAIL (TYPICAL) 2
A6.1 | A1.1 SCALE: 1:10



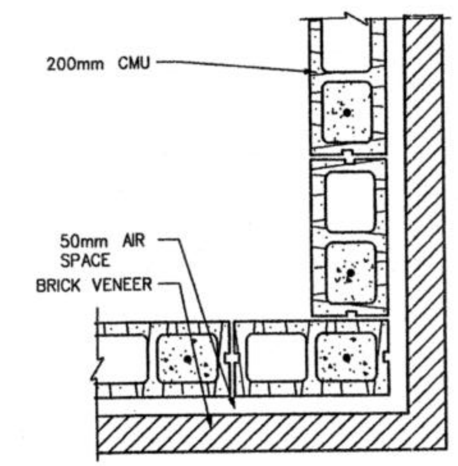
5 JAMB DETAIL
A6.1 | A6.1 SCALE: 1:5



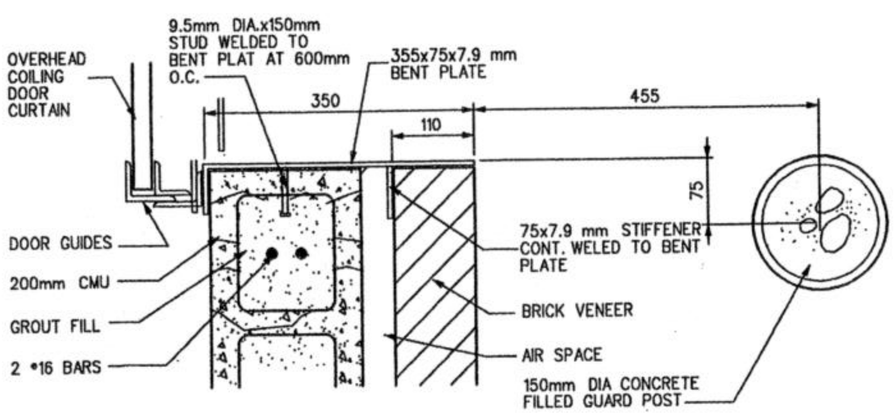
6 SILL DETAIL
A6.1 | A6.1 SCALE: 1:5



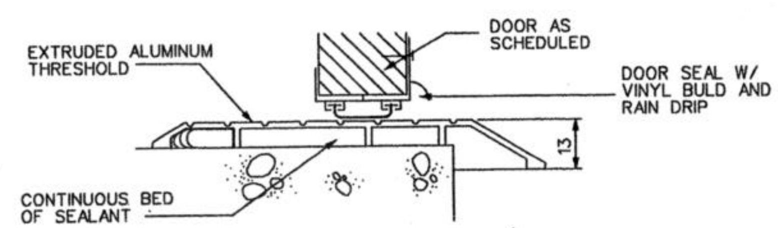
7 HEAD DETAIL
A6.1 | A6.1 SCALE: 1:5



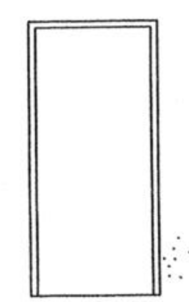
8 COLUMN DETAIL 2
A6.1 | A1.1 SCALE: 1:10



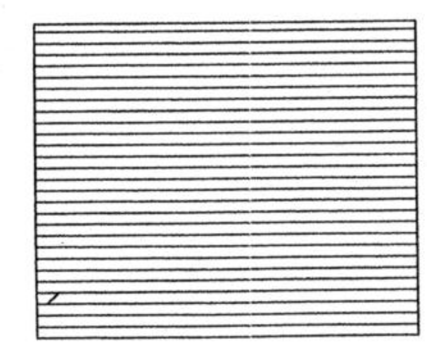
9 JAMB DETAIL
A6.1 | A6.1 SCALE: 1:5



10 THRESHOLD DETAIL
A6.1 | A6.1 SCALE: NONE



TYPE (A)
H. M. DOOR



TYPE (B)
STEEL OVER HEAD COILING DOOR

DOOR SCHEDULE - BOOSTER PUMP STATION

DOOR NO.	SIZE	DOOR TYPE	DOOR MAT'L	FIRE RATING	HARDWR SET	DETAILS HEAD	DETAILS JAMB	DETAILS THRESH	NOTES
100A	914 x 2134 x 45	A	HM	-	1	1/A6.1	2/A6.1	8/A6.1	-

NOTE 1: ALL HARWARE BY DOOR SUPPLIER

HARDWARE SET NO. 1

3 EA. HINGES	A5111
1 EA. LOCKSET	F13
1 EA. CLOSER	C02061 X PT4G

0 250 500mm
SCALE 1:5

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	REVISED DETAIL 4 AND 8	8/3/01	

Designed by: | Date: AUGUST 2001 | Rev.
Dwn by: | Ckd by: | Design file no.
Reviewed by: | Drawing code:
Submitted by: | File name: | Plot date: | Plot scale:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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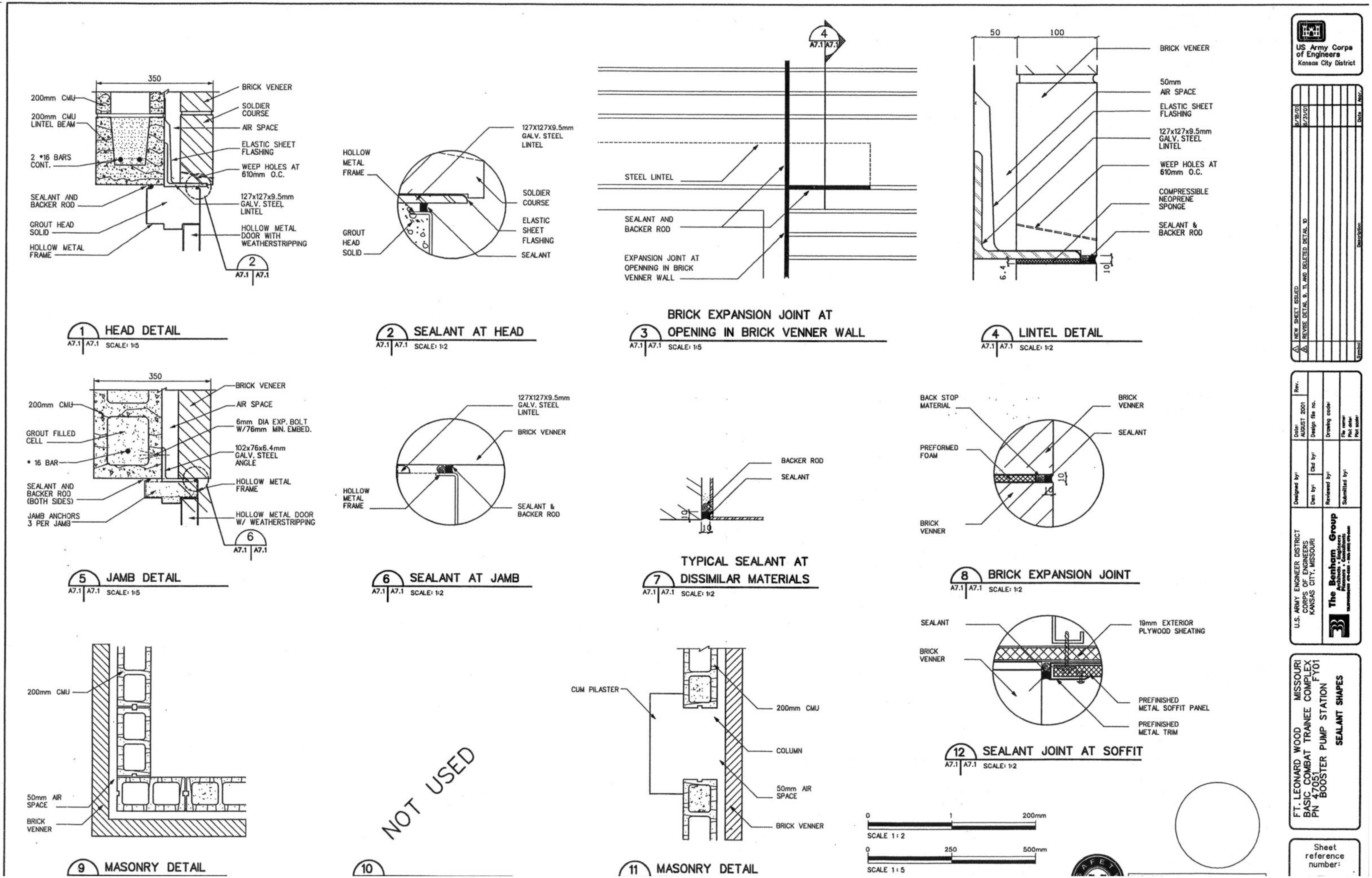
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
DOOR DETAILS

Sheet reference number:

Section:


350
200mm CMU
200mm CMU LINTEL BEAM
2 #16 BARS CONT.
SEALANT AND BACKER ROD
GROUT HEAD SOLID
HOLLOW METAL FRAME
BRICK VENEER
SOLDIER COURSE
AIR SPACE
ELASTIC SHEET FLASHING
WEEP HOLES AT 610mm O.C.
127x127x9.5mm GALV. STEEL LINTEL
HOLLOW METAL DOOR WITH WEATHERSTRIPPING
2 A7.1 A7.1
1 HEAD DETAIL
A7.1 A7.1 SCALE: 1:5
HOLLOW METAL FRAME
GROUT HEAD SOLID
127X127X9.5mm GALV. STEEL LINTEL
SOLDIER COURSE
ELASTIC SHEET FLASHING
SEALANT
2 SEALANT AT HEAD
A7.1 A7.1 SCALE: 1:2
4 A7.1 A7.1
STEEL LINTEL
SEALANT AND BACKER ROD
EXPANSION JOINT AT OPENNING IN BRICK VENNER WALL
3 BRICK EXPANSION JOINT AT OPENING IN BRICK VENNER WALL
A7.1 A7.1 SCALE: 1:5
50
100
BRICK VENEER
50mm AIR SPACE
ELASTIC SHEET FLASHING
127x127x9.5mm GALV. STEEL LINTEL
WEEP HOLES AT 610mm O.C.
COMPRESSIBLE NEOPRENE SPONGE
SEALANT & BACKER ROD
6.4
10
4 LINTEL DETAIL
A7.1 A7.1 SCALE: 1:2
350
200mm CMU
GROUT FILLED CELL
16 BAR
SEALANT AND BACKER ROD (BOTH SIDES)
JAMB ANCHORS 3 PER JAMB
BRICK VENEER
AIR SPACE
6mm DIA EXP. BOLT W/76mm MIN. EMBED.
102x76x6.4mm GALV. STEEL ANGLE
HOLLOW METAL FRAME
HOLLOW METAL DOOR W/ WEATHERSTRIPPING
6 A7.1 A7.1
5 JAMB DETAIL
A7.1 A7.1 SCALE: 1:5
127X127X9.5mm GALV. STEEL LINTEL
BRICK VENNER
HOLLOW METAL FRAME
SEALANT & BACKER ROD
6 SEALANT AT JAMB
A7.1 A7.1 SCALE: 1:2
BACKER ROD
SEALANT
10
10
7 TYPICAL SEALANT AT DISSIMILAR MATERIALS
A7.1 A7.1 SCALE: 1:2
BACK STOP MATERIAL
PREFORMED FOAM
BRICK VENNER
BRICK VENNER
SEALANT
10
10
8 BRICK EXPANSION JOINT
A7.1 A7.1 SCALE: 1:2
SEALANT
BRICK VENNER
19mm EXTERIOR PLYWOOD SHEATING
PREFINISHED METAL SOFFIT PANEL
PREFINISHED METAL TRIM
12 SEALANT JOINT AT SOFFIT
A7.1 A7.1 SCALE: 1:2
200mm CMU
50mm AIR SPACE
BRICK VENNER
9 MASONRY DETAIL
NOT USED
10
CUM PILASTER
200mm CMU
COLUMN
50mm AIR SPACE
BRICK VENNER
11 MASONRY DETAIL
0 1 200mm
SCALE 1:2
0 250 500mm
SCALE 1:5
US Army Corps of Engineers Kansas City District
NEW SHEET ISSUED 8/18/01
REVISE DETAIL 9, 11, AND DELETED DETAIL 10 8/31/01
Symbol Description Date Appr.
Date: AUGUST 2001
Rev.
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
SEALANT SHAPES
Sheet reference number:

DESIGN CRITERIA

1. GRAVITY LOADS IN ACCORDANCE WITH TI 809-02, "STRUCTURAL DESIGN CRITERIA FOR BUILDINGS" (1 SEPT 1999) AND ASCE 7-95, "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES"

LOCATION	UNIFORM LIVE LOAD*	CONCENTRATED LIVE LOAD**
MECHANICAL ROOMS	7.18 kPa (150 PSF)	8.90 kN (2000 LB.)
ROOF (MINIMUM)	0.96 kPa (20 PSF)	----------

ROOF LIVE LOAD IS NOT REDUCED. FLOOR LIVE LOADS ARE REDUCED IN ACCORDANCE WITH ASCE 7-95, "MINIMUM DESIGN LOADS FOR FOR BUILDINGS AND OTHER STRUCTURES".

2. SNOW LOAD IN ACCORDANCE WITH TI 809-01, "LOAD ASSUMPTIONS FOR BUILDINGS" (3 AUGUST 1998, UPDATED 30 AUGUST 1999) AND ASCE 7-95, "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES"

GROUND ROOF SNOW LOAD	Pg = 0.96 kPa	(FLW, 20 PSF)
TERRAIN CATEGORY	C	(ASCE 6.5.3)
SNOW EXPOSURE FACTOR	Ce = 1.0	(ASCE TABLE 7-2, PARTIALLY EXPOSED)
SNOW THERMAL FACTOR	Ct = 1.0	(ASCE TABLE 7-3, ALL STRUCTURES U.N.O.)
SNOW IMPORTANCE FACTOR	I = 1.0	(ASCE TABLE 7-4, CATEGORY II)
FLAT ROOF SNOW LOAD	Pf = 1.05 kPa	(PF=0.7CeCtIPg OR Ipg)
ROOF SLOPE FACTOR	Cs = 1.0	(ASCE FIG. 7.2 WARM ROOF)

RAIN-ON-SNOW LOAD OF 0.24 kPa (5 PSF) APPLIED IN ACCORDANCE WITH ASCE 7-95 AND KCD-SDDC.

3. LATERAL LOADS -

A. WIND LOAD IN ACCORDANCE WITH TI 809-01, "LOAD ASSUMPTIONS FOR BUILDINGS" (3 AUGUST 1998, UPDATED 30 AUGUST 1999) AND ASCE 7-95, "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES"

BASIC WIND SPEED	V = 40.2 M/sec	(90 MPH)
WIND IMPORTANCE FACTOR	I = 1.10	(CATEGORY III)
WIND EXPOSURE CATEGORY	C	
INTERNAL PRESSURE COEFF	GCpI = +/-0.18	(ALL BLDGS U.N.O.)

B. SEISMIC LOAD IN ACCORDANCE WITH TI 809-04 "SEISMIC DESIGN FOR BUILDINGS" (31 DECEMBER 1998) -

2. STATIC ANALYSIS CRITERIA -

SEISMIC USE GROUP	1
GROUND MOTION	A
SPECTRAL RESPONSE COEFFICIENT	Ss = 0.27 (PER BASE)
SPECTRAL RESPONSE COEFFICIENT	S1 = 0.13 (PER BASE)
SITE CLASSIFICATION	D
SEISMIC DESIGN CATEGORY	C

3. NO ALLOWANCE MADE FOR FUTURE EXTENSIONS OR ADDITIONS.

4. LOAD COMBINATIONS -

A. LOAD COMBINATIONS IN ACCORDANCE WITH ASCE 7-95, "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES" AND TI 809-04 "SEISMIC DESIGN FOR BUILDINGS" (31 DECEMBER 1998) AND USED IN COMBINATION WITH "AISC SPECIFICATIONS, NINTH EDITION" AND "ACI 318-95".

SOIL PREPARATION AND FOUNDATIONS

1. ALL EXCAVATION, FILL, COMPACTION AND GRADING OF THE SITE SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS AND THE RECOMMENDATIONS CONTAINED IN THE GEOTECHNICAL REPORT.

2. SOIL SUPPORTED FOUNDATIONS -

A. DESIGN BEARING PRESSURE (NET) IS 95 kPa (2000 PSF) FOR CONTINUOUS FOOTINGS AND 120 kPa (2500 PSF) FOR INDIVIDUAL SPREAD FOOTINGS BEARING ON UNDISTURBED FIRM SOIL OR APPROVED ENGINEERED FILL MATERIAL. BEARING MATERIALS SHALL BE VERIFIED BY A LICENSED GEOTECHNICAL ENGINEER.

B. ALL FOUNDATIONS ARE DESIGNED WITH AND SHALL HAVE FORMED SIDES.

C. FOUNDATION REINFORCING SHALL BE SUPPORTED FROM ABOVE OR WITH 75mm SBP (CONT. BOTTOM PLATE) AT 1220mm ON CENTER (MAX.) WHILE DEPOSITING CONCRETE IN FORMS.

D. MOISTURE CONTENT IN FOOTING EXCAVATIONS SHALL BE MAINTAINED UNTIL FOOTINGS ARE PLACED. FOOTINGS SHALL BE POURED AS SOON AS PRACTICAL AFTER EXCAVATIONS ARE COMPLETED.

3. DO NOT BACKFILL FOUNDATION WALLS UNTIL THE RESTRAINING SLABS OR ADEQUATE BRACING ARE IN PLACE. ALL BACKFILL SHALL BE PLACED AND COMPACTED IN ACCORDANCE WITH THE SPECIFICATIONS.

4. EXTERIOR SLABS SHALL SLOPE AWAY FROM THE STRUCTURE A MINIMUM

CAST-IN-PLACE CONCRETE -

1. ALL STRUCTURAL CONCRETE HAS BEEN DESIGNED IN ACCORDANCE WITH ACI 318-95 AND THE BUILDING CODE.

2. THE CONCRETE REQUIREMENTS ARE -

A. 28 DAY CONCRETE COMPRESSIVE STRENGTHS -

LOCATION	MINIMUM F'c MPa	UNIT WEIGHT kg/m^3	W/C RATIO
FOUNDATIONS	27.58 (4000 PSI)	2403 (150 PCF)	0.50
INT. SLAB-ON-GRADE	27.58 (4000 PSI)	2403 (150 PCF)	0.50
TANK WALLS AND FLOOR SLAB	34.45 (5000 PSI)	2403 (150 PCF)	0.45

Delete ~~*INTERIOR SLAB-ON-GRADE SHALL ALSO HAVE A 28 DAY MINIMUM FLEXURAL STRENGTH OF 4.5 MPa (650 PSI).~~ 1 1a

* MAXIMUM WATER/CEMENT RATIO = 0.41

*4% TO 6% AIR ENTRAINMENT

B. CONCRETE CLEAR COVER OVER REINFORCING SHALL BE IN ACCORDANCE WITH ACI 318-95, LISTED BELOW, UNLESS OTHERWISE NOTED -

LOCATION	CLEAR COVER (mm)
CAST AGAINST EARTH	75
EXPOSED TO EARTH OR WEATHER #19 AND LARGER	50
EXPOSED TO EARTH OR WEATHER #16 AND SMALLER	50
SLABS, WALLS, JOIST NOT EXPOSED TO WEATHER	50
BEAMS AND COLUMNS NOT EXPOSED TO WEATHER	50
SLABS ON GRADE (COVER FROM TOP OF SLAB)	76

3. CONCRETE REINFORCING SHALL MEET THE FOLLOWING -

A. REINFORCING BARS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A615M GRADE 420. REINFORCING BARS REQUIRED TO BE WELDED SHALL CONFORM TO THE REQUIREMENTS OF ASTM A706M GRADE 420. WELDING OF REINFORCING OTHER THAN SPECIFIED IS PROHIBITED.

B. ALL REINFORCING SHALL BE CONTINUOUS. CONTINUOUS BARS SHALL LAP IN ACCORDANCE WITH THE SCHEDULE ON SHEET SO.3, UNLESS OTHERWISE NOTED.

C. PROVIDE CORNER BARS IN OUTSIDE FACE OF ALL FOUNDATIONS AND WALLS EQUAL IN SIZE AND SPACING TO MAIN HORIZONTAL REINFORCING. EXTEND INSIDE FACE REINFORCING OF ALL FOUNDATIONS AND WALLS TO OUTSIDE FACE AND BEND TO A STANDARD 90-DEGREE HOOK.

D. PROVIDE 2-#16 EACH SIDE OF EACH OPENING THRU WALLS OR SLABS UNLESS NOTED OTHERWISE. BARS TO EXTEND 610mm PAST OPENING.

E. SHOP DRAWINGS SHALL BE SUBMITTED WITH REINFORCING STEEL DETAILED IN ACCORDANCE WITH ACI 315-94.

4. FORMING AND EMBEDMENTS SHALL MEET THE FOLLOWING -

A. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 19mm INSIDE FORMS OR TOOLED TO 19mm RADIUS ON SLABS UNLESS OTHERWISE NOTED.

B. SLABS ON GRADE SHALL HAVE CONSTRUCTION JOINTS AND CONTROL JOINTS (SAWED JOINTS) LOCATED AS SHOWN ON THE DRAWINGS. CONTRACTOR SHALL LOCATE SLAB JOINTS ON SHOP DRAWINGS.

C. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF ALL FORMING, TEMPORARY BRACING, AND SHORING.

D. NO ALUMINUM SHALL BE EMBEDDED IN CONCRETE. CONDUITS AND PIPING EMBEDDED IN CONCRETE SHALL BE SPACED A MINIMUM OF FOUR DIAMETERS AND THE OUTSIDE DIAMETER SHALL BE LESS THAN 30 PERCENT OF THE MEMBER THICKNESS PLACED BETWEEN LAYERS OF REINFORCING.

5. CURING FOR CONCRETE SURFACES NOT IN CONTACT WITH FORMS, ONE OF THE FOLLOWING PROCEDURES SHALL BE APPLIED IMMEDIATELY AFTER COMPLETION OF PLACEMENT AND FINISHING -

A. PONDING OR CONTINUOUS SPRINKLING.

B. APPLICATION OF ABSORPTIVE MATS OR FABRIC KEPT CONTINUOUSLY WET.

C. APPLICATION OF WATERPROOF SHEET MATERIALS, CONFORMING TO "SPECIFICATIONS FOR WATERPROOF SHEET MATERIALS FOR CURING CONCRETE" (ASTM C 171).

D. APPLICATION OF A CURING COMPOUND CONFORMING TO "SPECIFICATIONS FOR LIQUID MEMBRANE-FORMING COMPOUNDS FOR CURING CONCRETE" (ASTM C 309). THE COMPOUND SHALL BE APPLIED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE MANUFACTURER IMMEDIATELY AFTER ANY WATER SHEEN WHICH MAY DEVELOP AFTER FINISHING HAS DISAPPEARED FROM THE CONCRETE SURFACE. IT SHALL NOT BE USED ON ANY SURFACE AGAINST WHICH ADDITIONAL CONCRETE IS TO BE BONDED UNLESS IT IS PROVEN THAT THE CURING COMPOUND WILL NOT PREVENT BOND, OR UNLESS POSITIVE MEASURES ARE TAKEN TO REMOVE IT COMPLETELY FROM AREAS TO RECEIVE BONDED APPLICATIONS. CURING SHALL BE CONTINUED AT LEAST 7 DAYS.

STRUCTURAL STEEL -

1. STRUCTURAL STEEL HAS BEEN DESIGNED IN ACCORDANCE WITH TI 809-02, TI 809-04, THE BUILDING CODE AND AISC ASD SPECIFICATIONS, NINTH EDITION.

2. STRUCTURAL STEEL MATERIAL SHALL CONFORM TO ONE OF THE FOLLOWING STANDARD SPECIFICATIONS, LATEST EDITION:

A. STRUCTURAL STEEL WIDE FLANGE BEAMS & COLUMNS - ASTM A992 OR ASTM A572M, GRADE 345 (50KSI)

B. STRUCTURAL STEEL CHANNELS & ANGLES - ASTM A572M, GRADE 345 (50KSI)

C. STRUCTURAL STEEL PLATES - ASTM A36 OR ASTM A572 GRADE 248 (36KSI), GRADE 345 (50KSI)

D. STRUCTURAL STEEL TUBES - ASTM A500, GRADE B, Fy=317 MPa (46KSI)

E. COMMON BOLTS - ASTM A307, GRADE A

F. HIGH STRENGTH BOLTS - ASTM A325

3. STRUCTURAL STEEL CONNECTIONS -

A. CONNECTION BOLTS SHOWN IN DRAWINGS ARE 13mm (1/2") DIAMETER A325 BEARING TYPE "N" UNLESS NOTED OTHERWISE.

4. NO HOLES SHALL BE CUT THRU STEEL BEAMS IN FIELD UNLESS APPROVED BY THE ENGINEER.

5. ALL ROOF OPENINGS GREATER THAN 150mm WIDE MEASURED PARALLEL TO THE SUPPORTING MEMBERS SHALL BE FRAMED WITH FRAMING ANGLES L76x76x6.4 UNLESS SHOWN OR NOTED OTHERWISE.

6. STEEL ROOF DECKS SHALL COMPLY WITH THE STEEL DECK INSTITUTE REQUIREMENTS.

7. STEEL ROOF DECK SHALL BE 38mm (1-1/2") DEEP, 22 GA., WIDE RIB METAL DECKING. DECKING SHALL HAVE A MINIMUM YIELD STRENGTH OF 227.5 MPa (33 KSI), A MINIMUM I OF 230 784 mm^4/m (0.169 IN. 4/FT.), A MINIMUM Sp OF 10 000 mm^3/m (0.186 IN.^3/FT.), AND A MINIMUM Sn OF 10 323 mm^3/m (0.192 IN.^3/FT.). DECKING SHALL RECEIVE A GALVANIZED FINISH PER SPECIFICATION. DECKING SHALL BE CONTINUOUS OVER A MINIMUM OF THREE SUPPORTS. EACH DECK UNIT SHALL BE ATTACHED TO SUPPORTING MEMBERS AND ADJACENT PANELS AS FOLLOWS -

	610mm PANEL	914mm PANEL
NO. OF END AND SUPPORT (PERPENDICULAR & PARALLEL) 16mm (5/8") DIA. PUDDLE WELDS	24/4, 305 O.C @ PERIMETER	36/7, 350 O.C. @ PERIMETER
#10 TEK SCREW SIDELAP CONNECTION EQUALLY SPACED BETWEEN SUPPORTS	5	5

8. COLD FORMED METAL FRAMING (CFMF) WALL STUDS SHALL BE GALVANIZED AND HAVE THE FOLLOWING PROPERTIES -

LOCATION	SPACING mm (IN.)	DEPTH mm (IN.)	WIDTH mm (IN.)	GAUGE	MIN. FY MPa (KSI)	MIN. Ix mm^4 (IN.^4)	MIN. Sx mm^3 (IN.^3)
FACE OF MANSARD ROOF	400 (16)	150 (6)	64 (2.50)	16 (16)	344.7 (50)	1517580 (3.646)	17518 (1.069)

1 RFI # 187 - 650 flex strength applies to 5000psi concrete

1a RFI 187R - disregard 650 Flex requirement

2 RFI # 685 NO MOISTURE BARRIER OR SEALER IS REQUIRED FOR THE TANK WALLS.

US Army Corps of Engineers
Kansas City District

8/3/01

Symbol	Description	Date	Appr.

Designed by: E. RICHARDS
Dwn by: PSG
Ckd by:
Reviewed by:
Submitted by:
Date: AUGUST 2001
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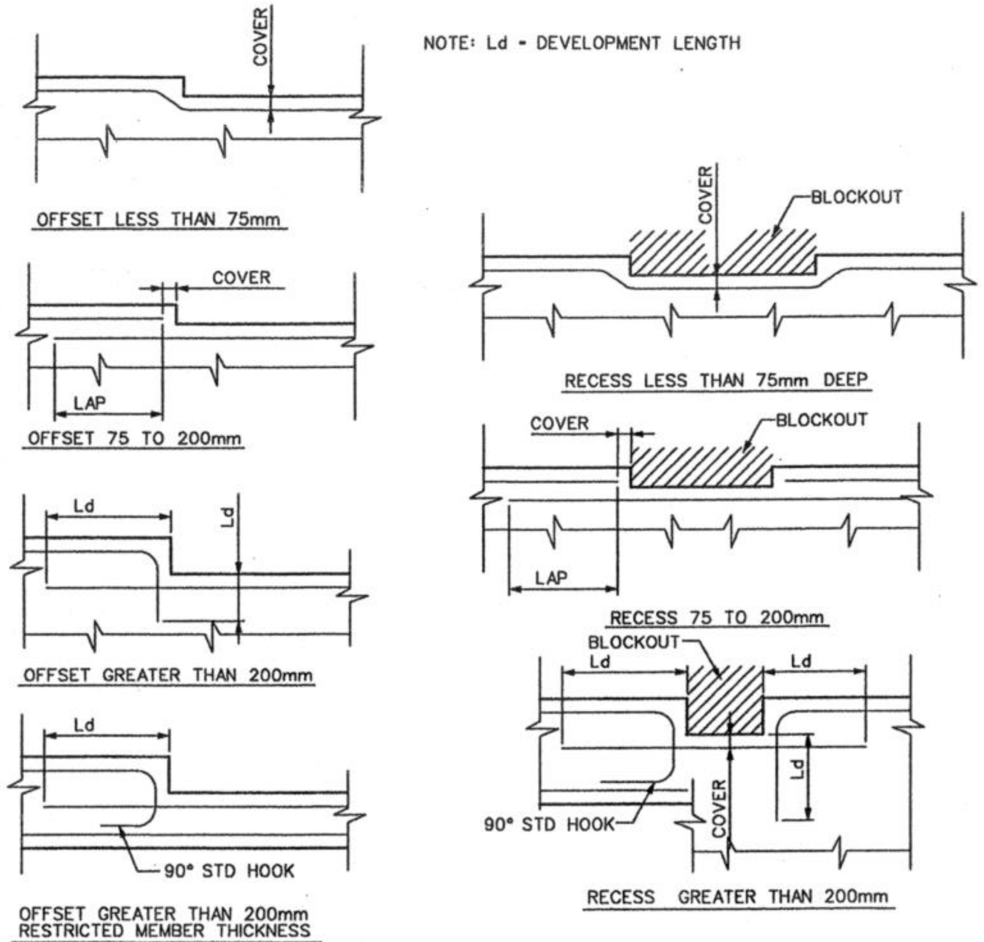
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
GENERAL NOTES

Sheet reference number:

NOTE: Ld = DEVELOPMENT LENGTH



1 TYPICAL OFFSET & BLOCKOUT DETAILS

S0.3 S0.3 SCALE: NONE

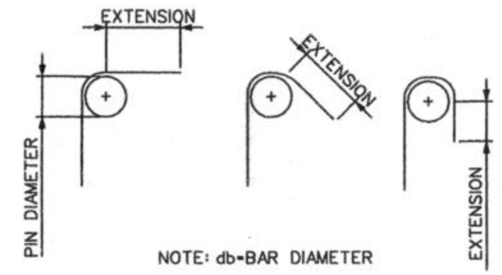


TABLE OF PIN DIAMETERS IN MILLIMETERS (BEND DIAMETERS)

BAR SIZE	10	13	16	19	22	25	29	32
STANDARD BENDS	57	76	95	114	133	152	241	273
STIRRUP AND TIE BENDS	38	51	64	114	133	152		

STANDARD HOOKS:

1. 180-DEGREE BEND PLUS 4db EXTENSION, BUT NOT LESS THAN 65mm AT THE FREE END OF THE BAR.
2. 90-DEGREE BEND PLUS 12db EXTENSION AT THE FREE END OF THE BAR.

STIRRUP AND TIE HOOKS:

1. #16 BAR AND SMALLER, 90-DEGREE BEND PLUS 6db EXTENSION AT THE FREE END OF THE BAR.
2. #19, #22, AND #25 BARS, 90-DEGREE BEND PLUS 12db EXTENSION AT THE FREE END OF THE BAR.
3. #25 BARS AND SMALLER, 135-DEGREE BEND PLUS 6db EXTENSION AT THE FREE END OF THE BAR, BUT NOT LESS THAN 100mm.

2 TYPICAL HOOK DETAILS

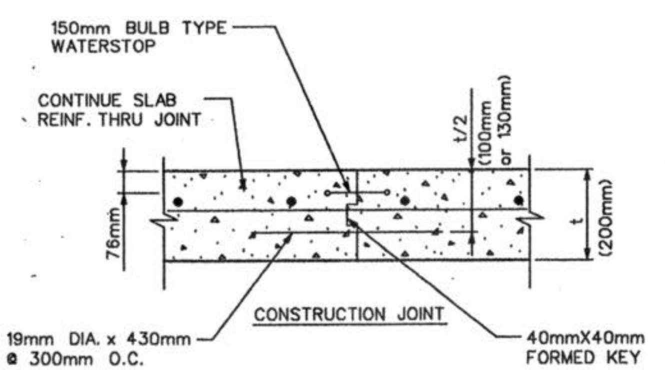
S0.3 S0.3 SCALE: NONE

REINFORCING BAR LAP SPLICE & EMBEDMENT LENGTH SCHEDULE CAST-IN-PLACE CONCRETE (f'c = 28 MPa)

(CLASS B TENSION SPLICES)

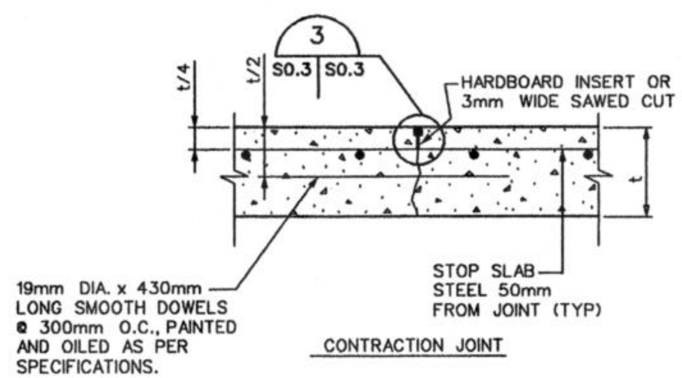
BAR SIZE	BASIC SPLICE LENGTH	"TOP BAR" SPLICE LENGTH	EMBEDMENT LENGTH, Ld
# 10	410	510	310
# 13	410	510	310
# 16	460	610	360
# 19	560	740	430
# 22	810	1070	640
# 25	940	1220	710
# 29	1170	1500	890
# 32	1400	1830	1070
# 36	1730	2240	1320

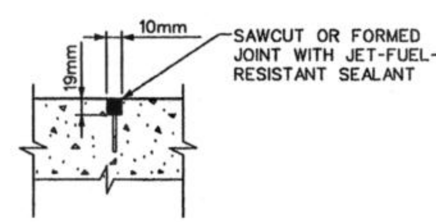
NOTE:
"TOP BARS" ARE HORIZONTAL BARS SO PLACED THAT MORE THAN 300mm OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR.



3 200mm SLAB-ON-GRADE-DETAIL WITHIN TANK

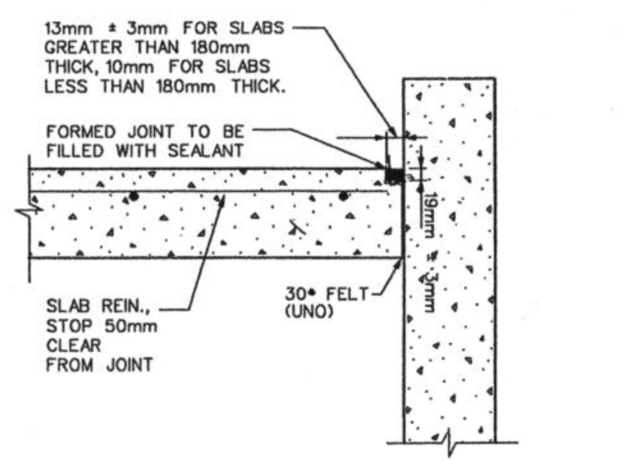
S0.3 S0.3 SCALE: NONE





3 DETAIL

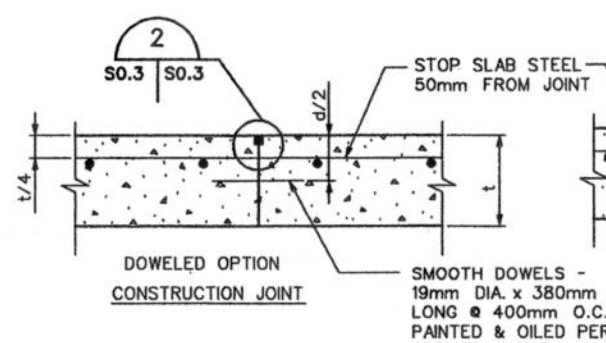
S0.3 S0.3 SCALE: NTS

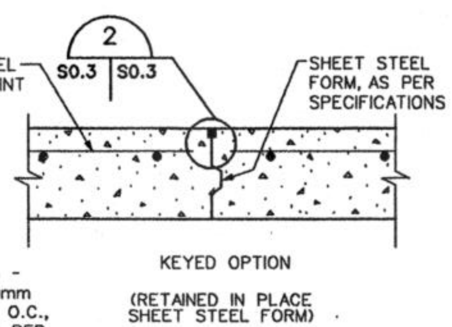


FOR USE AT EXPOSED CONCRETE FLOOR LOCATIONS

E SLAB SEALANT DETAIL @ FOUNDATION WALL

S0.3 S0.3 SCALE: NONE





US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
△	ENTIRE SHEET SUBMITTED	8/31/01	

Designed by: E. RICHARDS | Dwn by: PSG | Ckd by: | Date: AUGUST 2001 | Rev.
Reviewed by: | Design file no.
Submitted by: | Drawing code:
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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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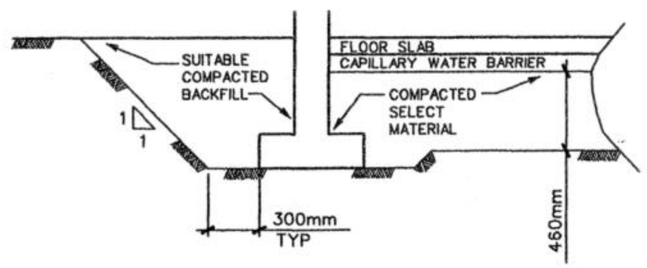
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
STANDARD FOUNDATION DETAILS

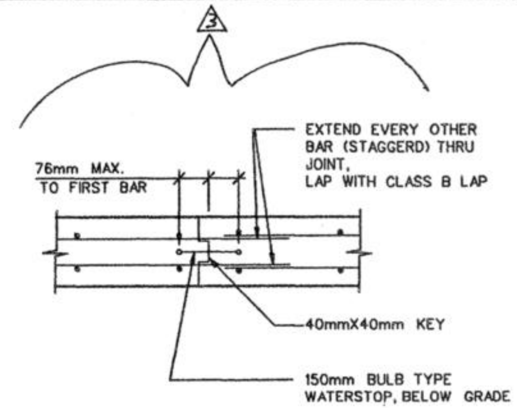
Sheet reference

Section:



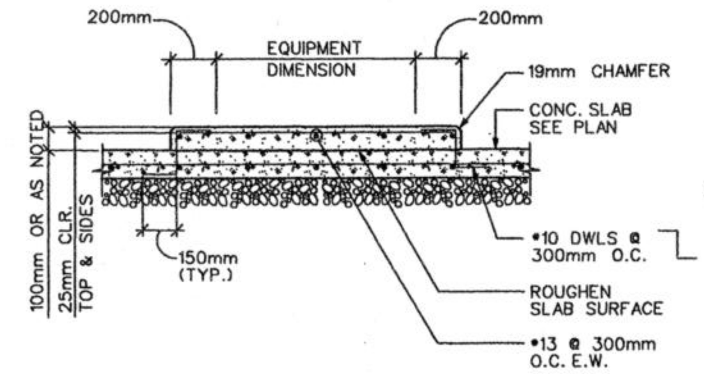
1 TYPICAL FOUNDATION & FLOOR SLAB OVEREXCAVATION DETAILS

S0.4 | S0.4 SCALE: NONE



2 CONCRETE WALL CONSTRUCTION JOINT DETAIL

S0.4 | S0.4 SCALE: NONE



3 TYPICAL EQUIPMENT PAD DETAIL

S0.4 | S0.4 SCALE: NONE

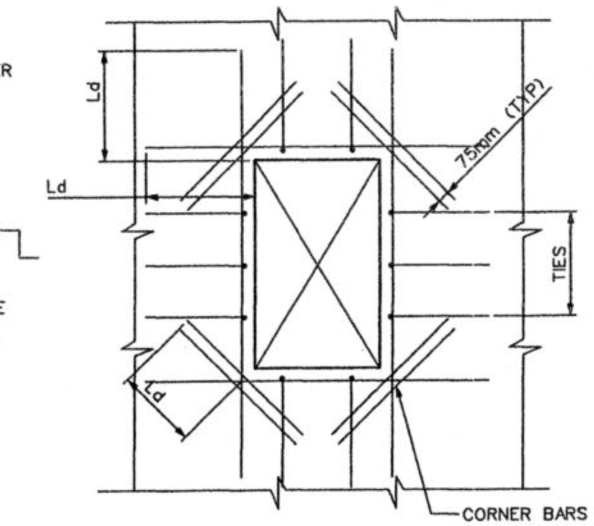


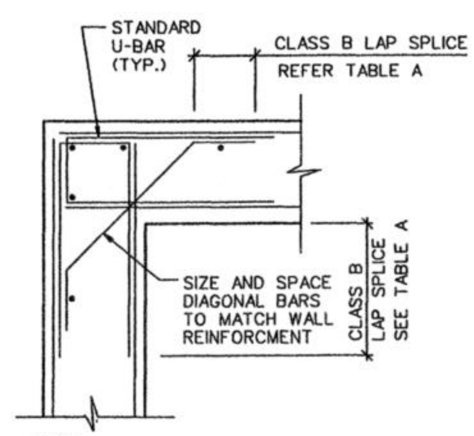
TABLE FOR REINFORCEMENT AROUND OPENINGS (TYP UNO ON DETAILS)

MEMBER THICKNESS (mm)	TIE BARS	EDGE BARS	CORNER BARS
LESS THAN 250	NONE	1 CTR	2 - #16 CTR
250 THRU 460	NONE	2 - (1 EF)	4 - #16 (2 EF)
480 THRU 910	#13 @ 305mm	3 - EQ SP	4 - #16 (2 EF)
OVER 910	#19 @ 305mm	SP @ 305mm	4 - #16 (2 EF)

OMIT EDGE AND TIE BARS ALONG SIDES OF OPENINGS WHERE DIMENSION IS LESS THAN 460mm
OMIT CORNER BARS AT SIDES OF OPENINGS ADJACENT TO FLOORS, WALLS, OR BEAMS.
CORNER BARS REQUIRED IF EITHER DIMENSION OF OPENING IS GREATER THAN 460mm
USE CORNER BARS IN FACE OF RECESSES DEEPER THAN 100mm IF EITHER DIMENSION OF RECESS IS GREATER THAN 460mm

4 TYPICAL SLAB & OPENING REINFORCING DETAIL

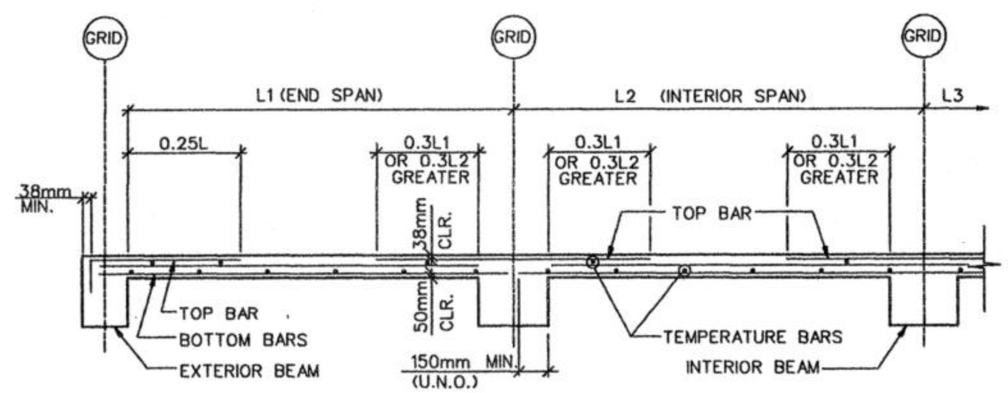
S0.4 | S0.4 SCALE: NONE



NOTE:
REINFORCING SHOWN APPLIES TO TOP, BOTTOM, AND INTERMEDIATE BARS IN WALLS UNLESS NOTED OTHERWISE.

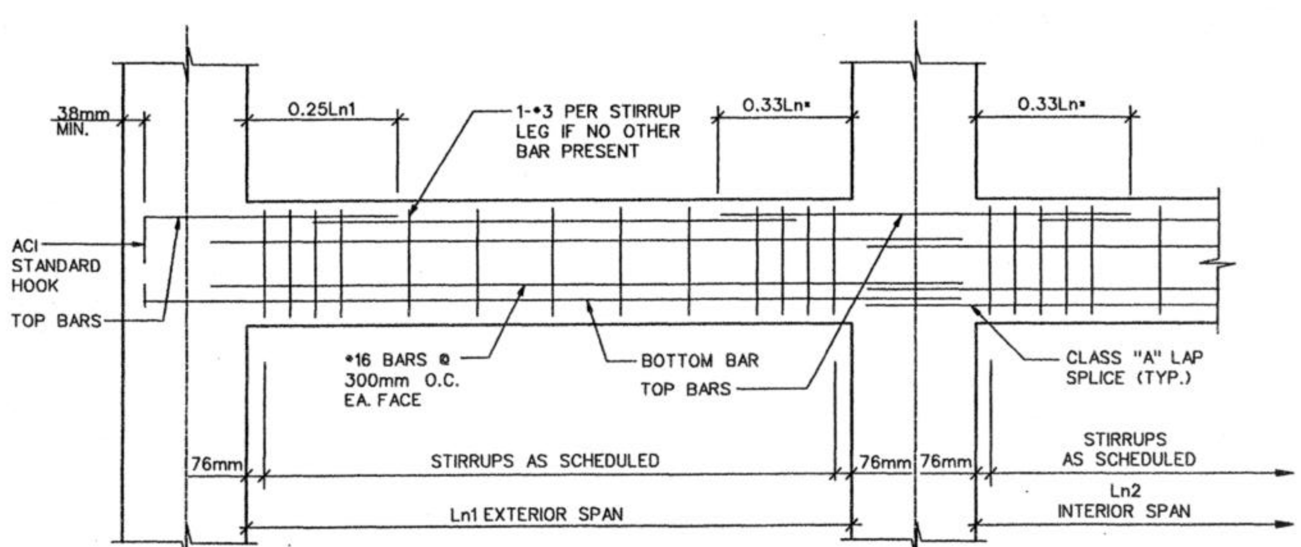
5 TYPICAL WALL CORNER & REINFORCING DETAIL

S0.4 | S0.4 SCALE: NONE



6 TYP. ONE-WAY SLAB REINFORCING DETAIL

S0.4 | S0.4 SCALE: NONE



NOTE:
LN * IS THE GREATER OF Ln1 OR Ln2

US Army Corps of Engineers
Kansas City District

RFI # 393: Ct. waterstop and chamfer ... | ENTIRE SHEET SUBMITTED | 8/31/01

Symbol | Description | Date | Appr.

Rev.

Date: AUGUST 2001 | Design file no. | Drawing code:
Designed by: E. RICHARDS | Ckd by: | Dwn by: PSG | Reviewed by: | Submitted by:
File name: | Plot date: | Plot scale:

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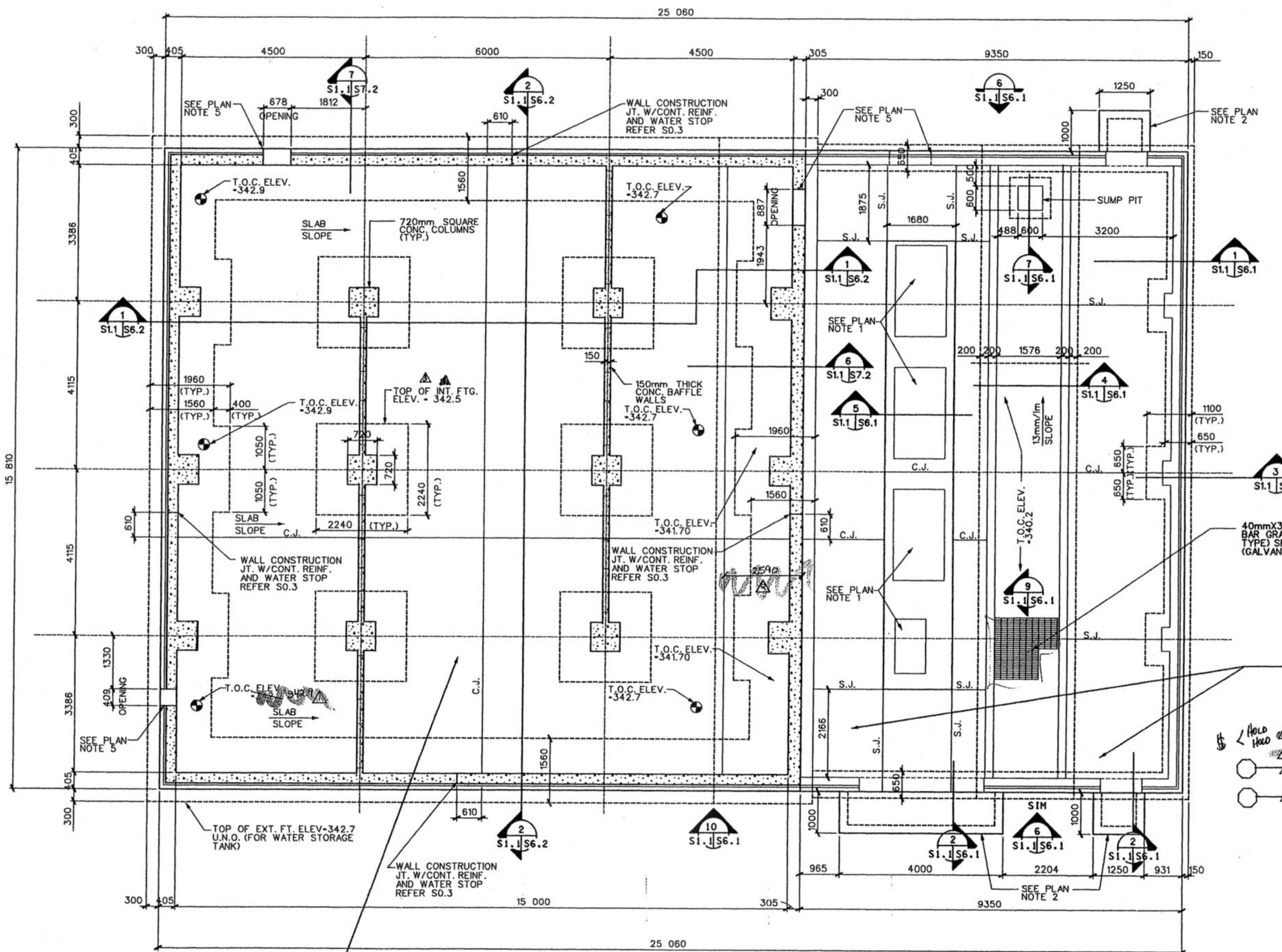
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
STANDARD FOUNDATION DETAILS

Sheet reference

Section:



200mm CONCRETE SLAB W/#19 @ 305mm O.C. E.W. OVER VAPOR RETARDER OVER 150mm CAPILLARY WATER BARRIER OVER PREPARED SUBGRADE. T.O.C. ELEV. = VARIES

WATER STORAGE TANK

1 FOUNDATION PLAN
S1.0 S1.0 SCALE: 1:50

PUMP STATION BUILDING

HOLD
RFI#124 CORRECT ELEVATION IS 342.9
RFI#119 DIMENSION IS 2590.
RFI#139 Interior footing elev. slope with slab and is always 200 below top of slab.
RFI#136 - Reinf. can be continuous to the edge of the footing deleting the top bar in the footing.

PLAN NORTH

GENERAL NOTES:
1. T.O.C. ELEV. = 341.70 UNLESS NOTED OTHERWISE ON PLANS
2. TOP FOOTING ELEV. = 341.0 1 (FOR PUMP STATION BUILDING) UNLESS NOTED OTHERWISE ON PLANS

PLAN NOTES:
1. HOUSEKEEPING PAD. SEE .MECH OR ELEC. FOR COORDINATION OF SIZE AND LOCATION. SEE GENERAL STRUCTURAL NOTES FOR REINFORCING.
2. STOOP. SEE DETAIL 2/S6.1 SEE ARCH. FOR DIMENSIONS.
3. C.J. INDICATES CONSTRUCTION JOINT ON PLANS. SEE SHEET S0.3 FOR DETAILS.
4. S.J. INDICATES SAW JOINT ON PLANS. SEE SHEET S0.3 FOR DETAILS.
5. INDICATES OPENINGS WITHIN WALL. COORDINATE SIZE AND LOCATION WITH MECHANICAL.

US Army Corps of Engineers
Kansas City District

Date: AUGUST 2001
Designed by: E.RICHARDS
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
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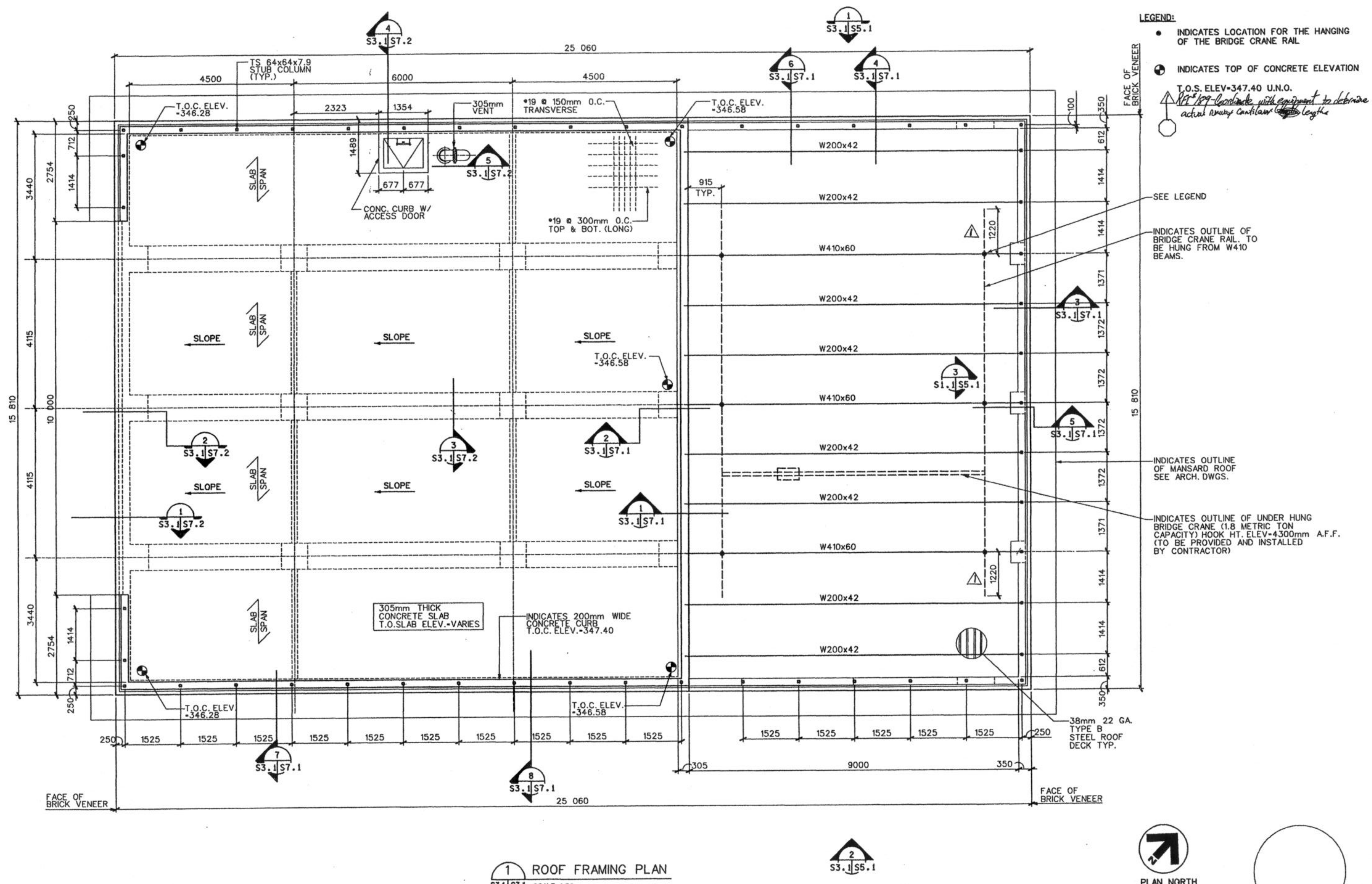
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
FOUNDATION PLAN

Sheet reference number:

Section:



ROOF FRAMING PLAN
S3.1 | S3.1 SCALE: 1:50

LEGEND:
- INDICATES LOCATION FOR THE HANGING OF THE BRIDGE CRANE RAIL
- INDICATES TOP OF CONCRETE ELEVATION

T.O.S. ELEV=347.40 U.N.O.

RFI#189 Coordinate with equipment to determine actual runway cantilever lengths

US Army Corps of Engineers
Kansas City District

ENTIRE SHEET REVISED 6/3/01

Date: AUGUST 2001

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI

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BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION

ROOF FRAMING PLAN

Sheet reference

MASONRY

1. ALL MASONRY HAS BEEN DESIGNED IN ACCORDANCE WITH AFM 88-3, CHAPTER 3, MASONRY STRUCTURAL DESIGN FOR BUILDINGS (OCTOBER 1992). DESIGN IS BASED ON ALL MASONRY RECEIVING FIELD INSPECTION.

2. CONCRETE MASONRY UNITS (CMU) MATERIALS SHALL BE:

   A. ALL CONCRETE MASONRY UNITS (CMU) SHALL BE TWO CELL ***LIGHTWEIGHT (USE FOR PARTITIONS) AGGREGATE UNITS WITH A SPECIFIED MINIMUM COMPRESSIVE STRENGTH OF 13.79 MPa (2000 PSI) ON NET AREA (6.90 MPa (1000 PSI) ON GROSS AREA) AT 28 DAYS CONFORMING TO ASTM C90, TYPE I, GRADE N. CMU BELOW GRADE SHALL BE NORMAL WEIGHT AGGREGATE UNITS.

   B. ALL MORTAR SHALL BE TYPE "S" WITH A MINIMUM MORTAR COMPRESSIVE STRENGTH OF 12.41 MPa (1800 PSI) AT 28 DAYS CONFORMING TO ASTM C270. THE MINIMUM COMPRESSIVE STRENGTH (f'm) OF A PRISM ASSEMBLED OF CMU AND MORTAR SHALL BE 9.31 MPa (1350 PSI) ON THE NET AREA AT 28 DAYS.

   C. GROUT SHALL CONFORM TO ASTM A476 WITH 9mm (3/8") AGGREGATE WITH THE FOLLOWING REQUIREMENTS:

LOCATION	MINIMUM F'c MPa	UNIT WEIGHT kg/m°3
CMU GROUT	20.68 (3000 PSI)	2403 (150 PCF)

   D. REINFORCING STEEL SHALL MEET THE REQUIREMENTS OF ASTM A615M GRADE 420.

3. VERTICAL REINFORCING

   A. PROVIDE VERTICAL REINFORCING (NORMAL REINFORCING) IN GROUT FILLED CELLS IN ALL WALLS AS FOLLOWS UNLESS NOTED OTHERWISE -

WALL TYPE	REINF. IN FILLED CELLS	MAXIMUM SPACING
200mm CMU	1 - •19	600mm

   THERE SHALL BE A FOUNDATION DOWEL FOR EACH VERTICAL REINFORCING BAR (NORMAL REINFORCING).

   B. MASONRY DOWELS INTO CONCRETE FOOTINGS SHALL BE LOCATED TO MATCH WITH HOLLOW MASONRY BLOCK CELL. THERE SHALL BE A FOUNDATION DOWEL FOR EACH VERTICAL MASONRY WALL REINFORCEMENT. DOWEL LAPPED WITH THE VERTICAL REINFORCEMENT IN THE SAME GROUTED CELL.

4. HORIZONTAL WALL REINFORCING

   A. PROVIDE GROUT FILLED BOND BEAM AT THE TOP OF WALL OR PARAPET, AT FLOOR LEVELS (ABOVE GRADE), AT TOP OF OPENINGS, BELOW OPENINGS, AT BEARING LOCATIONS, AND INTERMEDIATELY AT EVERY SIXTH COURSE (1220mm O.C.). BOND BEAMS SHALL BE REINFORCED AS FOLLOWS:

WALL TYPE	BOND BEAM REINF.
200mm CMU	2 - •16

   B. PROVIDE BENT BARS AT ALL CORNERS.

   C. JOINT REINFORCING SHALL BE 9 GAUGE HORIZONTAL LADDER TYPE TIES (USE AA 500 BLOCK-LOK OR APPROVED EQUAL). USE AA 510 3 WIRE TRI-LOK TYPE OR APPROVED EQUAL AT EXTERIOR CAVITY WALLS FOR THE FULL WIDTH OF THE WALL TO ANCHOR THE BRICK VENEER TO BLOCK WALL.

   D. UNLESS NOTED OTHERWISE ON THE DRAWINGS USE 48 DIA. MIN. LAP. IN ADDITION, VERTICAL REINFORCING SHALL BE LOCATED AT CORNER OF WALLS, EDGES OF OPENINGS AND AT EACH SIDE OF CONTROL JOINTS. REFER TO STANDARD DETAILS ON THIS SHEET.

   E. APPROVED BAR POSITIONERS SHALL BE USED AT A MAXIMUM SPACING OF 192 BAR DIAMETERS FOR ALL VERTICAL REINFORCEMENT IN CMU WALLS AND AT EACH END. VERTICAL REINFORCING BARS SHALL BE CENTERED IN THE WALLS.

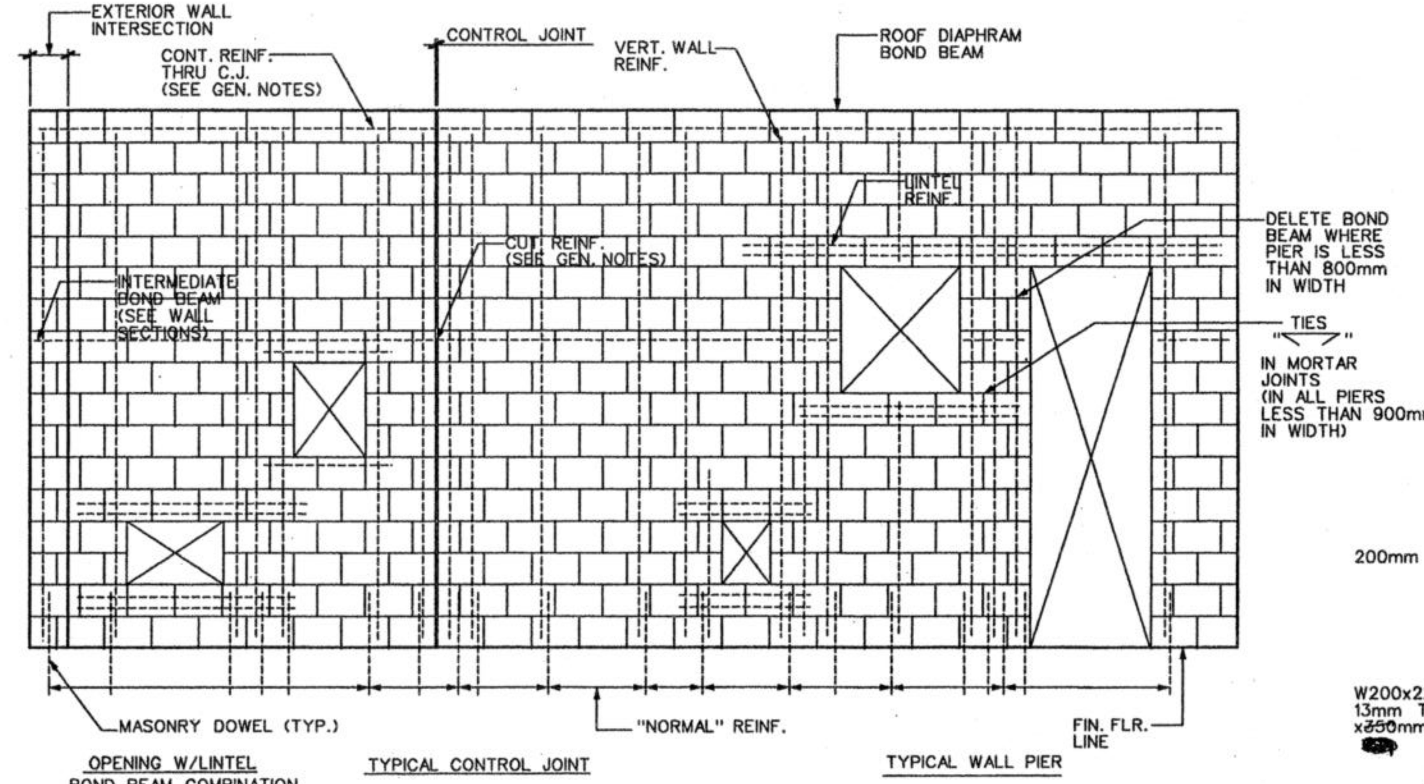
5. LOCATION AND DETAILS OF CONTROL AND ISOLATION JOINTS IN REINFORCED MASONRY SHALL BE AS SHOWN ON THE STRUCTURAL AND/OR ARCHITECTURAL DRAWINGS. THE MAXIMUM SPACING OF CONTROL OR ISOLATION JOINTS SHALL BE AT A LENGTH TO HEIGHT RATIO OF 4 TO 1 OR 18 288mm (60 FT.) ON CENTER, WHICHEVER IS LESS. CONTRACTOR SHALL SUBMIT A JOINT LAYOUT PLAN FOR APPROVAL PRIOR TO CONSTRUCTION.

6. FULLY GROUT BOTTOM COARSE OF CMU WALLS.

7. OPENINGS IN STRUCTURAL WALLS ARE SHOWN AND DETAILED ON MASONRY WALL ELEVATIONS, SHEETS S5.1 THRU S5.5. FOR OPENINGS NOT ALREADY SHOWN ON MASONRY WALL ELEVATIONS, SEE MISCELLANEOUS OPENINGS IN MASONRY WALLS DETAIL CASES 1 SHOWN ON THIS SHEET. CONTRACTOR SHALL COORDINATE AND VERIFY ALL OPENINGS WITH OTHER WORK. SHOW ALL OPENINGS ON MASONRY SHOP DRAWINGS (SEE SPECIFICATION FOR MORE INFORMATION).

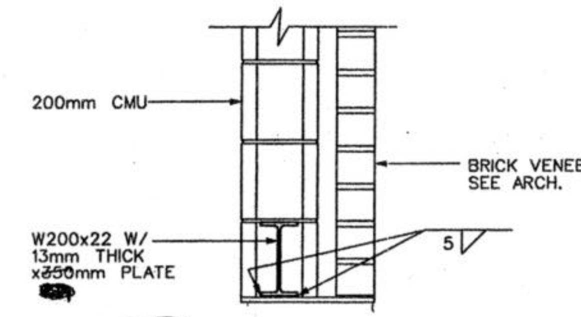
8. LINTELS SHALL CONSIST OF GROUT FILLED BOND BEAMS MEETING THE FOLLOWING UNLESS OTHERWISE NOTED

CMU TYPE	CLEAR OPENING WIDTH UP TO 1016mm DEPTH/REINF.	UP TO 1930mm DEPTH/REINF.	UP TO 2438mm DEPTH/REINF.	UP TO 3048mm DEPTH/REINF.

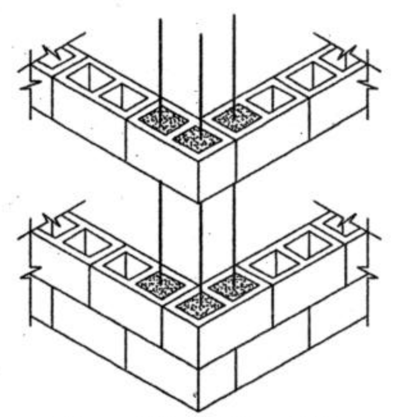


1 TYP MASONRY WALL REINFORCEMENT DETAIL
S5.0 | S5.0 SCALE: NTS

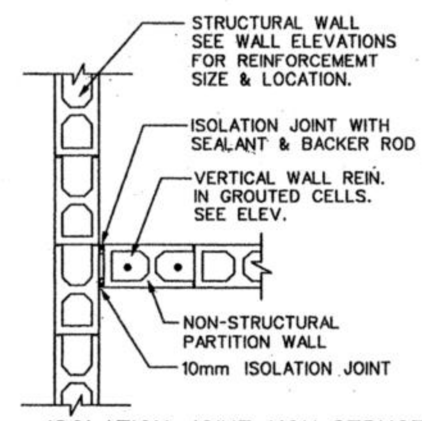
MASONRY REINFORCING BAR LAP SPLICE LENGTH SCHEDULE (48 BAR DIAMETERS)	
BAR SIZE	BASIC SPLICE LENGTH
• 10	460
• 13	610
• 16	770
• 19	920
• 22	1070
• 29	1380



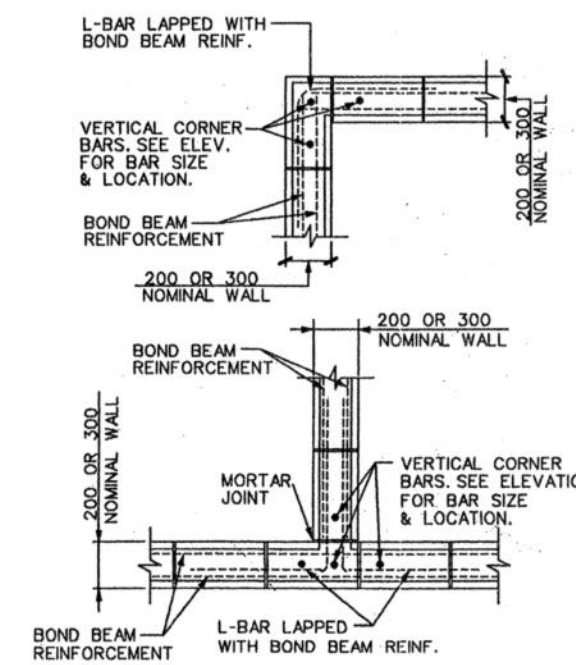
2 STEEL LINTEL DETAIL
S5.1 | S5.0 SCALE: NTS



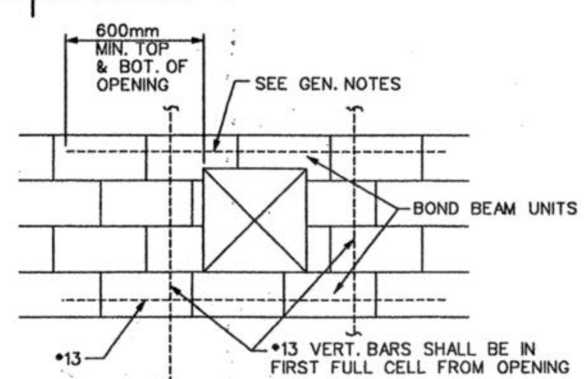
3 TYP. MASONRY CORNER DETAILS
S5.0 | S5.0 SCALE: NTS



4 ISOLATION JOINT NON-STRUCTURAL & STRUCTURAL WALL
S5.0 | S5.0 SCALE: NTS

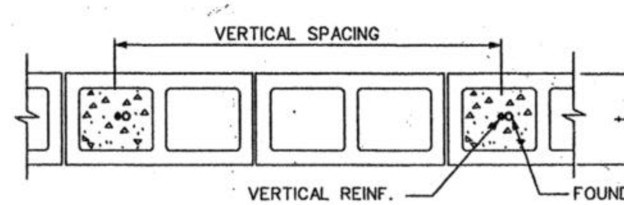


5 TYP. BOND BEAM INTERSECTION DETAILS
S5.0 | S5.0 SCALE: NTS



CASE I

APPLIES TO ANY OPENING IN NON-STRUCTURAL



US Army Corps of Engineers
Kansas City District

Designed by: E. RICHARDS | Dwn by: PSG | Ckd by: | Reviewed by: | Submitted by: | Date: AUGUST 2001 | Design file no. | Drawing code: | File name: | Plot date: | Plot scale:

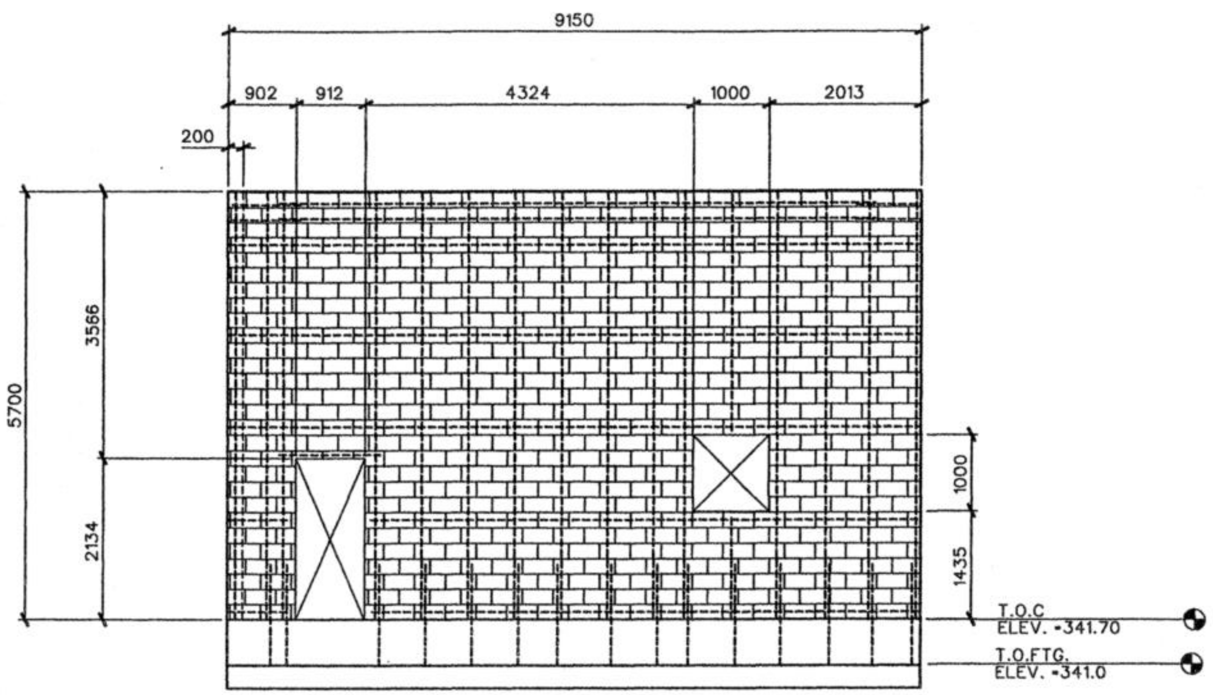
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI

The Benham Group

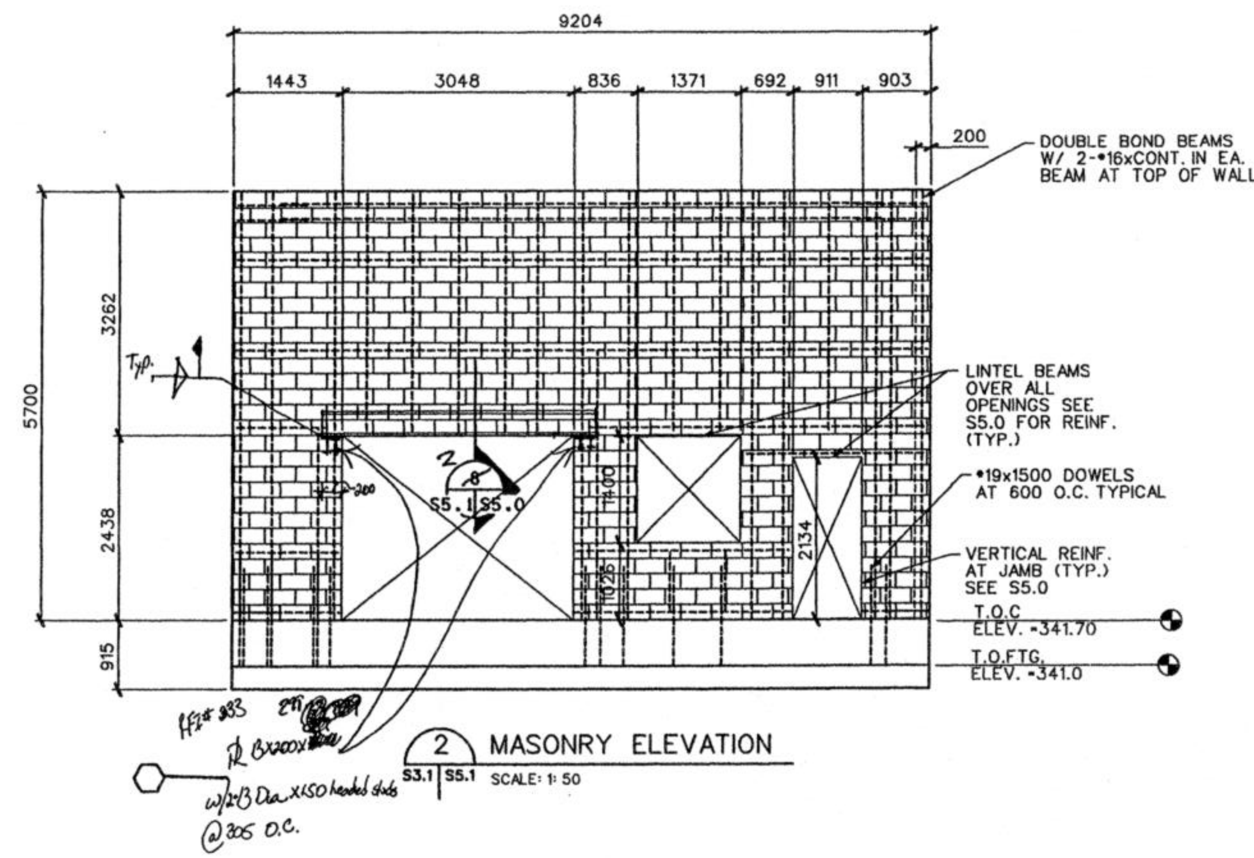
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
TYP. MASONRY NOTES & DETAILS

Sheet reference

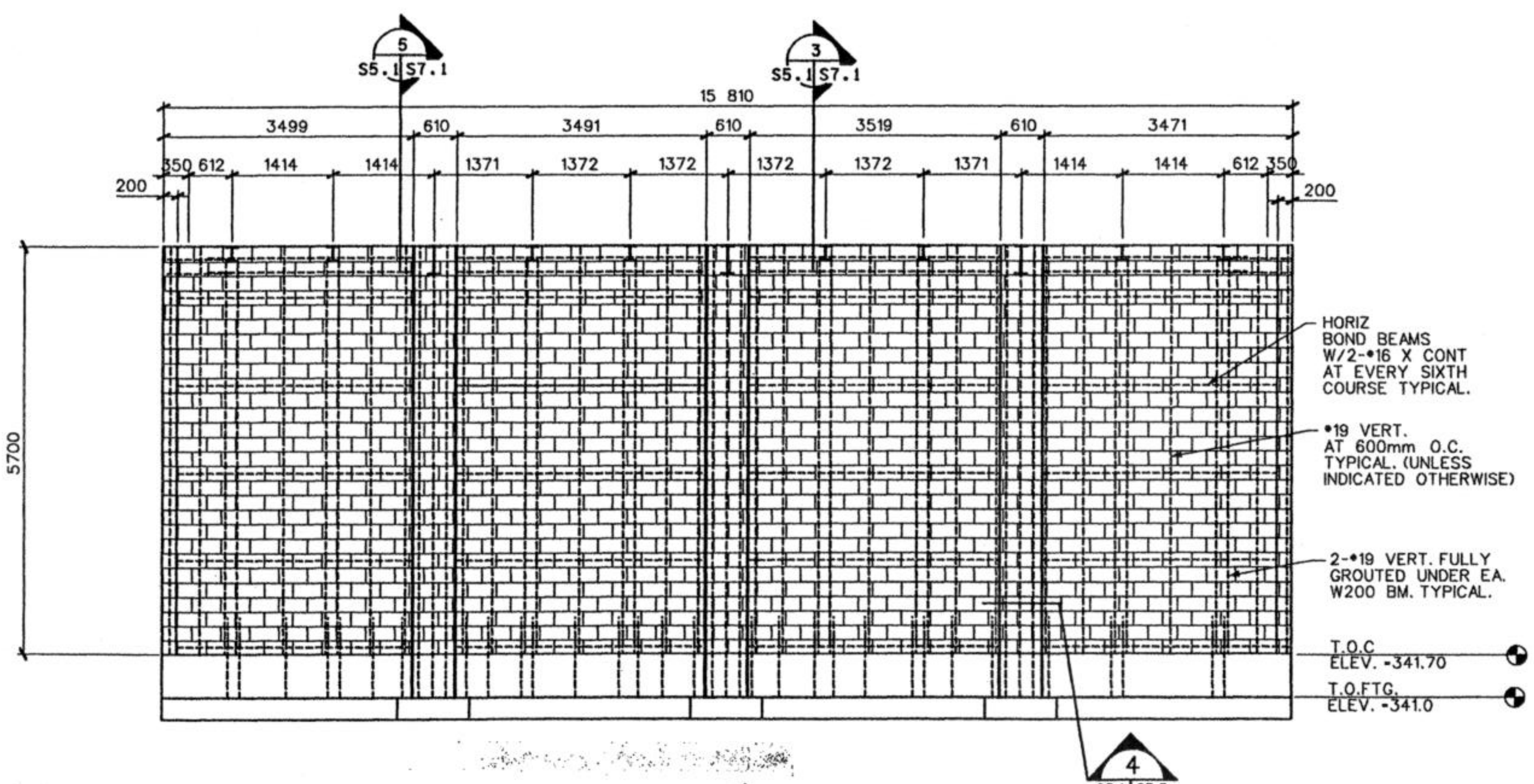
Section:



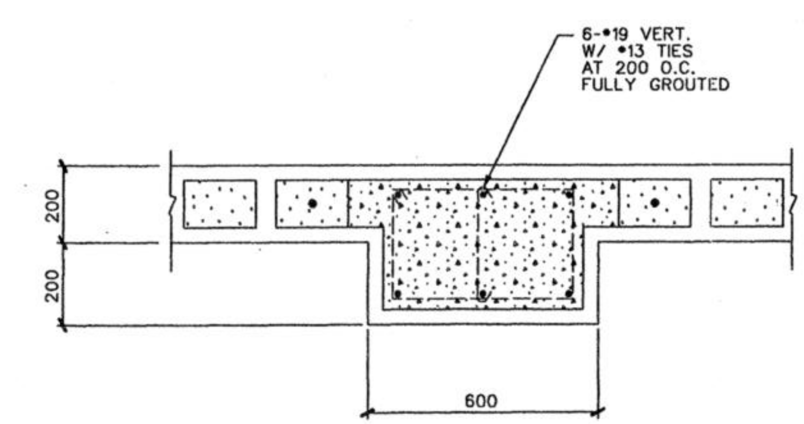
1 MASONRY ELEVATION
S3.1 | S5.1 SCALE: 1: 50



2 MASONRY ELEVATION
S3.1 | S5.1 SCALE: 1: 50



3 MASONRY ELEVATION
S3.1 | S5.1 SCALE: 1: 50



4 SECTION THRU MASONRY COL.
S5.1 | S5.1 N.T.S.

US Army Corps of Engineers
Kansas City District

8/31/01 ENTIRE SHEET REVISED

Symbol	Description	Date	Appr.

Designed by: | Date: AUGUST 2001 | Rev.
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Submitted by: | File name: | Plot date: | Plot scale:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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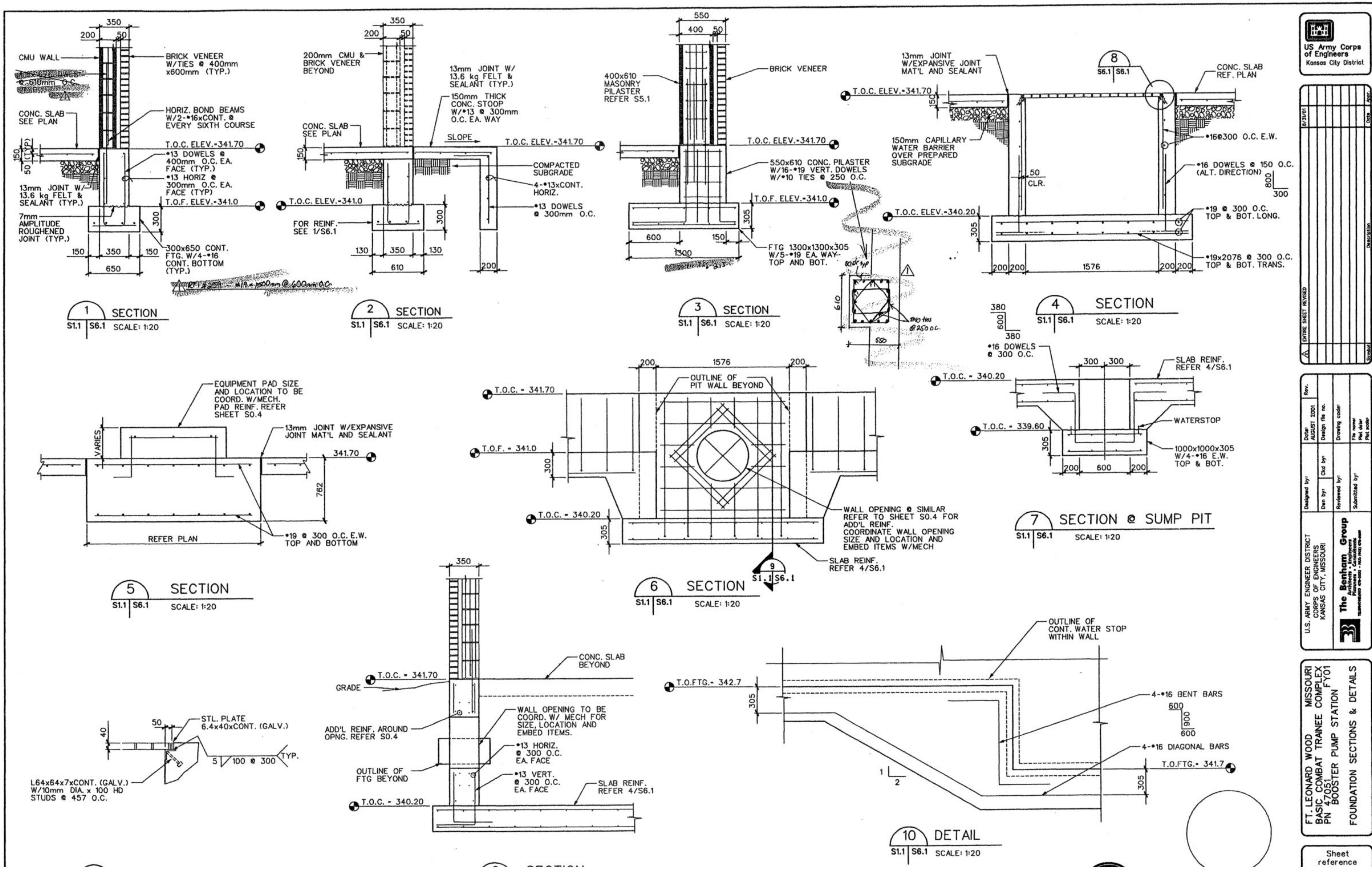
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION

MASONRY WALL ELEVATIONS

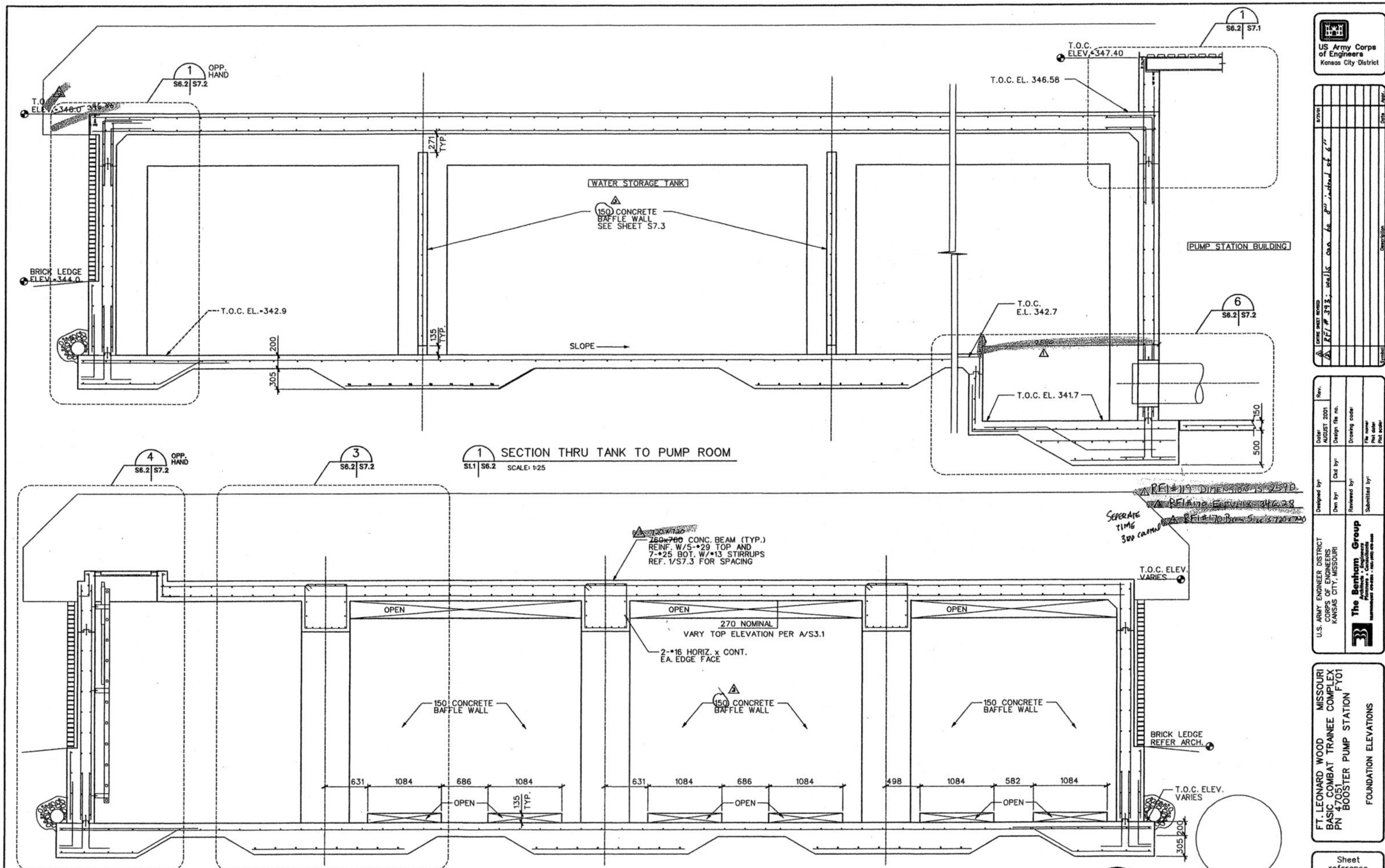
Sheet reference number:

Section:

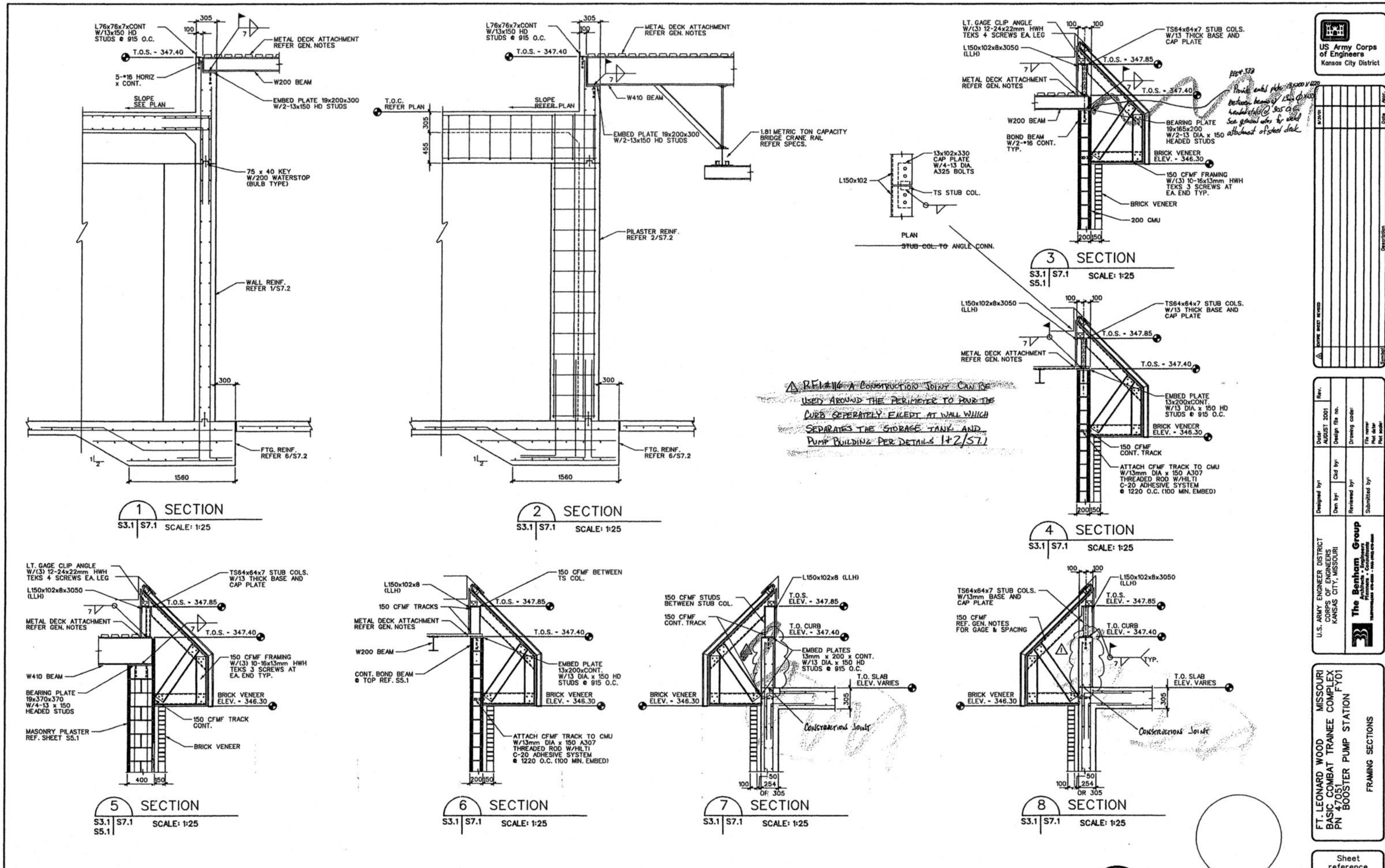


CMU WALL
BRICK VENEER W/TIES @ 400mm x600mm (TYP.)
HORIZ. BOND BEAMS W/2-#16xCONT. @ EVERY SIXTH COURSE
CONC. SLAB SEE PLAN
T.O.C. ELEV.=341.70
#13 DOWELS @ 400mm O.C. EA. FACE (TYP.)
#13 HORIZ @ 300mm O.C. EA. FACE (TYP)
13mm JOINT W/ 13.6 kg FELT & SEALANT (TYP.)
T.O.F. ELEV.=341.0
7mm AMPLITUDE ROUGHENED JOINT (TYP.)
300x650 CONT. FTG. W/4-#16 CONT. BOTTOM (TYP.)
1 SECTION S1.1 S6.1 SCALE: 1:20
200mm CMU & BRICK VENEER BEYOND
13mm JOINT W/ 13.6 kg FELT & SEALANT (TYP.)
150mm THICK CONC. STOOP W/#13 @ 300mm O.C. EA. WAY
CONC. SLAB SEE PLAN
SLOPE
T.O.C. ELEV.=341.70
COMPACTED SUBGRADE
4-#13xCONT. HORIZ.
#13 DOWELS @ 300mm O.C.
T.O.C. ELEV.=341.0
FOR REINF. SEE 1/S6.1
2 SECTION S1.1 S6.1 SCALE: 1:20
400x610 MASONRY PILASTER REFER S5.1
BRICK VENEER
T.O.C. ELEV.=341.70
550x610 CONC. PILASTER W/16-#19 VERT. DOWELS W/#10 TIES @ 250 O.C.
T.O.F. ELEV.=341.0
FTG 1300x1300x305 W/5-#19 EA. WAY TOP AND BOT.
3 SECTION S1.1 S6.1 SCALE: 1:20
13mm JOINT W/EXPANSIVE JOINT MAT'L AND SEALANT
CONC. SLAB REF. PLAN
T.O.C. ELEV.=341.70
150mm CAPILLARY WATER BARRIER OVER PREPARED SUBGRADE
#16@300 O.C. E.W.
#16 DOWELS @ 150 O.C. (ALT. DIRECTION)
50 CLR.
T.O.C. ELEV.=340.20
#19 @ 300 O.C. TOP & BOT. LONG.
#19x2076 @ 300 O.C. TOP & BOT. TRANS.
4 SECTION S1.1 S6.1 SCALE: 1:20
EQUIPMENT PAD SIZE AND LOCATION TO BE COORD. W/MECH. PAD REINF. REFER SHEET S0.4
13mm JOINT W/EXPANSIVE JOINT MAT'L AND SEALANT
VARIES
341.70
REFER PLAN
#19 @ 300 O.C.E.W. TOP AND BOTTOM
5 SECTION S1.1 S6.1 SCALE: 1:20
OUTLINE OF PIT WALL BEYOND
T.O.C. = 341.70
T.O.F. = 341.0
T.O.C. = 340.20
WALL OPENING @ SIMILAR REFER TO SHEET S0.4 FOR ADD'L REINF. COORDINATE WALL OPENING SIZE AND LOCATION AND EMBED ITEMS W/MECH
SLAB REINF. REFER 4/S6.1
6 SECTION S1.1 S6.1 SCALE: 1:20
#16 DOWELS @ 300 O.C.
SLAB REINF. REFER 4/S6.1
T.O.C. = 340.20
T.O.C. = 339.60
WATERSTOP
1000x1000x305 W/4-#16 E.W. TOP & BOT.
7 SECTION @ SUMP PIT S1.1 S6.1 SCALE: 1:20
STL. PLATE 6.4x40xCONT. (GALV.)
L64x64x7xCONT. (GALV.) W/10mm DIA. x 100 HD STUDS @ 457 O.C.
5 100 @ 300 TYP.
CONC. SLAB BEYOND
T.O.C. = 341.70
GRADE
WALL OPENING TO BE COORD. W/ MECH FOR SIZE, LOCATION AND EMBED ITEMS.
ADD'L REINF. AROUND OPNG. REFER S0.4
#13 HORIZ. @ 300 O.C. EA. FACE
#13 VERT. @ 300 O.C. EA. FACE
OUTLINE OF FTG BEYOND
SLAB REINF. REFER 4/S6.1
T.O.C. = 340.20
OUTLINE OF CONT. WATER STOP WITHIN WALL
T.O.FTG.= 342.7
4-#16 BENT BARS
4-#16 DIAGONAL BARS
T.O.FTG.= 341.7
10 DETAIL S1.1 S6.1 SCALE: 1:20
US Army Corps of Engineers Kansas City District
ENTIRE SHEET REVISED
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
Date: AUGUST 2001
FT. LEONARD WOOD MISSOURI BASIC COMBAT TRAINEE COMPLEX FY01 PN 47051 BOOSTER PUMP STATION
FOUNDATION SECTIONS & DETAILS
Sheet reference

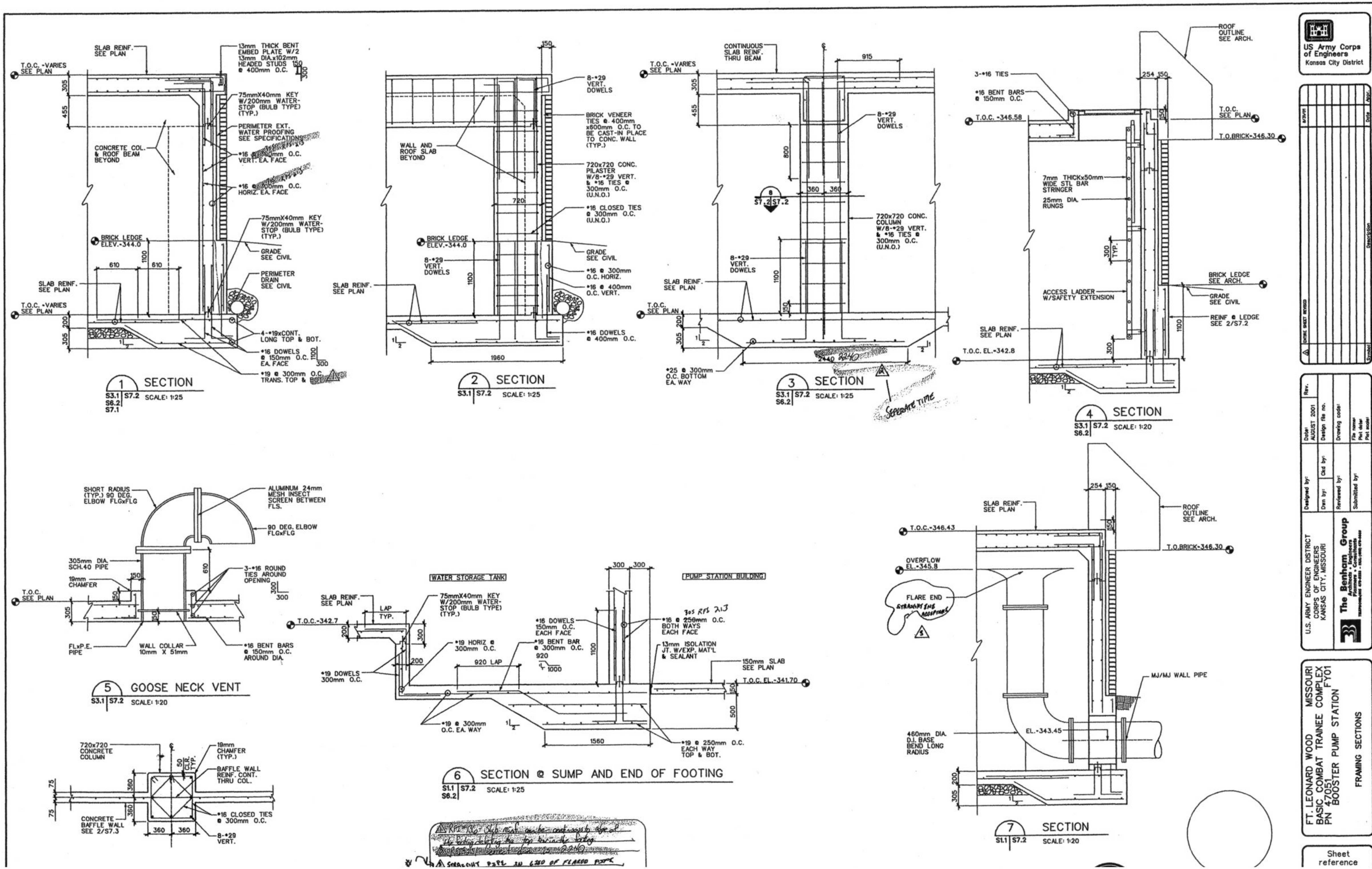
Section:


1 SECTION THRU TANK TO PUMP ROOM
S1.1 | S6.2 SCALE: 1:25
WATER STORAGE TANK
150 CONCRETE BAFFLE WALL SEE SHEET S7.3
PUMP STATION BUILDING
T.O.C. ELEV.-347.40
T.O.C. EL. 346.58
T.O.C. ELEV.-346.0
BRICK LEDGE ELEV.-344.0
T.O.C. EL.-342.9
T.O.C. E.L. 342.7
T.O.C. EL. 341.7
SLOPE
271 TYP.
135 TYP.
200
305
150
500
1 OPP. HAND S6.2 | S7.2
1 S6.2 | S7.1
6 S6.2 | S7.2
4 OPP. HAND S6.2 | S7.2
3 S6.2 | S7.2
760x700 CONC. BEAM (TYP.) REINF. W/5-#29 TOP AND 7-#25 BOT. W/#13 STIRRUPS REF. 1/S7.3 FOR SPACING
OPEN
270 NOMINAL
VARY TOP ELEVATION PER A/S3.1
2-#16 HORIZ. x CONT. EA. EDGE FACE
150 CONCRETE BAFFLE WALL
631 1084 686 1084
498 1084 582 1084
T.O.C. ELEV. VARIES
BRICK LEDGE REFER ARCH.
SEPERATE TIME
US Army Corps of Engineers Kansas City District
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
Designed by: Dwn by: Ckd by: Reviewed by: Submitted by:
Date: AUGUST 2001
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
FOUNDATION ELEVATIONS
Sheet reference number:

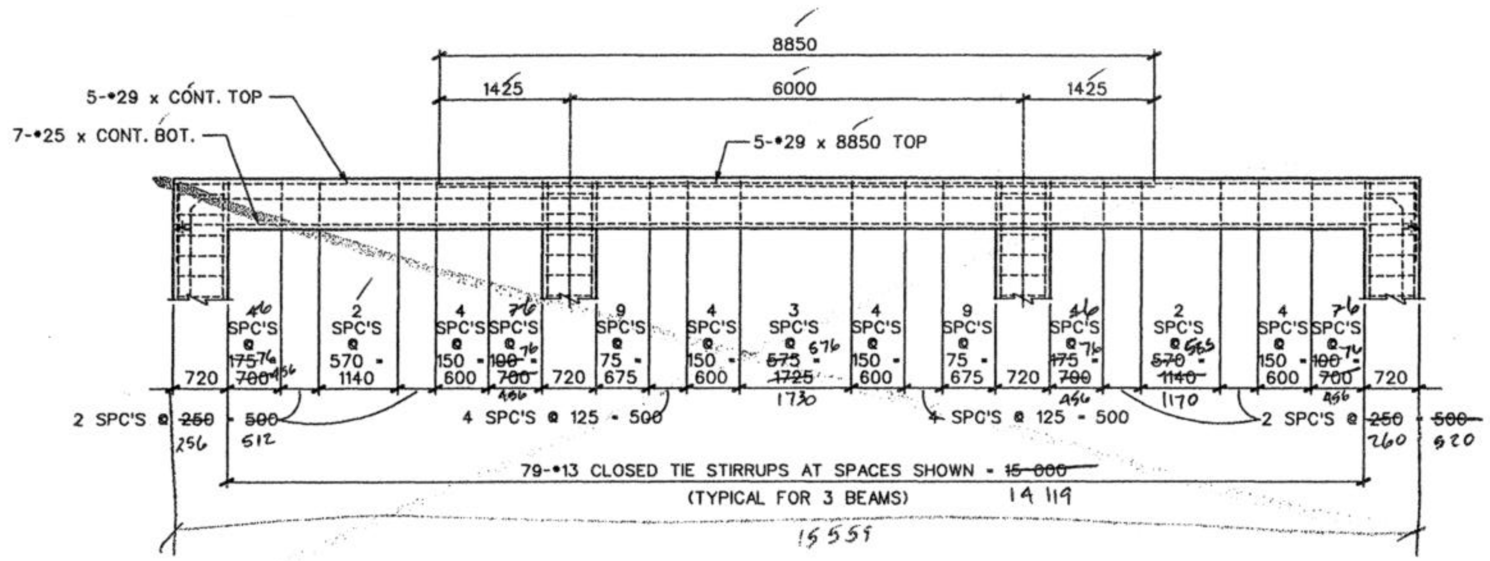
Section:


L76x76x7xCONT W/13x150 HD STUDS @ 915 O.C.
305
100
T.O.S. - 347.40
METAL DECK ATTACHMENT REFER GEN. NOTES
5-#16 HORIZ x CONT.
W200 BEAM
SLOPE SEE PLAN
EMBED PLATE 19x200x300 W/2-13x150 HD STUDS
75 x 40 KEY W/200 WATERSTOP (BULB TYPE)
WALL REINF. REFER 1/S7.2
300
FTG. REINF. REFER 6/S7.2
1560
1 SECTION
S3.1 S7.1 SCALE: 1:25
T.O.C. REFER PLAN
W410 BEAM
SLOPE REFER PLAN
EMBED PLATE 19x200x300 W/2-13x150 HD STUDS
1.81 METRIC TON CAPACITY BRIDGE CRANE RAIL REFER SPECS.
PILASTER REINF. REFER 2/S7.2
2 SECTION
S3.1 S7.1 SCALE: 1:25
LT. GAGE CLIP ANGLE W/(3) 12-24x22mm HWH TEKS 4 SCREWS EA. LEG
L150x102x8x3050 (LLH)
TS64x64x7 STUB COLS. W/13 THICK BASE AND CAP PLATE
T.O.S. - 347.85
T.O.S. - 347.40
BEARING PLATE 19x165x200 W/2-13 DIA. x 150 HEADED STUDS
BOND BEAM W/2-#16 CONT. TYP.
BRICK VENEER ELEV. - 346.30
150 CFMF FRAMING W/(3) 10-16x13mm HWH TEKS 3 SCREWS AT EA. END TYP.
BRICK VENEER
200 CMU
RFI# 338
Provide embed plate 13x200x1220 between beams w/ 13mm ϕ x 150 headed studs @ 305 O.C.
See general notes for weld attachment of steel deck
13x102x330 CAP PLATE W/4-13 DIA. A325 BOLTS
L150x102
TS STUB COL.
PLAN
STUB COL. TO ANGLE CONN.
3 SECTION
S3.1 S5.1 S7.1 SCALE: 1:25
EMBED PLATE 13x200xCONT. W/13 DIA. x 150 HD STUDS @ 915 O.C.
150 CFMF CONT. TRACK
ATTACH CFMF TRACK TO CMU W/13mm DIA x 150 A307 THREADED ROD W/HILTI C-20 ADHESIVE SYSTEM @ 1220 O.C. (100 MIN. EMBED)
4 SECTION
S3.1 S7.1 SCALE: 1:25
RFI #116 A CONSTRUCTION JOINT CAN BE USED AROUND THE PERIMETER TO POUR THE CURB SEPARATELY EXCEPT AT WALL WHICH SEPARATES THE STORAGE TANK AND PUMP BUILDING PER DETAILS 1+2/S7.1
W410 BEAM
BEARING PLATE 19x370x370 W/4-13 x 150 HEADED STUDS
MASONRY PILASTER REF. SHEET S5.1
150 CFMF TRACK CONT.
400 150
5 SECTION
S3.1 S5.1 S7.1 SCALE: 1:25
L150x102x8 (LLH)
150 CFMF TRACKS
150 CFMF BETWEEN TS COL.
CONT. BOND BEAM @ TOP REF. S5.1
6 SECTION
S3.1 S7.1 SCALE: 1:25
150 CFMF STUDS BETWEEN STUB COL.
T.O. CURB ELEV. - 347.40
EMBED PLATES 13mm x 200 x CONT. W/13 DIA. x 150 HD STUDS @ 915 O.C.
T.O. SLAB ELEV. VARIES
Construction Joint
OR 305
7 SECTION
S3.1 S7.1 SCALE: 1:25
150 CFMF REF. GEN. NOTES FOR GAGE & SPACING
TYP.
Construction Joint
8 SECTION
S3.1 S7.1 SCALE: 1:25
US Army Corps of Engineers Kansas City District
Date: AUGUST 2001
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
FRAMING SECTIONS
Sheet reference number:

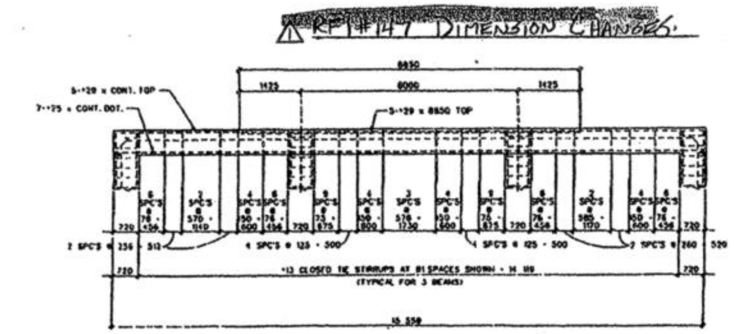
Section:

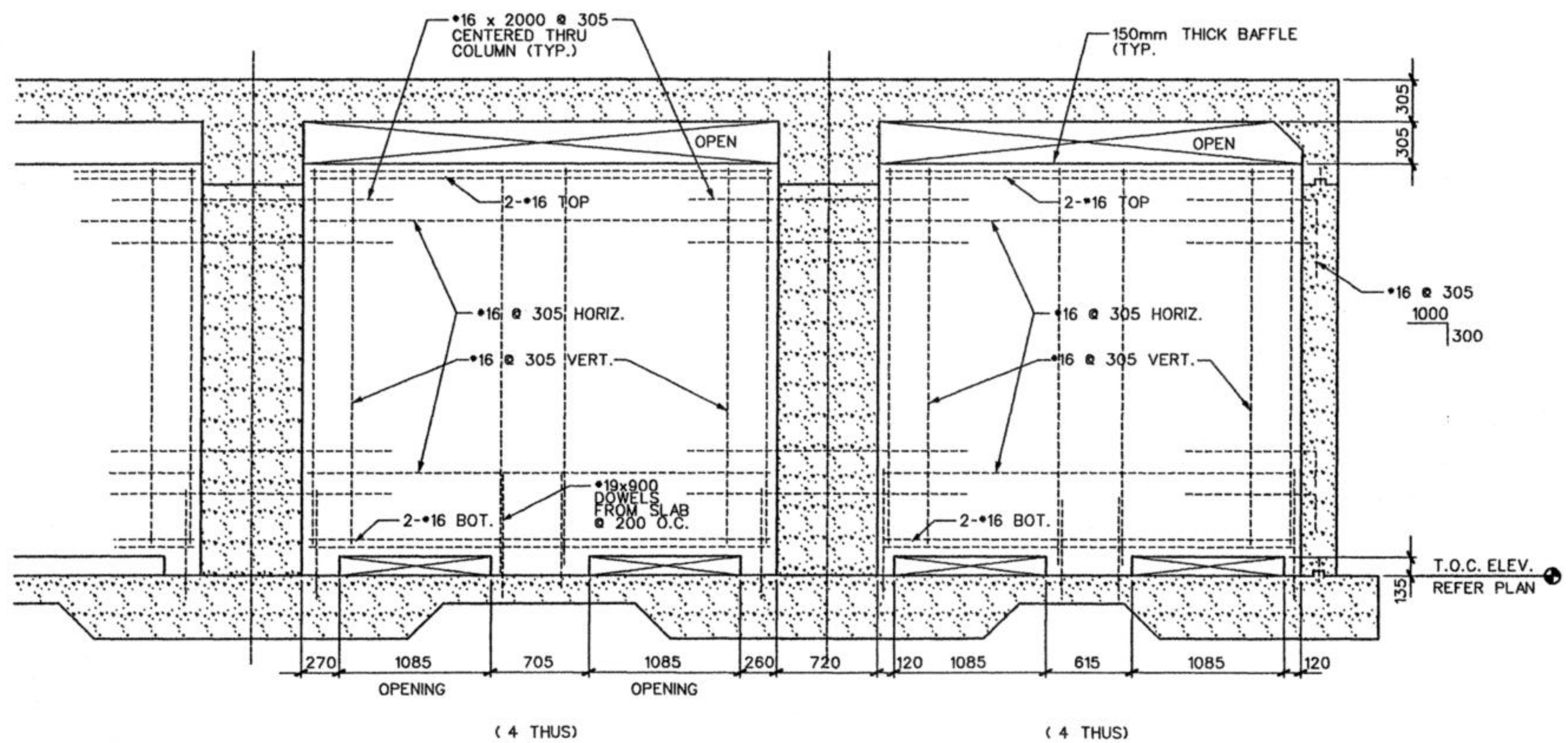

SLAB REINF. SEE PLAN
T.O.C. =VARIES SEE PLAN
13mm THICK BENT EMBED PLATE W/2 13mm DIA.x102mm HEADED STUDS @ 400mm O.C.
75mmX40mm KEY W/200mm WATER-STOP (BULB TYPE) (TYP.)
PERIMETER EXT. WATER PROOFING SEE SPECIFICATIONS
CONCRETE COL. & ROOF BEAM BEYOND
#16 @ 300mm O.C. VERT. EA. FACE
#16 @ 300mm O.C. HORIZ. EA. FACE
BRICK LEDGE ELEV.=344.0
GRADE SEE CIVIL
PERIMETER DRAIN SEE CIVIL
4-#19xCONT. LONG TOP & BOT.
#16 DOWELS @ 150mm O.C. EA. FACE
#19 @ 300mm O.C. TRANS. TOP & BOT.
1 SECTION
S3.1 S7.2 S6.2 S7.1 SCALE: 1:25
8-#29 VERT. DOWELS
BRICK VENEER TIES @ 400mm x600mm O.C. TO BE CAST-IN PLACE TO CONC. WALL (TYP.)
WALL AND ROOF SLAB BEYOND
720x720 CONC. PILASTER W/8-#29 VERT. & #16 TIES @ 300mm O.C. (U.N.O.)
#16 CLOSED TIES @ 300mm O.C. (U.N.O.)
#16 @ 300mm O.C. HORIZ.
#16 @ 400mm O.C. VERT.
#16 DOWELS @ 400mm O.C.
2 SECTION
S3.1 S7.2 SCALE: 1:25
CONTINUOUS SLAB REINF. THRU BEAM
720x720 CONC. COLUMN W/8-#29 VERT. & #16 TIES @ 300mm O.C. (U.N.O.)
#25 @ 300mm O.C. BOTTOM EA. WAY
2440 3240
SEPERATE TYPE
3 SECTION
S3.1 S7.2 S6.2 SCALE: 1:25
ROOF OUTLINE SEE ARCH.
3-#16 TIES
#16 BENT BARS @ 150mm O.C.
T.O.C.=346.58
T.O.C. SEE PLAN
T.O.BRICK=346.30
7mm THICKx50mm WIDE STL BAR STRINGER
25mm DIA. RUNGS
BRICK LEDGE SEE ARCH.
ACCESS LADDER W/SAFETY EXTENSION
REINF @ LEDGE SEE 2/S7.2
T.O.C. EL.=342.8
4 SECTION
S3.1 S7.2 S6.2 SCALE: 1:20
SHORT RADIUS (TYP.) 90 DEG. ELBOW FLGxFLG
ALUMINUM 24mm MESH INSECT SCREEN BETWEEN FLS.
90 DEG. ELBOW FLGxFLG
305mm DIA. SCH.40 PIPE
19mm CHAMFER
3-#16 ROUND TIES AROUND OPENING
FLxP.E. PIPE
WALL COLLAR 10mm X 51mm
#16 BENT BARS @ 150mm O.C. AROUND DIA.
5 GOOSE NECK VENT
S3.1 S7.2 SCALE: 1:20
WATER STORAGE TANK
PUMP STATION BUILDING
LAP TYP.
T.O.C.=342.7
#19 HORIZ @ 300mm O.C.
#16 DOWELS 150mm O.C. EACH FACE
#16 BENT BAR @ 300mm O.C.
920 LAP
#19 DOWELS 300mm O.C.
#16 @ 250mm O.C. BOTH WAYS EACH FACE
305 RFI 213
13mm ISOLATION JT. W/EXP. MAT'L & SEALANT
150mm SLAB SEE PLAN
T.O.C. EL.=341.70
#19 @ 300mm O.C. EA. WAY
#19 @ 250mm O.C. EACH WAY TOP & BOT.
6 SECTION @ SUMP AND END OF FOOTING
S1.1 S7.2 S6.2 SCALE: 1:25
720x720 CONCRETE COLUMN
19mm CHAMFER (TYP.)
BAFFLE WALL REINF. CONT. THRU COL.
CONCRETE BAFFLE WALL SEE 2/S7.3
#16 CLOSED TIES @ 300mm O.C.
8-#29 VERT.
T.O.C.=346.43
OVERFLOW EL.=345.8
FLARE END
STRAIGHT END ACCEPTABLE
MJ/MJ WALL PIPE
EL.=343.45
460mm DIA. D.I. BASE BEND LONG RADIUS
7 SECTION
S1.1 S7.2 SCALE: 1:20
STRAIGHT PIPE IN LIEU OF FLARED PIPE
US Army Corps of Engineers Kansas City District
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS KANSAS CITY, MISSOURI
The Benham Group
Date: AUGUST 2001
FT. LEONARD WOOD MISSOURI BASIC COMBAT TRAINEE COMPLEX FY01 PN 47051 BOOSTER PUMP STATION
FRAMING SECTIONS
Sheet reference

Section:



1 STORAGE TANK SLAB BEAM STIRRUP REINFORCING PLACEMENT
S6.2 | S7.3 SCALE: 1:50





2 CONCRETE BAFFLE WALLS DETAIL
S6.2 | S7.3 SCALE: 1:25

0 1 2 2.5m

US Army Corps of Engineers
Kansas City District

Symbol | Description | Date | Appr.

Designed by: | Dwn by: | Ckd by: | Date: AUGUST 2001 | Rev.
Reviewed by: | Design file no.
Submitted by: | Drawing code:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

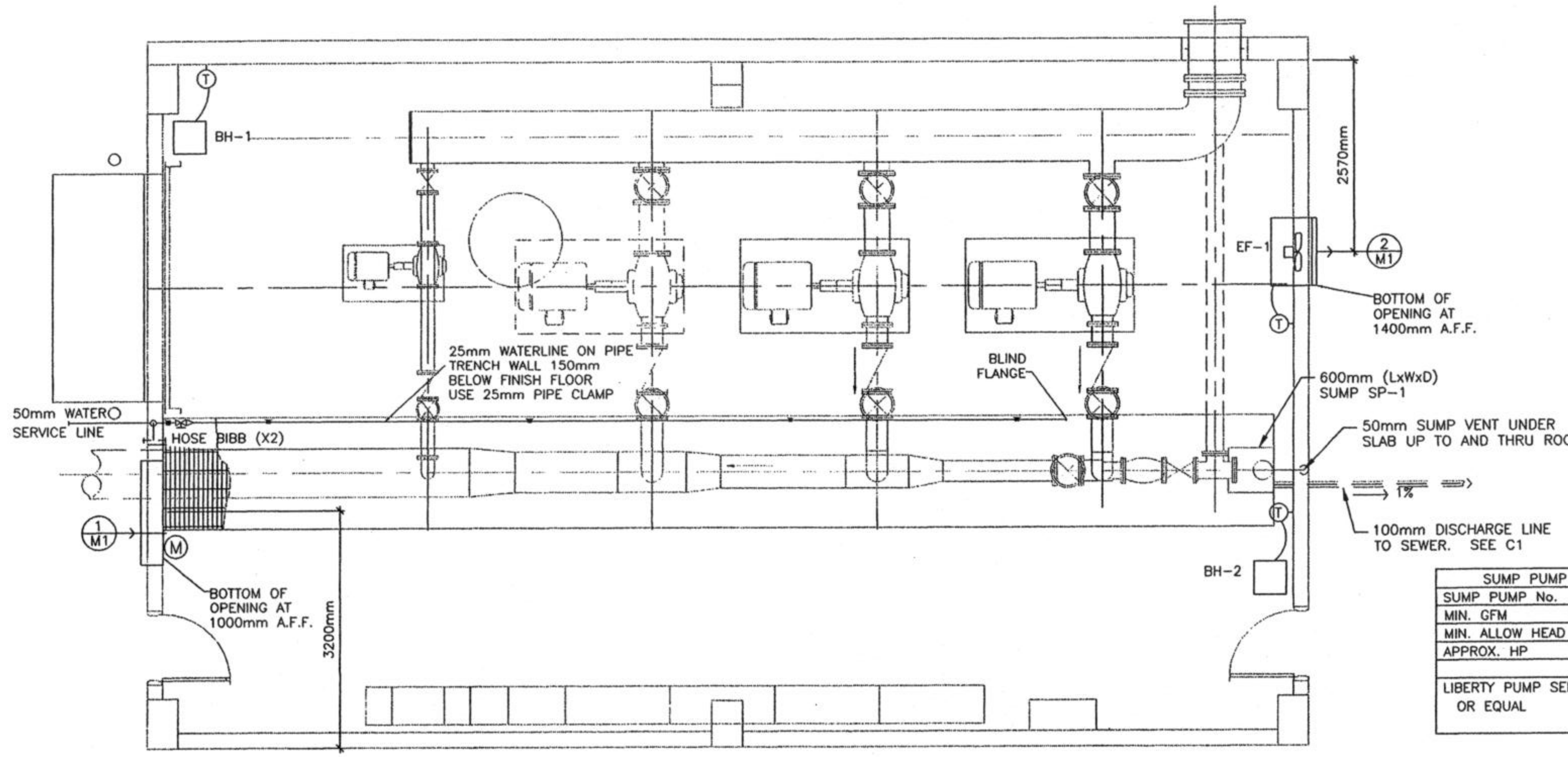
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION

FRAMING REINFORCING DETAILS

Sheet reference

Section:

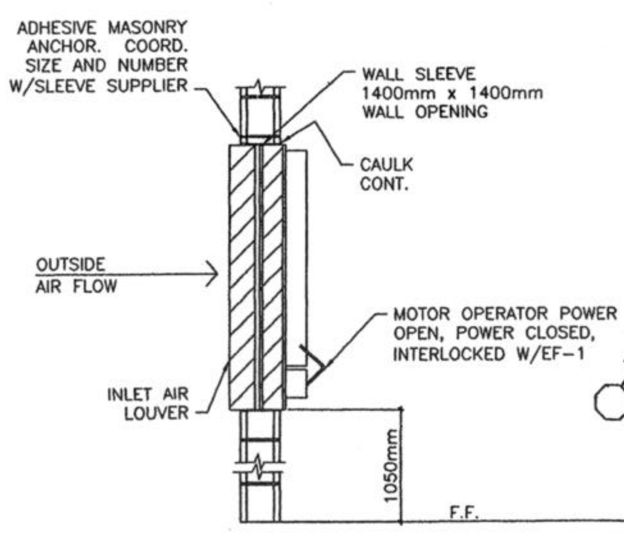
BLOWER HEATER SCHEDULE	
HEATER No.	BH-1/BH-2
BOTTOM AFF	3000mm
APPROX. CFM	750 CFM
OUTPUT BTU	10 KW
ELEC DATA	480/3/60
CHROMALUX KVH-10 OR EQUAL	



SUMP PUMP SCHEDULE	
SUMP PUMP No.	SP-1
MIN. GFM	40
MIN. ALLOW HEAD	12
APPROX. HP	1/2
LIBERTY PUMP SERIES 280 OR EQUAL	

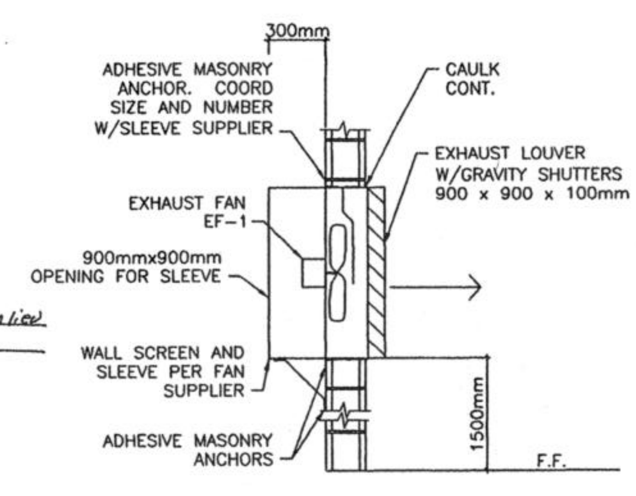
PUMP STATION MECHANICAL PLAN
SCALE: 1 : 40

0 2m 4m
SCALE 1 : 40



1 M1 SECTION-INLET AIR LOUVER
NOT TO SCALE

RFI # 045 The use of PVC Pipe and Fittings in lieu of Cast iron is not acceptable.



2 M1 SECTION - EXHAUST FAN
NOT TO SCALE

FAN SCHEDULE	
FAN	EF-1
TYPE	PROPELLER
SERVICE	EXHAUST
CFM @ STD COND.	7000
STATIC PRESSURE IN W.G.	.375
WHEEL DIA.	600mm
WHEEL RPM	1725
APPROX. MOTOR HP	2
ELECTRICAL	460/3/60
DRIVE	DIRECT

US Army Corps of Engineers
Kansas City District

Symbol | Description | Date | Appr.

Designed by: | Dwn by: | Ckd by: | Reviewed by: | Submitted by:
Date: JULY 2001 | Rev.
Design file no.
Drawing code:
File name:
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
PUMP STATION MECHANICAL PLAN

Sheet reference number:

LEGEND

SYMBOL	DESCRIPTION
AW	ACID WASTE
AV	ACID VENT
	SOIL OR WASTE
	SOIL OR WASTE VENT
RD	ROOF DRAIN LINE
SD	STORM DRAIN
G	NATURAL GAS, LOW PRESS
MG	NATURAL GAS, MED PRESS
CW	DOMESTIC COLD WATER
HW	DOMESTIC HOT WATER (110°F)
HWR	DOMESTIC HOT WATER RETURN
HHW	DOMESTIC HOT WATER (180°F)
FP	FIRE PROTECTION WATER SUPPLY
SP	SPRINKLER MAIN
S	STEAM, LOW PRESS 0-15 PSI
MPS	STEAM, MED PRESS 16-124 PSI
HPS	STEAM, HIGH PRESS 125 & ABOVE
C	CONDENSATE, LOW PRESS 0-15 PSI
MPC	CONDENSATE, MED PRESS 16-124 PSI
HPC	CONDENSATE, HIGH PRESS 125 PSI & ABOVE
CP	CONDENSATE, PUMPED
FST	FLASH STEAM
BFW	BOILER FEED WATER
BD	BLOWDOWN, BOILER, COOLING TOWER, ETC
BO	BOILER BLOWOFF: RELIEF VALVE
CHS	CHILLED WATER SUPPLY
CHR	CHILLED WATER RETURN
HS	HEATING WATER SUPPLY
HR	HEATING WATER RETURN
CS	CONDENSER WATER SUPPLY
CR	CONDENSER WATER RETURN
CD	CONDENSATE DRAIN
FOS	FUEL OIL SUPPLY
FOR	FUEL OIL RETURN
FOV	FUEL OIL VENT
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
RG	REFRIGERANT GAS
CF	CHEMICAL FEED
AF	ACID FEED
SW	SOFT WATER
DS	DISTILLED WATER
DI	DEMINERALIZED OR DEIONIZED WATER
PCW	PROCESS COLD WATER
CA	COMPRESSED AIR
MA	COMPRESSED AIR, MEDICAL
LA	COMPRESSED AIR, LABORATORY
PA	COMPRESSED AIR, PLANT
DV	DRY VACUUM, HOUSEKEEPING
WV	WET VACUUM, HOUSEKEEPING
V	VACUUM, MEDICAL
LV	VACUUM, LABORATORY
DWS	CHILLED DRINKING WATER SUPPLY
DWR	CHILLED DRINKING WATER RETURN
W	WATER SUPPLY MAIN 2

SYMBOL	DESCRIPTION
OX	OXYGEN
N	NITROGEN
NO	NITROUS OXIDE
H	HYDROGEN
Ar	ARGON
He	HELIUM
CO_2	CARBON DIOXIDE
CH_4	METHANE
HCL	HYDROGEN CHLORIDE
F	FLUORINE
	RISER DOWN (ELBOW)
	RISER UP (ELBOW)
	RISE OR DROP
	TEE DOWN
	TEE UP
	TOP CONNECTION
	BOTTOM CONNECTION
	SIDE CONNECTION
	GATE VALVE
	BALANCING VALVE
	PLUG COCK/GAS STOP
	CHECK VALVE
	GLOBE VALVE
	SOLENOID VALVE
	BALL VALVE
	BUTTERFLY VALVE
	PRESSURE REDUCING VALVE
	PRESSURE RELIEF VALVE
	TRIPLE DUTY VALVE
	NEEDLE VALVE
	CONTROL VALVE, 2 WAY PNEUMATIC
	CONTROL VALVE, 3 WAY PNEUMATIC
	ANGLE VALVE
	CONTROL VALVE, 2 WAY ELECTRIC
	CONTROL VALVE, 3 WAY ELECTRIC
	BACKFLOW PREVENTION DEVICE
	COMPRESSED AIR CONNECTION
	AIR/VACUUM RELIEF VALVE
	PRESSURE AND TEMPERATURE RELIEF
	REDUCER, ECCENTRIC
	REDUCER, CONCENTRIC
	CAP OR BLIND FLANGE
	STRAINER, "Y" TYPE
	STRAINER, "U" TYPE
CO	CLEANOUT PLUG
CO	CLEANOUT, FLOOR

SYMBOL	DESCRIPTION
CO	CLEANOUT, WALL
	VACUUM BREAKER
HB	HOSE BIBB
WH	WALL HYDRANT
YH	YARD HYDRANT
	FLOW IN DIRECTION OF ARROW
	PIPE SLOPE IN DIRECTION OF ARROW
PT	PRESSURE AND TEMPERATURE TEST PLUG (PETES PLUG)
TI	TEMPERATURE INDICATOR
TW	THERMOMETER WELL
PI	PRESSURE GAUGE WITH GAUGE COCK & SNUBBER
	AIR VENT, AUTOMATIC
	UNION
	FLEXIBLE PIPE CONNECTION
	WATER HAMMER ARRESTOR
FD	FLOOR DRAIN
SD	SHOWER DRAIN
AD	AREA DRAIN
RD	ROOF DRAIN
T	THERMOSTAT
DA	DRIP ASSEMBLY, REF DETAIL
TA	CONDENSATE TRAP ASSEMBLY REF DETAIL
PRS	PRESSURE REDUCING STATION REF DETAIL
11'-0"	UNINSULATED LINES- DISTANCE FROM FF TO BOP INSULATED LINES- DISTANCE FROM FF TO BOI
	REMOVE EXIST TO THIS POINT
	TIE-IN TO EXIST AT THIS POINT
	UPRIGHT SPRINKLER HEAD
	PENDANT SPRINKLER HEAD
	SIDE WALL SPRINKLER HEAD
	FIRE DEPARTMENT CONNECTION
	FIRE HYDRANT
FHC	FIRE HOSE CABINET FOR OCCUPANT'S USE
FHE	FIRE HOSE W/ FIRE EXTINGUISHER CABINET
HVC	FIRE HOSE VALVE IN CABINET
FEC	FIRE EXTINGUISHER CABINET
FE	HAND EXTINGUISHER

SYMBOL	DESCRIPTION
	PROPELLER FLOWMETER
	ELECTROMAGNETIC FLOWMETER
FE FX	SONIC FLOWMETER
	VORTEX FLOWMETER
	PITOT TUBE (ANNULAR) FLOWMETER
	VENTURI FLOWMETER
	ORIFICE FLOWMETER
	FLUME FLOWMETER
	WEIR FLOWMETER
FI	ROTAMETER
DE DX	DENSITY METER
LE	SONIC LEVEL SENSOR
TE	TEMPERATURE ELEMENT WITH WELL
LT	LEVEL TRANSMITTER FLOAT TYPE
PT	PRESSURE TRANSMITTER W/CHEMICAL SEAL
WT	SCALE WEIGHT TRANSMITTER (HYDRAULIC TYPE)

SYMBOL	DESCRIPTION
	DUCT SECTION, SUPPLY
	DUCT SECTION, EXHAUST OR RETURN
	CEILING DIFFUSER SQUARE PATTERN. NO ARROWS INDICATE 4-WAY AIR PATTERN
	RETURN, EXHAUST, OR TRANSFER REGISTER
	SUPPLY AIR TROFFER SIDE OR TOP INLET
	SIDEWALL SUPPLY REGISTER OR GRILLE
	LINEAR DIFFUSER, NO ARROWS INDICATE 2-WAY AIR PATTERN
MD ACCESS	MD = MANUAL DAMPER MTD = MOTORIZED DAMPER GD = GRAVITY DAMPER OA = OUTSIDE AIR DAMPER RA = RETURN AIR DAMPER BD = BACKDRAFT DAMPER FD = FIRE DAMPER SMD = SMOKE DAMPER RLA = RELIEF DAMPER
	90 DEGREE RECTANGULAR ELBOW UP WITH SINGLE THICKNESS TURNING VANES
	90 DEG. ELBOW UP
	90 DEGREE RECTANGULAR ELBOW DOWN WITH SINGLE THICKNESS TURNING VANES
	90 DEG. ELBOW DOWN
	90 DEGREE RECTANGULAR ELBOW WITH SINGLE THICKNESS TURNING VANES
	90 DEGREE ROUND ELBOW, HORIZONTAL
	45 DEG. RECTANGULAR BEND
	45 DEG. RECTANGULAR BEND, 1-1/2 RADIUS
	45 DEG. ROUND BEND, 1-1/2 RADIUS
	ROUND PRESSURE TAP WITH VOLUME DAMPER
	STRAIGHT SIDED BRANCH SPLIT. TRANSITION TO FULL SIZE BEFORE ELBOW.
	BRANCH SPLIT. TRANSITION TO SPLIT. TRANSITION TO FULL SIZE BEFORE ELBOW.
	WYE SPLIT. TRANSITION TO FULL SIZE BEFORE ELBOW.

SYMBOL	DESCRIPTION
	END CAPS
F	F= FALL IN DUCT ELEV R= RISE IN DUCT ELEV

NOTE: AIR DISTRIBUTION DEVICES ARE ARE DENOTED AS ILLUSTRATED BELOW:

- 12/4 - 200 - A

- DEVICE TYPE REFER SCHEDULE
- CFM
- INDICATES CONNECTION SIZE OF THE DEVICE (ø INDICATES ROUND)
- QUANTITY, BLANK IF ONLY ONE.

SYMBOL	DESCRIPTION
LIT	INSTRUMENT OF OTHER COMPONENT TO BE MOUNTED IN THE FIELD, (SEE PLANS)
TSL	INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED INSIDE MAIN CONTROL BOARD OR OTHER PANEL AS MARKED
FIC	INSTRUMENT OR OTHER COMPONENT TO BE MOUNTED ON MCB FRONT PANEL OR OTHER PANEL AS MARKED
FIR PSH	SINGLE INSTRUMENT OR OTHER COMPONENT HAVING MULTIPLE FUNCTIONS
	INSTRUMENT OF OTHER COMPONENT ACCESSED THROUGH COMPUTER CRT
F	COMPUTER INTERFACE
	RELATED DEVICE PERFORMS LINEARIZING OR SQUARE ROOT FUNCTION
	RELATED DEVICE PERFORMS MULTIPLYING SUMMATION OR DIVISION FUNCTION
I	GENERALIZED FOR COMPLEX INTERLOCK LOGIC - SEE ELECTRIC SCHEMATICS OR SPECIFICATIONS
OR	INTERLOCK IF ANY ONE OR MORE INPUTS EXIST
AND	INTERLOCK IF ALL INPUTS EXIST
	STATUS OR PILOT LIGHT: R - RED G - GREEN A - AMBER
CV	CONTROLLED VARIABLE
E	VOLTAGE
I	CURRENT
P	PNEUMATIC
PD	PULSE DURATION
PF	PULSE FREQUENCY
SP	SET POINT
	PNEUMATIC PRESSURE (P) SIGNAL
(3)	INDICATES QUANTITY OF SIGNALS (THREE)
	ELECTRIC SIGNAL
	HYDRAULIC LINE
	PROCESS PIPING
	SONIC SIGNAL
	CAPILLARY TUBING (FILLED SYSTEM)
24 ES VDC	POWER SUPPLY AS NOTED 24V, 60 HZ; 24 VDC; ETC.)
AS	AIR SUPPLY (20 PSIG-EXCEPT AS NOTED)
	PRIMARY ELECTRICAL SUPPLY (120V. 60HZ)
*	INDICATES COMPONENTS ARE NOT SPECIFIED AS PART OF THE INSTRUMENT PACKAGE
	CABLE (MULTICONDUCTOR OR COAXIAL) FURNISHED WITH EQUIPMENT
	MULIPLEXER LOOP

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	ADDED WATER SUPPLY MAIN TO LEGEND	8/31	

Designed by: | Dwn by: | Ckd by: | Reviewed by: | Submitted by:

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U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
PROCESS AND PIPING LEGEND

Sheet reference

DISTRIBUTION SYSTEM NOTES

OVERALL LAYOUT AND PHASES. THE BCT COMPLEX DISTRIBUTION SYSTEM IS A CLOSED SYSTEM, THE FLOW AND PRESSURE TO WHICH IS PROVIDED, WITH MINOR EXCEPTION, SOLELY BY THE BOOSTER PUMP STATION. THE DISTRIBUTION SYSTEM CONSISTS OF TWO LOOPS, THE EXTERIOR LINES OF WHICH ARE 12-INCH LINES, WITH A COMMON 16-INCH LINE. WATER IS DISCHARGED FROM THE PUMP STATION TO A POINT COMMON TO BOTH LOOPS AND THEREAFTER DISTRIBUTED AMONG THE BUILDINGS BY 12 AND 16-INCH LINES WITH INDIVIDUAL 8-INCH BUILDING SERVICE CONNECTIONS.

MAG FLOW METER. AS WATER LEAVES THE PUMP STATION IT PASSES THROUGH A 24-INCH MAGNETIC FLOW METER, TO BE PROVIDED AND INSTALLED UNDER THIS CONTRACT, THE OUTPUT OF WHICH IS PASSED TO THE PLC IN THE MAIN PUMP STATION, WHICH RECORDS INSTANTANEOUS AND TOTALIZED FLOW.

LOOPS. AFTER THE FLOW METER, THE WATER IS DIRECTED TO A REDUCER AND CROSS WHICH SPLITS THE FLOW TO THE EXTERIOR LOOP OR INTERIOR COMMON LINE AS DEMAND REQUIRES.

VALVES. VALVES ARE SPECIFIED AND ARE TO BE PROVIDED SO AS TO PERMIT PORTIONS OF THE LOOP AND COMMON LINE OR INDIVIDUAL BRANCHES TO BE ISOLATED FOR MAINTENANCE AND REPAIR.

SERVICE CONNECTIONS. SERVICE CONNECTIONS TO BUILDINGS CONSIST OF AN INDIVIDUAL CONNECTION FROM THE MAIN DISTRIBUTION LINE, WHICH IS SUBSEQUENTLY DIVIDED INTO DOMESTIC AND FIRE PIPEAGE. THESE SERVICE CONNECTIONS ARE NOT SHOWN ON THE PLAN AND PROFILE SHEETS AS THEY ARE NOT CONSIDERED DISTRIBUTION LINES BUT ARE A PART OF THIS CONTRACT. POST INDICATOR VALVES ARE TO BE INSTALLED AT LOCATIONS WHICH PERMIT READY CHECKING.

VAULTS FOR AIR RELEASE AND CHECK VALVES. CONCRETE VAULTS OR REINFORCED CONCRETE PIPES WITH ACCESS COVERS ARE TO BE CONSTRUCTED FOR EACH AND ALL AIR RELEASE/VACUUM RELIEF OR COMBINATION AIR VALVES, CHECK VALVE ASSEMBLIES, AND LEVEL CONTROL OR SOLENOID VALVES, IN ORDER TO PERMIT READY MAINTENANCE OR REPLACEMENT WITHOUT EXCAVATION. ALL OTHER DISTRIBUTION VALVES MAY BE DIRECT BURIAL VALVES WITH VALVE BOXES AND STANDARD AWWA OPERATING NUTS.

INTERCONNECTION BETWEEN EXISTING AND NEW SYSTEMS. DOWNSTREAM OF THE MAIN CROSS, AN OUTLET IS PROVIDED WHICH PERMITS FLOW FROM THE SYSTEM TO BE DIRECTED INTO THE MAIN POST SYSTEM BY THE MANUAL OPENING OF VALVES OFF THE COMMON LINE AND ONTO THE EXISTING 10-INCH POST LINE NEARBY. A SECOND INTERCONNECTION IS TO BE PROVIDED AND CONSTRUCTED AS SHOWN ON THE PLAN AND PROFILE SHEETS NEAR THE SECOND COMMON POINT OF THE 16-INCH LINE AND THE OUTER LOOP LINES. ISOLATION VALVES AND A CHECK VALVE IN A CONCRETE VAULT ARE TO PERMIT FLOW FROM THE MAIN POST SYSTEM LINE ALONG IOWA AVENUE IN THE EVENT COMPLEX SYSTEM PRESSURE DROPS BELOW THE POST SYSTEM PRESSURE.

PROCEDURES TO DRAIN STORAGE TANK. THE DISTRIBUTION SYSTEM IS DESIGNED SO THAT THE MAIN STORAGE TANK MAY BE DRAINED DIRECTLY BY MEANS OF THE MAIN DRAIN LINE ON THE WESTERLY SIDE OF THE STORAGE TANK. THE TANK MAY ALSO BE PARTIALLY DRAINED BY MANUALLY ISOLATING THE MAIN STORAGE TANK INFLOW LINE AND MANUALLY OPENING THE VALVES FROM THE 16-INCH LINE TO THE 8-INCH INTERCONNECT LINE AND FROM THE 8-INCH INTERCONNECT LINE TO THE EXISTING 10-INCH POST LINE.

DISCHARGE PRESSURE AT PUMP STATION. THE DESIGN DISCHARGE PRESSURE AT THE NEW PUMP STATION IS NOT LESS THAN 80 PSI. THE DISCHARGE PRESSURE NECESSARY TO ACHIEVE DESIGN FLOWS IN THE SYSTEM SHALL REQUIRE FIELD ADJUSTMENT BY THE CONTRACTOR DURING SYSTEM TESTING AND ACCEPTANCE. SUCH ADJUSTMENT MAY BE EFFECTED BY PUMP SEQUENCING AND SPEED CONTROL AND ADJUSTMENT OF THE RELIEF PRESSURE OF THE SURGE AND PRESSURE RELIEF VALVE IN THE BOOSTER PUMP STATION.

SYSTEM TESTING. LINE TESTING OF ALL DISTRIBUTION PIPEAGE SHALL CONSIST OF A 30-MINUTE PRESSURE TEST AT 150 PSI, FOLLOWED BY A 2-HOUR LEAKAGE TEST AT 100 PSI. EXCESS PRESSURE DROPS DUE TO LEAKS SHALL BE CORRECTED AND THE LINE RETESTED PRIOR TO FINAL ACCEPTANCE.

2

Request For Information No. 206

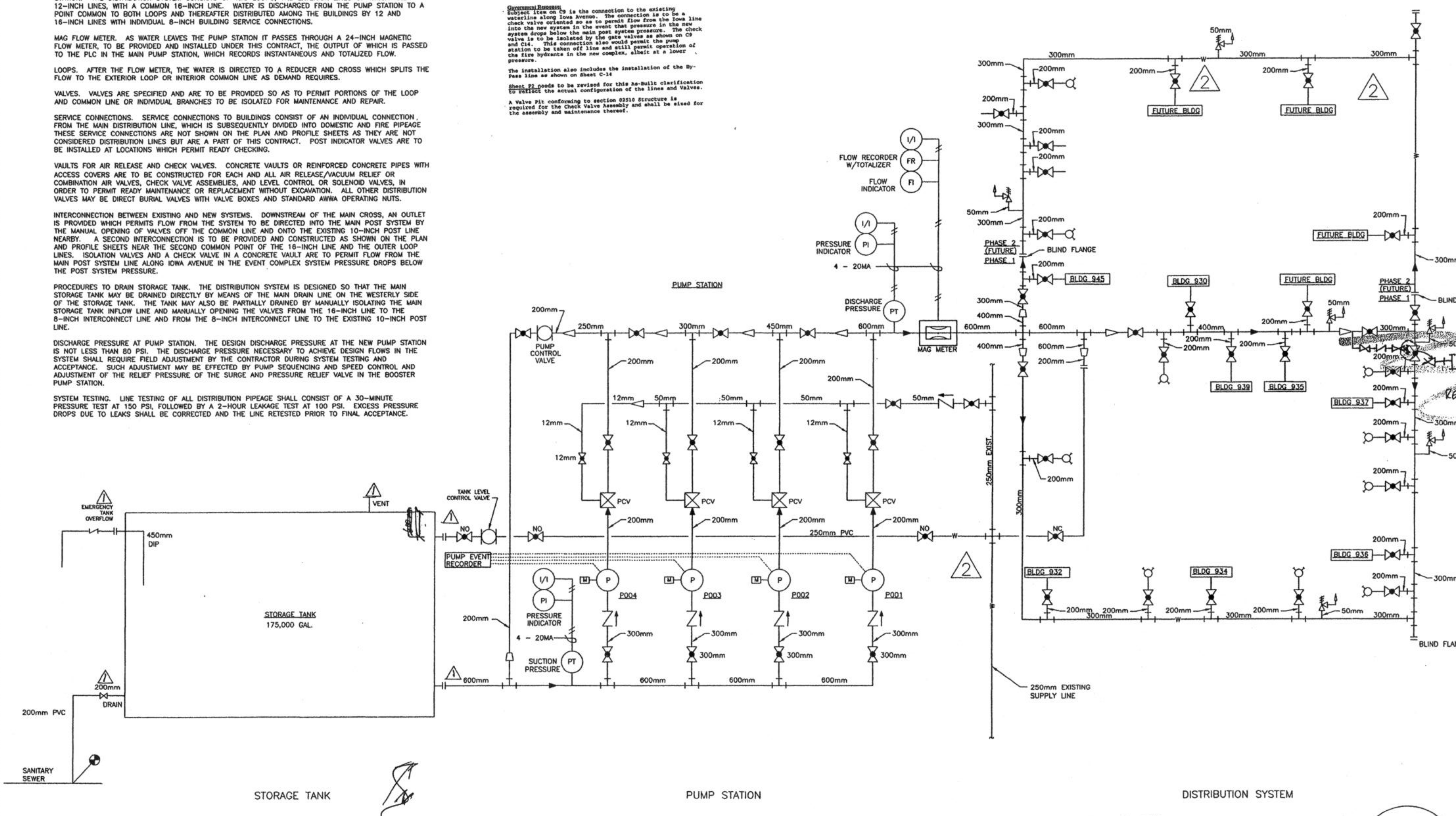
Subject: Water Distribution Gate Valves

Government Response:
Subject item on C9 is the connection to the existing waterline along Iowa Avenue. The connection is to be a check valve oriented so as to permit flow from the Iowa line into the new system in the event that pressure in the new system drops below the main post system pressure. The check valve is to be isolated by the gate valves as shown on C9 and C14. This connection also would permit the pump station to be taken off line and still permit operation of the fire hydrants in the new complex, albeit at a lower pressure.

The installation also includes the installation of the By-Pass line as shown on Sheet C-14

Sheet P2 needs to be revised for this As-Built clarification to reflect the actual configuration of the lines and Valves.

A Valve Pit conforming to section 02510 Structure is required for the Check Valve Assembly and shall be sized for the assembly and maintenance thereof.



POST NOTE

Vent in storage tank, suction line, and overflow penetrations are shown on S7.2. Fill and drain lines are not detailed but should be similar to the suction and overflow penetrations with wall collars (1/2" x 2" (or 10mmx50mm)).

Elevation of the fill line is 200 mm above the floor of the tank. This will permit the fill line to pass over the foundation drain line placed at the edge of the exterior perimeter of the tank. The center of the fill line should be through the southwesterly face of the storage tank wall, 600mm from the interior face of the southeasterly wall.

2 RFI 206 - see top of page

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	ADDED DISTRIBUTION NOTES, AND WATER MARK	8/31	

Designed by: | Dwn by: | Ckd by: | Reviewed by: | Submitted by:
Date: AUGUST 2001 | Rev. 2 | Design file no. | Drawing code: | File name: | Plot date: | Plot scale:

U.S. ARMY ENGINEER DISTRICT
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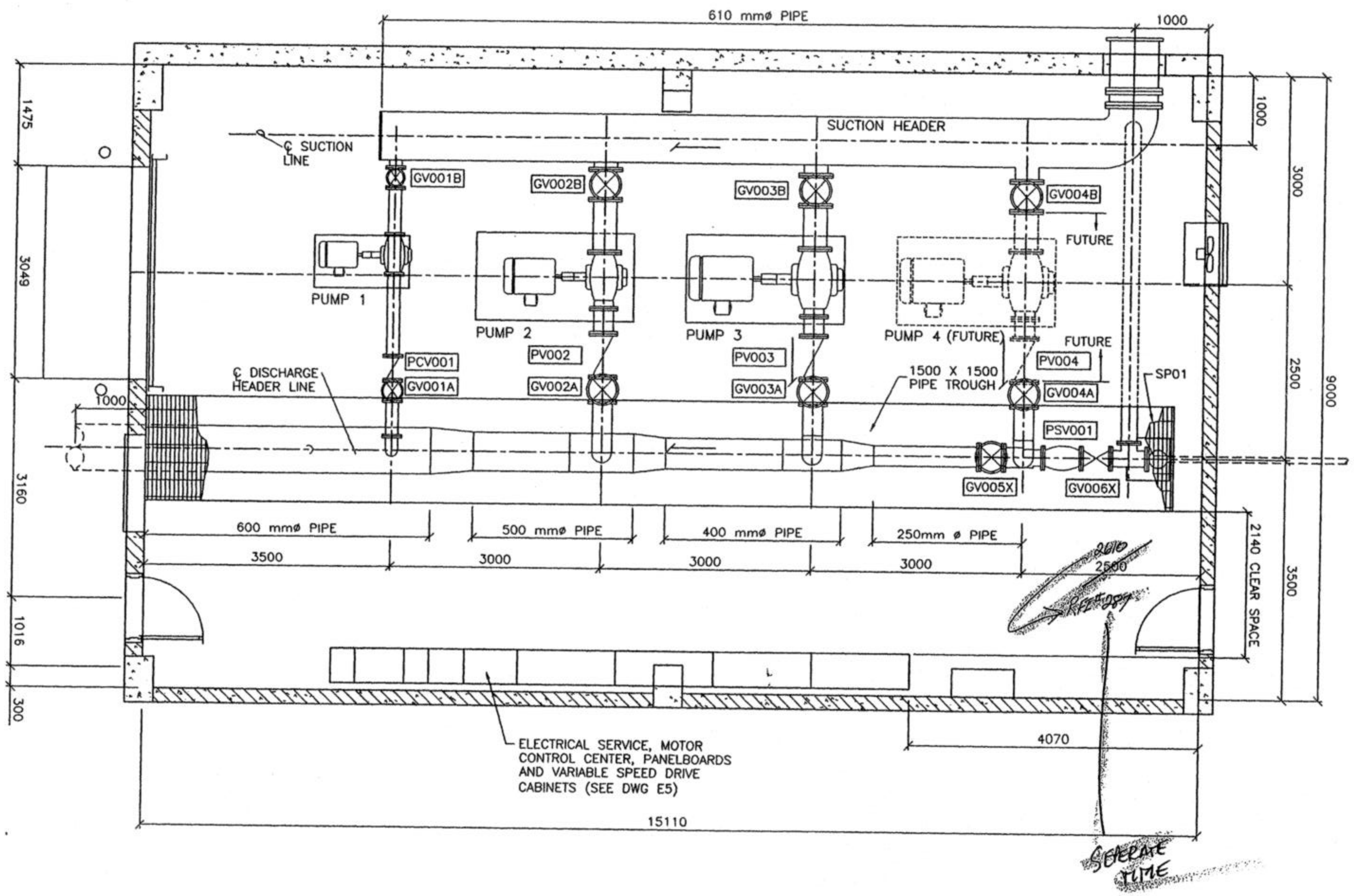
KANSAS CITY, MISSOURI

The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
PROCESS AND INSTRUMENTATION DIAGRAM

Sheet reference number:



A P3 **PUMP STATION PIPING PLAN**
SCALE: 1 : 40

0 2 4m

PUMP AND VALVE SCHEDULE	
GV001A	8" GATE VALVE
GV001B	8" GATE VALVE
GV002A	8" GATE VALVE
GV002B	10" GATE VALVE
GV003A	8" GATE VALVE
GV003B	10" GATE VALVE
GV004A	8" GATE VALVE
GV004B	10" GATE VALVE
PCV001	8" PUMP CONTROL VALVE CLA-VAL 660-11 OR EQUAL
PCV002	8" PUMP CONTROL VALVE CLA-VAL 660-11 OR EQUAL
PVC003	8" PUMP CONTROL VALVE CLA-VAL 660-11 OR EQUAL
PVC004	8" PUMP CONTROL VALVE CLA-VAL 660-11 OR EQUAL
GV005X	8" GATE VALVE
GV006X	8" GATE VALVE
PSV001	8" PRESSURE RELIEF PRESSURE SUSTAINING VALVE CLA-VAL 650-01 OR EQUAL
P001	PUMP 50 HP @ 185' TDH , 560 GPM PEERLESS 3AE14 OR EQUAL
P002	~~PUMP 75~~ 100 HP @ 185' TDH, 1500 GPM PEERLESS 5AE14 OR EQUAL
P003	PUMP 150 HP @ 185' TDH, 2500 GPM PEERLESS 6AE14 OR EQUAL
P004 FUTURE	PUMP 150 HP @ 185' TDH PEERLESS 6AE14 OR EQUAL
SP01	SUMP PUMP 1/2 HP @ 20' HD LIBERTY MODEL 283 OR EQUAL
SCV01 STORAGE TANK	8" SOLENOID CONTROL VALVE CLA-VAL 636-03 OR EQUAL WITH TANK FLOAT CONTROL FOR INLET CONTROL

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	ADDED GPM TO P001, P002, P003	8/31	

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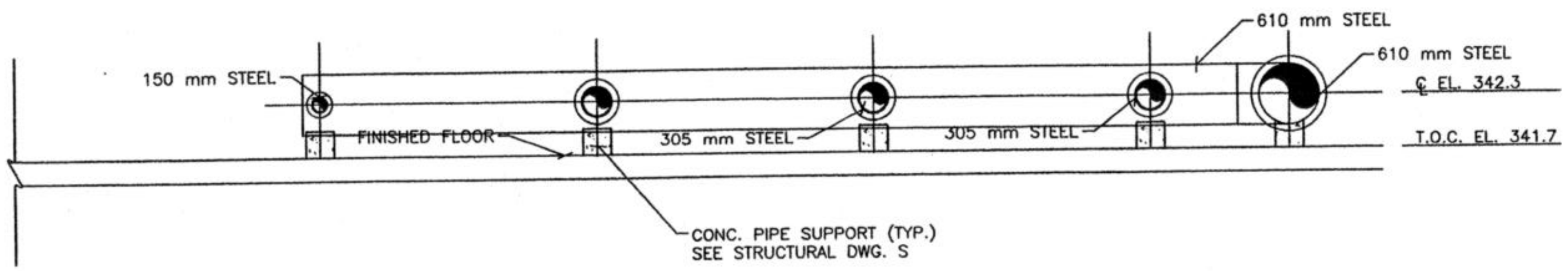
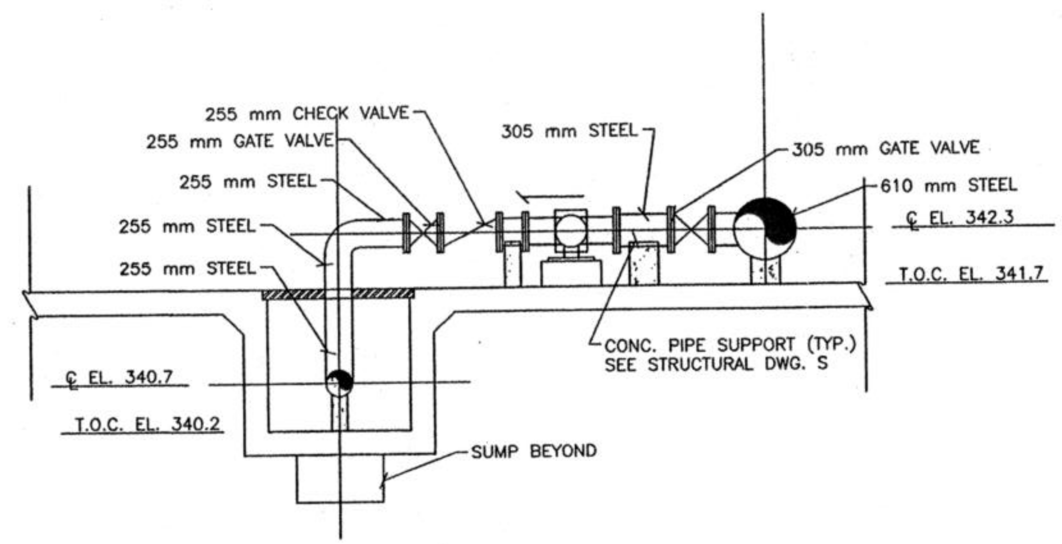
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
PUMP STATION PIPING PLAN

Sheet

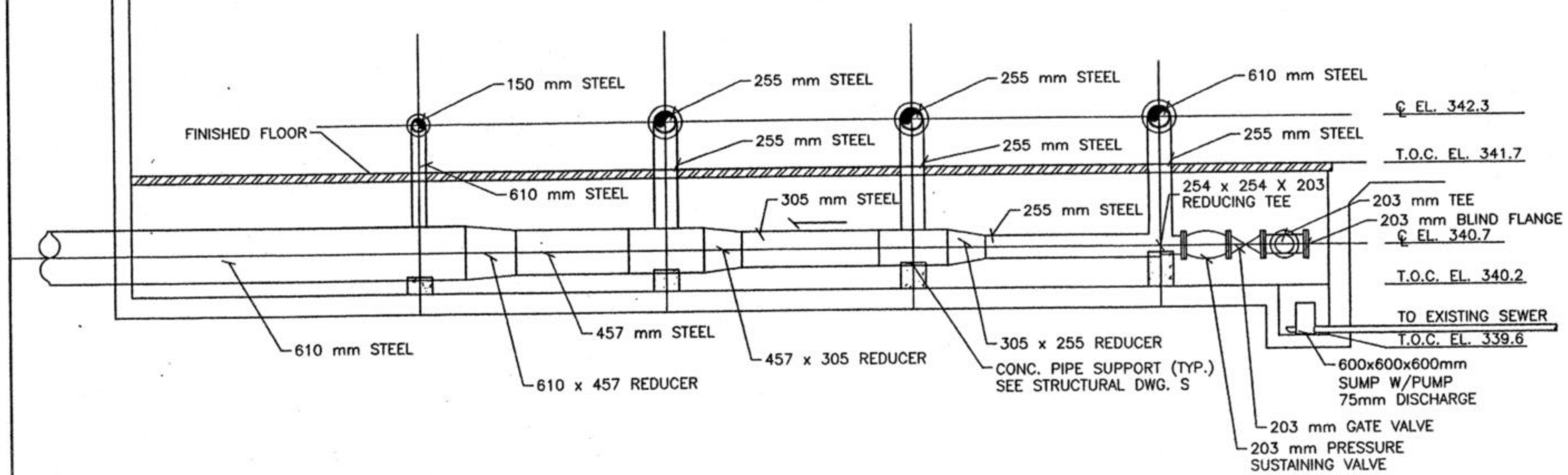
Section:



(A/P4) PUMP STATION SUCTION PIPE SECTION
SCALE: 1 : 40



(B/P4) PUMP STATION SECTION
SCALE: 1 : 40



(C/P4) PUMP STATION DISCHARGE PIPE SECTION
SCALE: 1 : 40

0 2 4m

NOTES:

1. ALL STEEL PIPE SHALL BE 6.35 mm THICKNESS
2. FLANGED COUPLING ADAPTER (FCA) SHALL BE DRESSER STYLE 128 OR EQUAL

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
PUMP STATION PIPING SECTIONS AND DETAILS

Sheet reference

Section:

LEGEND

SCHEMATIC DIAGRAMS

SYMBOL	DESCRIPTION
	TERMINAL
A B	(A) CONDUCTOR CONNECTION (B) CONDUCTOR CONNECTION
	CONTACT–NORMALLY OPEN
	CONTACT–NORMALLY CLOSED
	SWITCH AS DESIGNATED ON DIAGRAM
	SELECTOR SWITCH
	PUSHBUTTON–NORMALLY–OPEN MOMENTARY
	PUSHBUTTON–NORMALLY CLOSED MOMENTARY
	PUSHBUTTON–MANTAINED CONTACT
	PRESSURE OR VACUUM SWITCH–CLOSES WITH INCREASING PRESSURE OR DECREASING VACUUM
	PRESSURE OR VACUUM SWITCH–OPEN WITH INCREASING PRESSURE OR DECREASING VACUUM
	FLOW SWITCH–CLOSES WITH INCREASING FLOW
	FLOW SWITCH–OPENS WITH INCREASING FLOW
	FLOAT OR OTHER LIQUID LEVEL SWITCH–CLOSES WITH RISING LEVEL
	FLOAT OR OTHER LIQUID LEVEL SWITCH–OPENS WITH RISING LEVEL
	TEMPERATURE SWITCH–CLOSES WITH RISING TEMPERATURE
	TEMPERATURE SWITCH–OPENS WITH RISING TEMPERATURE
A B	(A) LIMIT SWITCH–NORMALLY OPEN (B) LIMIT SWITCH–NORMALLY OPEN–HELD CLOSED
A B	(A) LIMIT SWITCH–NORMALLY CLOSED (B) LIMIT SWITCH–NORMALLY CLOSED–HELD CLOSED
M	COIL OR TIMING MODULE
C.L.(3)	THERMAL OVERLOAD RELAY
	EQUIPMENT ENCLOSURE
RES	RESISTANCE OR HEATING ELEMENT
	FUSE
	TRANSFORMER
	GROUND
	NORMALLY OPEN TIME DELAY CONTACT. CONTACT CLOSES ON TIME DELAY AFTER ENERGIZATION OR RELAY COIL
	NORMALLY CLOSED TIME DELAY CONTACT. CONTACT OPENS ON TIME DELAY AFTER ENERGIZATION OR RELAY COIL
	NORMALLY OPEN TIME DELAY CONTACT. CONTACT CLOSES UPON ENERGIZATION OF RELAY COIL CONTACT OPENS ON TIME DELAY AFTER DE–ENERGIZATION OF RELAY COIL
	NORMALLY CLOSED TIME DELAY CONTACT. CONTACT OPENS UPON ENERGIZATION OF RELAY COIL. CONTACT CLOSES ON TIME DELAY AFTER DE–ENERGIZATION OF RELAY COIL
	TORQUE SWITCH
H O A	HAND–OFF–AUTO SELECTOR SWITCHES
	SOLENOID VALVE COIL
	INDICATING LIGHT PILOT–TYPE WITH COLOR INDICATED R=RATED, A=AMBER, G=GREEN, W=WHITE BL=BLUE, I=IVORY AND Y=YELLOW WET VACUUM HOUSEKEEPING

SCHEMATIC DIAGRAM DEVICE DESIGNATIONS

DESIGNATION DESCRIBING DEVICE OPERATION OR FUNCTION

A AUTO	AUTOMATE
CL	CLOSE
HI	HIGH
H	HAND
LCL	LOCAL
L	LOW
HR	HAND RESET
HS	HIGH SPEED
LS	LOW SPEED
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
RMT	REMOTE
OP	OPEN
O	OFF
INST	INSTANTANEOUS
FWD	FORWARD
REV	REVERSE
ACK	ACKNOWLEDGE

DEVICE DESIGNATIONS

AM SW	AMMETER SWITCH
AR	ALARM RELAY OR ALARM TIMER
ANN	ANNUNICTATOR
CB	CIRCUIT BREAKER
CLD	CHLORINE LEAK DETECTOR
CR	CONTROL RELAY
CS	CONTROL SWITCH
CT	CYCLE TIMER
ES	ELECTRONIC SWITCH
F/T	FREQUENCY TO CURRENT TRANSDUCER
F/MV	FREQUENCY TO MILLIVOLT TRANSDUCER
FSR	FREQUENCY SHIFT TONE RECEIVER
FST	FREQUENCY SHIFT TONE TRANSDUCER
FLS	FLOW SWITCH
FS	FLOAT SWITCH
FU	FUSE
IL	INDICATING LIGHT
IPB	ILLUMINATED PUSHBUTTON
ISP	ILLUMINATED SELECTOR PUSHBUTTON
ISS	ILLUMINATED SELECTOR SWITCH
T/F	CURRENT TO FREQUENCY TRANSDUCER
I/I	CURRENT TO CURRENT TRANSDUCER
LC	LIGHTING CONTACTOR
LS	LIMIT SWITCH
LLS	LIQUID LEVEL SWITCH
M	MOTOR STARTER COIL OR CONTACTOR
MV/I	MILLIVOLT TO CURRENT TRANSDUCER
MX	MOTOR STARTER AUXILIARY RELAY
OL	OVERLOAD RELAY
PB	PUSHBUTTON
PS	PRESSURE SWITCH
REC	RECTIFIER
SOL	SOLENOID (OTHER THAN VALVE)
SV	SOLENOID VALVE
SR	SOLID STATE SCANNER RECEIVER
SPB	SELECTOR PUSHBUTTON
SVM	SYSTEM VOLTAGE MONITOR
XFMR	TRANSFORMER
T	THERMOSTAT
TDAE	TIME DELAY AFTER ENERGIZATION
TDR	TIME DELAY RELAY
TQS	TORQUE SWITCH
VS	VACUUM SWITCH
TMR	TIMER
ETM	ELAPSED TIME METER
EP	ELECTRIC–PHEUMATIC
FD	FLUID DETECTOR

CONTROL CIRCUIT CALLOUT

3–1 — CIRCUIT TYPE (CONTROL); CIRCUIT NUMBER; DIAGRAM NUMBER

3C–1 B — WIRE COLOR DESIGNATION B=BLACK; R=RED; ETC.

DEVICE CALLOUT

3CR–2 — DEVICE IDENTIFICATION; DEVICE DESIGNATION; DIAGRAM NUMBER

CONTROL CIRCUIT CALLOUT

ON–LINE DIAGRAMS

SYMBOL	DESCRIPTION
	POWER CIRCUIT AND EQUIPMENT INSTALLED BY THIS CONTRACT
	EQUIPMENT ENCLOSURE
	CONTROL OR INTERLOCK CIRCUIT
	CONNECTION
	MOLDED CASE CIRCUIT BREAKER
	FUSE
	FUSED DISCONNECT SWITCH
	PLUG–IN OR DRAWOUT CONNECTION
	DISCONNECT SWITCH
	FUSED CONTROL POWER TRANSFORMER
	POWER TRANSFORMER (XFMR)
	CURRENT TRANSFORMER (2 REQUIRED)
	POTENTIAL TRANSFORMER (2 REQUIRED)
	LIGHTING OR SURGE ARRESTER
	GROUND CONNECTION
X CPT	COMBINATION MAGNETIC MOTOR STARTER W/THERMAL O.L. AND 120V CONTROL CIRCUIT. X DENOTES NEMA SIZE
X CPT	MAGNETIC LIGHTING CONTACTOR LO/120V CONTROL. X DENOTES NEMA SIZE X DENOTES NEMA SIZE
X	STARTER W/120V FUSED CONTROL POWER TRANSFORMER X DENOTES NEMA STARTER SIZE.
X	CONBINATION FUSED DISCONNECTED SWITCH TYPE SINGLE SPEED NON–REVERSING MAGNETIC MOTOR STARTER W/FUSED CONTROL POWER TRANSFORMER X DENOTES NEMA STARTER SIZE.
	SOLID STATE STARTER WITH MANUAL BYPASS SINGLE SPEED NON–REVERSING MAGNETIC MOTOR STARTER W/FUSED CONTROL POWER TRANSFORMER X DENOTES NEMA STARTER SIZE.
	ELECTRICAL SERVICE SURGE PROTECTION
AS	AMMETER SWITCH
VS	VOLTMETER SWITCH
A	AMMETER
V	VOLTMETER
W	GROUND DETECTOR INDICATING LIGHT
HP	ELECTRIC MOTOR–APPROXIMATE HORSEPOWER AS INDICATED
(1)	INDICATES NUMBER REQUIRED
	TERMINAL
VSD	VARIBLE SPEED DRIVE CONTROLLER W/BYPASS AND ISOLATION SWITCHES OR CONTACTORS. SIZED TO MATCH LOAD, W/HARMONIC/NOISE ATTENUATION.
VFD	VARIABLE FREQUENCY DRIVE
VFD	VARIABLE FREQUENCY DRIVE WITH MANUAL BYPASS CONTACTOR

ABBREVIATIONS

ACK	ACKNOWLEDGE
A.F.G.	ABOVE FINISHED GRADE
A.F.F.	ABOVE FINISHED FLOOR
ANN	ANNUNICTATOR
BC	BARE COOPER WIRE TYPE BC1
EF	EXHAUST FAN
EFF	EFFLUENT
EWC	ELECTRIC WATER COOLER
EXP.	EXPLOSION–PROOF (CLASS 1, FIV 1, GROUP D)
H.S.	HIGH SERVICE
MCC	MOTOR CONTROL CENTER
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
	PROGRAMMABLE LOGIC CONTROLLER

PLANS

SYMBOL	DESCRIPTION
	CONDUIT EXPOSED
	CONDUIT CONCEALED IN WALL, CEILING OR HIDDEN FROM VIEW
	CONDUIT CONCEALED IN FLOOR OR UNDERGROUND
	FLEXIBLE CONDUIT
	GROUND CABLE
	GROUND CABLE RISER
	BOLTED GROUND CONNECTION
	WELDED GROUND CONNECTION
	GROUND ROD (3/4"ø X 10' LONG COPPERCLAD STEEL)
PHASE– NEUTRAL– Y GND	HOME RUN TO PANELS. ARROW HEADS INDICATE NUMBER OF CIRCUITS. Y DENOTES CKT #
	CONDUIT TURNING UP
	CONDUIT TURNING DOWN
	CONDUIT WITH BUSHING
	CONDUIT TERMINATED OR CAPPED
	POWER PANEL (480 VOLT)
	LIGHTING PANEL (120/208 VOLT)
	DISCONNECT SWITCH
MS	MANUAL MOTOR STARTER
	CLOCK RECEPTACLE
	COMBINATION DISCONNECT SWITCH/MAGNETIC MOTOR STARTER
M	MOTOR
P	PULL BOX
169	VALVE WITH TAG NUMBER INDICATED INSIDE CIRCLE (169)
J	JUNCTION BOX
	EXIT LIGHT TYPE L–7 (DARKENED SECTION INDICATES NUMBER OF FACES AND DIRECTION OF FACE)
L1	FLUORESCENT LUMINAIRE WITH LUMINAIRE TYPE L–1
L4	EMERGENCY LIGHTING FIXTURE TYPE L–4 (UNSWITCHED)
L2	WALL MOUNT, WEATHER–PROOF METAL HALIDE LIGHT FIXTURE W/PE CELL
1000 L3	1000W MH POLE MOUNTED FLOODLIGHT
EX	LIGHTED LED EXIT LIGHT
	DUPLEX FLUSH MOUNTED RECEPTACLE OUTLET. "WP" DENOTES WEATHERPROOF, "GFI" DENOTES GROUND FAULT INTERRUPTED, SEE SPECIFICATIONS.
	DUPLEX SURFACE MOUNTED RECEPTACLE OUTLET
	TOMBSTONE RECEPTACLE WITH TWO DUPLEX RECEPTACLE OUTLETS AND MOUNTED ON COUNTER TOP.
	FLUSH MOUNTED 250V, 1' WITH GROUND, POWER RECEPTACLE
T	THERMOSTAT
S	SINGLE POLE SWITCH
S_3	THREE–WAY SWITCH
S_4	FOUR–WAY SWITCH

NOTES

1. THIS IS A STANDARD ELECTRICAL LEGEND AND NOT ALL DEVICES AND DEVICE DESIGNATIONS ARE USED ON THIS PROJECT
2. ALL "I" CIRCUITS SHALL BE TYPE "IVV1" CABLE.
3. ALL "C" CIRCUITS SHALL BE TYPE "CEV1" CABLE.
4. ALL LIGHTING CIRCUITS SHALL BE TYEP "SVN3" CABLE
5. ALL MOTOR AND POWER CIRCUITS INDICATED AS THREE SINGLE CONDUCTORS PLUS GROUND SHALL BE TYPE "SVN3" CABLE.
6. ALL BARE COPPER GROUND CABLE SHALL BE TYPE "BC2" CABLE.

INSTRUMENTATION

SYMBOL	DESCRIPTION
	DUAL FUNCTION INSTRUMENT OR INSTRUMENTS
	FIELD MOUNTED INSTRUMENT
	PRIMARY LOCATION, ACCESSIBLE TO OPERATOR
	INACCESSIBLE OR BEHIND THE PANEL DEVICE
	CYLINDER OPERATOR WITH POSITIONER
	CYLINDER OPERATOR WITHOUT POSITIONER
	MAGMETER
S	SOLENOID VALVE
	BUTTERFLY VALVE
	GLOBE VALVE
	GATE VALVE
	CHECK VALVE

PROCESS VARIABLE LETTER CODE

I/P–R	CURRENT TO PNUEMATIC WITH AIR REGULATOR
PD/I	PULSE DURATION TO CURRENT

FIT 3 — F IT 3 = FLOW INDICATION TRANSMITTER NO.3; LOOP NUMBER; FUNCTION; PROCESS VARIABLE

INSTRUMENT CIRCUIT CALLOUT

I3–1 — LOOP NUMBER; CIRCUIT NUMBER; CIRCUIT TYPE (INSTRUMENT)

	FIRST LETTER	SUCCEEDING LETTERS
A	ANALYSIS	ALARM
C	CONDUCTIVITY	CONTROL
D	DENSITY	DIFFERENTIAL
E	VOLTAGE	PRIMARY ELEMENT
F	FLOW	RATION (FRACTION)
H	HAND	HIGH
I	CURRENT	INDICATOR
K	TIME	
L	LEVEL	LOW
M	MOISTURE	
P	PRESSURE	
Q	QUANTITY	TOTALIZE OR INTEGRATE
R	RADIOACTIVITY	RECORD
S	SPEED	SWITCH
T	TEMPERATURE	TRANSMITTER
TB	TURBIDITY	
V	VISCOSITY	VALVE
W	WEIGHT	
Y		RELAY OR COMPUTE
P	POSITION	

1 — INDICATES THE NUMBER OF THE NOTE. INDICATES A SPECIFIC NOTE AND THIS SYMBOL WILL BE LOCATED ON THE DWG. WHERE THE NOTE APPLIES. (THIS COULD APPLY TO SEVERAL LOCATIONS ON ONE DWG.)

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Rev. | Date | Description | Date | Appr.

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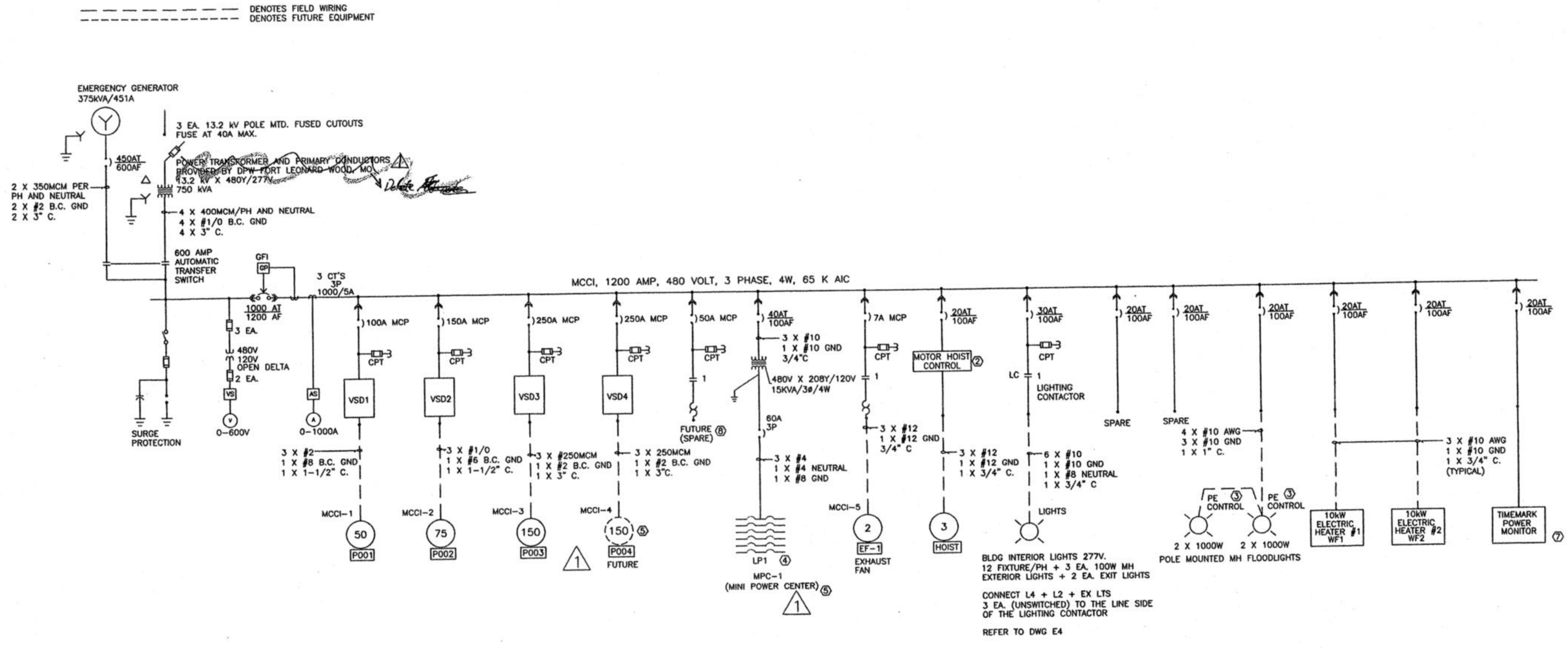
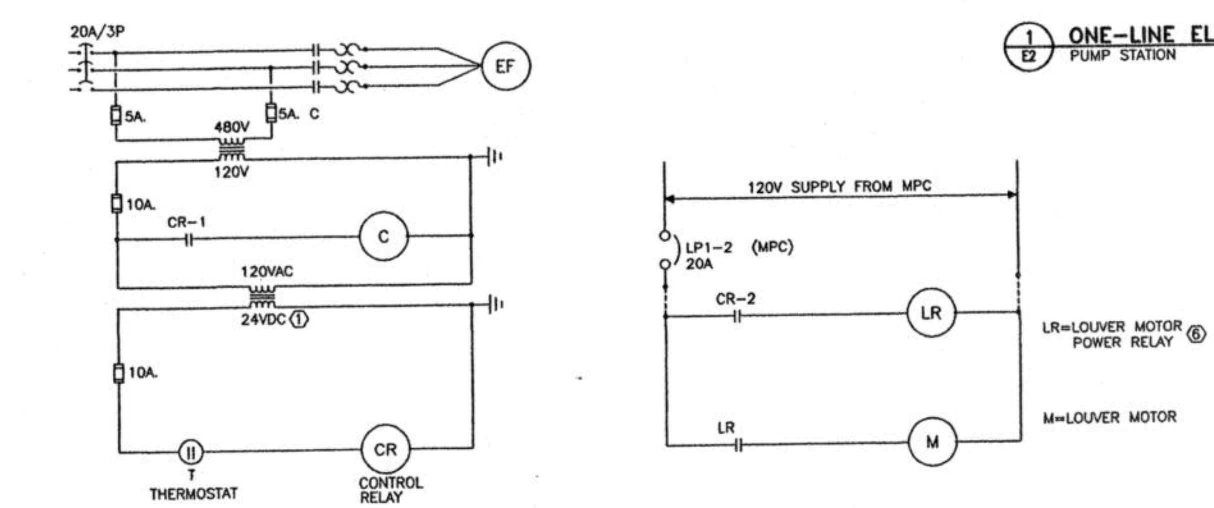
The Benham Group

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
ELECTRICAL LEGEND

Sheet reference



① ONE–LINE ELECTRICAL DIAGRAM
E2 PUMP STATION



② SCHEMATIC–EXHAUST FAN CONTROL & POWER
E2 PUMP STATION
CR=CONTROL RELAY FOR LOUVER MOTOR START/STOP

① CONTROL SYSTEM INCLUDES A 120V x 24V STEPDOWN TRANSFORMER AND INTERPOSING RELAY FOR OPERATION W/THERMOSTAT. LOCATE 120V X 24V STEP–DOWN TRANSFORMER IN SAME MCC CUBICLE WITH EXHAUST FAN MOTOR STARTER.

② HOIST CONTROL TO BE INCLUDED W/MCC.

③ INDIVIDUAL PE CONTROL W/EACH OUTDOOR LIGHT FIXTURE.

④ MINI–POWER CENTER (MPC) TO BE LOCATED INSIDE 480V MCC. ALTERNATE, INCLUDE 15kVA 480V x 208Y/120V TRANSFORMER AND 12 POLE 1100A PANELBOARD.

⑤ PUMP P001 LOCKED OUT THRU CONTROL SYSTEM WHEN EMERGENCY GENERATOR IS ON LINE.

⑥ LOCATE LR RELAY IN SAME CUBICLE W/EXHAUST FAN MOTOR STARTER.

⑦ LOCATED INSIDE MCC CUBICLE W/ 480V BREAKER. INCLUDE CONTROL RELAYS CR1 AND CR2 WITH TIMEMARK POWER MONITOR.

SEPERATE TIME RFI #198 The contractor will provide the power transformer and primary conductors in accordance with Vol. 1 of the drawings, sheets C10.3, C11.1 and C11.2.

RFI #189 - Mount controls for crane, hoist, and trolley on the crane and hoist system

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	ADDITIONAL INFORMATION	8/18/01	

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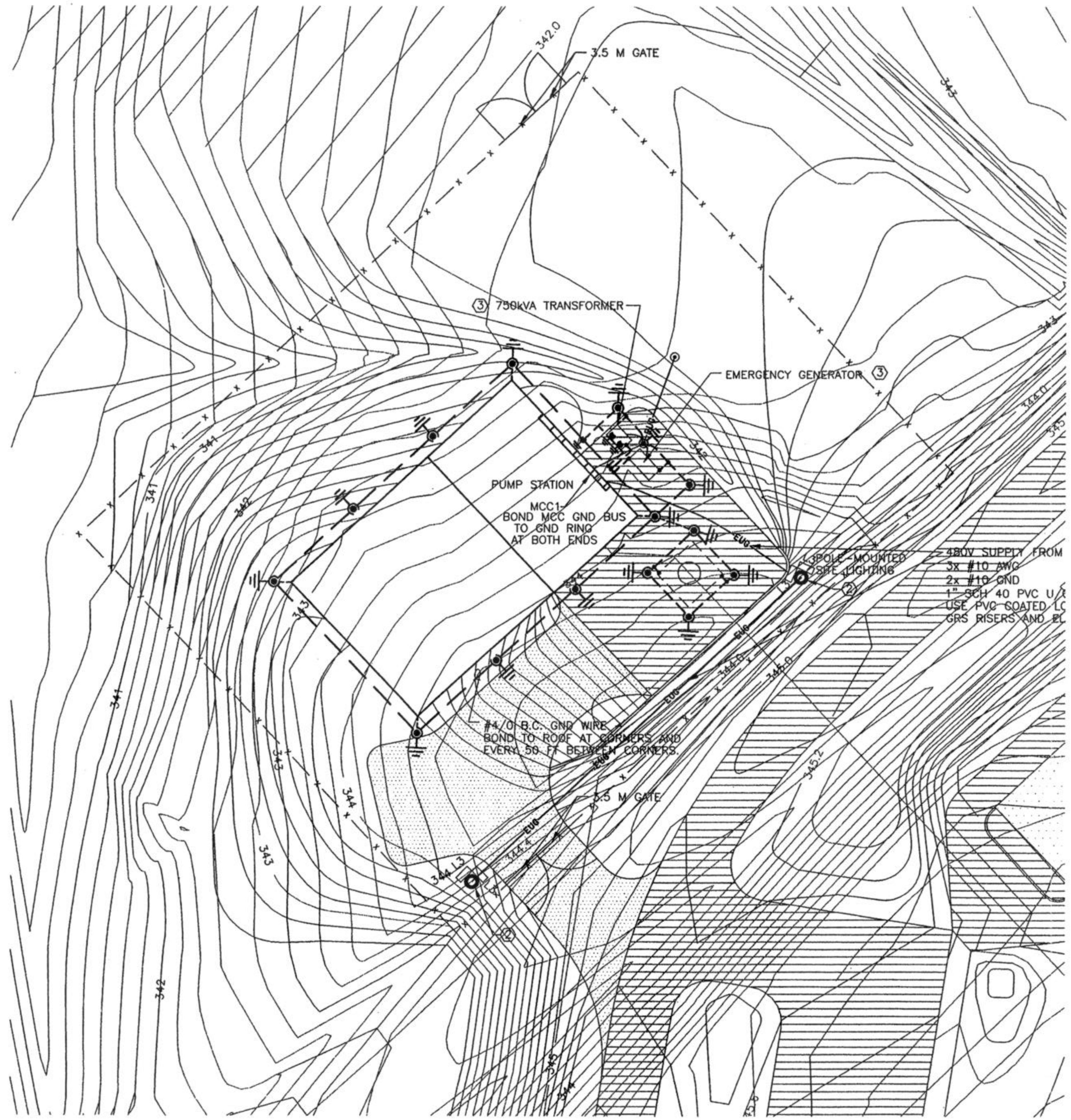
PN 47051 FY01
BOOSTER PUMP STATION
ONE–LINE DIAGRAM

Sheet reference number:

Section:



NOTES:

1. BURY ALL U/G CONDUIT 3'-0" BELOW GRADE. INSTALL 4" SCH 40 GALVANIZED PIPE OVER ALL U/G CONDUITS WHEN THEY PASS UNDER ROADWAYS.

2. 35' TALL ROUND GALVANIZED STEEL POLE SUPPLIED BY ELECTRICAL CONTRACTOR.

3. EQUIPMENT NOT DRAWN TO SCALE. FIELD LOCATE

1 ELECTRICAL SITE PLAN

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PN 47051 FY01
BOOSTER PUMP STATION
ELECTRICAL SITE PLAN

Sheet reference

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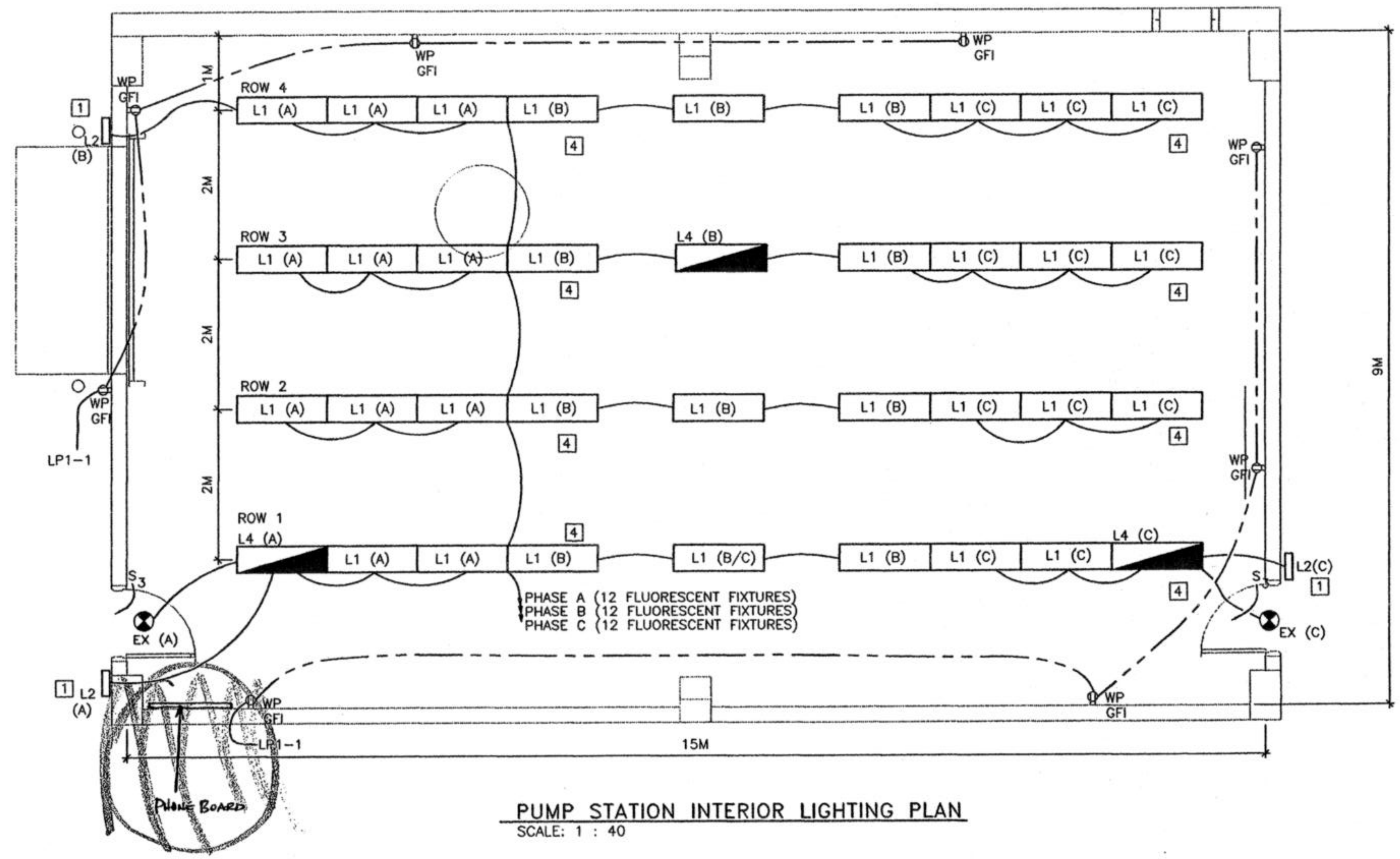


PUMP STATION INTERIOR LIGHTING PLAN

SCALE: 1 : 40

NOTES:

1. FIXTURE CONTROLLED BY PHOTOELECTIC CELL MOUNT CELL 6" ABOVE DOOR. CONNECT TO UNSWITCHED 277V SUPPLY W/INTERIOR EMERGENCY LIGHTS.
2. ALL CONDUITS 3/4" UNLESS OTHERWISE INDICATED.
3. MOUNT FIXTURES TO THE BOTTOM OF THE PRE-CAST PRESTRESSED DOUBLE TEE BEAMS STEMS. ALL MOUNTING HARDWARE TO BE COORDINATED WITH DOUBLE-TEE MANUFACTURER. PROVIDE CLEARANCE TO AVOID OVERHEAD CRANE.
4. TANDEM UNITS TYPE TAF. SEE VENDOR DATA FOR DETAILS.
5. INCLUDE ONE (1) MOUNTING BRACKET #MPB29 PER POLE.

L1 & L4 LIGHTS ARE 277V 2 X 32W FLUORESCENT.

L4 EMERGENCY LIGHTS ARE NOT SWITCHED.

L2 100W MH WALL PACK W/PE CELL 277V. POWERED FROM UNSWITCHED LEG W/L4. (EMERG. LIGHT)

1000 1000W/480W OUTDOOR METAL HALIDE FLOODLIGHT W/P.E. CONTROL. INCLUDE ONE (1) 2-FIXTURE MOUNTING BRACKET, #MPB29 FOR EACH POLE.

S_3 3-WAY SWITCH FOR INTERIOR LIGHTS WIRED BACK TO LIGHTING CONTACTOR IN MCC.

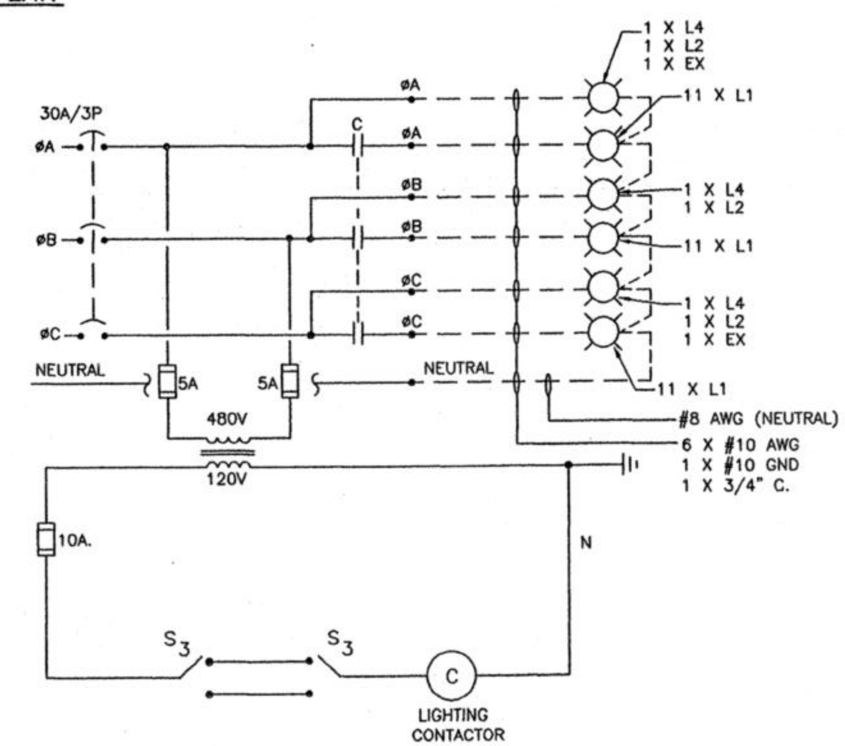
0 2m 4m

SCALE 1 : 40

RFI #520 Delete overhead Coiling door

LIGHT FIXTURE SCHEDULE

SYMBOL	MANUFACTURER CATALOG NO.	VOLTS	QTY.-WATTS TYPE	MOUNTING	FIXTURE NOTES
L1	LITHONIA AF10-4-32 -277-PO	277	2-32W FLUORESCENT	4' H.D. TURRENT INDUSTRIAL 10% UPLIGHT	4
L2	LITHONIA TWP-100M-277-LLRPSL-PE-SF	277	100W MH	EXTERIOR WALL, SURFACE	WEATHER PROOF W/ PE CELL
1000 L3	LITHONIA 170S-1000M-HPN-480-TS-DF-PER SCWA-UV-PE4	480	1000W MH	EXTERIOR ROUND METAL POLE (STD. TENON)	WEATHER PROOF W/ PE CELL 5
L4	LITHONIA AF10-4-32 -277-PO	277	2-32W FLUORESCENT	4' H.D. TURRENT INDUSTRIAL 10% UPLIGHT	4
EX	LITHONIA LV-S-W-I-R -277-CB	277	2.5W MH	EXIT LIGHT	LED



SCHEMATIC LIGHTING CONTACTOR CONTROL

US Army Corps of Engineers
Kansas City District

Date: JULY 2001

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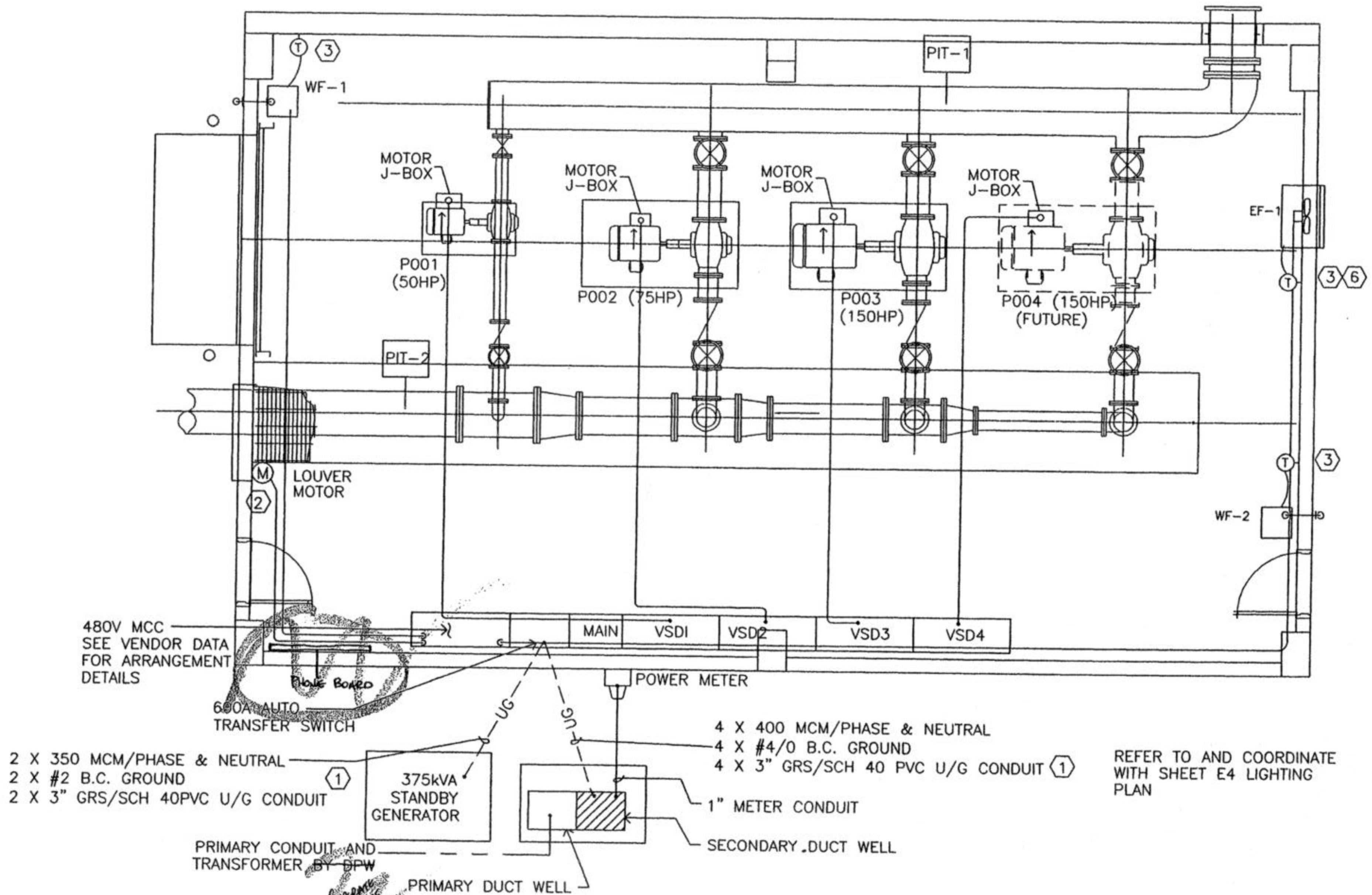
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
PUMP STATION LIGHTING PLAN

Sheet reference

Section:



REFER TO AND COORDINATE WITH SHEET E4 LIGHTING PLAN

0 2m 4m
SCALE 1 : 40

PUMP STATION ELECTRICAL PLAN

SCALE: 1 : 40

NOTES:

1. USE SCH 40 PVC COATED GRS LONG RADIUS CONDUIT RISERS & ELBOWS.
2. LOUVER MOTOR OPERATED BY EF-1 CONTROL RELAY. 120VAC SUPPLY FROM MCP-1, SWITCHED BY RELAY LR LOCATED IN CUBICLE FOR EXHAUST FAN STARTER.
3. FIELD LOCATE AND INSTALL THERMOSTATS.
4. CONDUIT ROUTING SHOWN FOR CONCEPT ONLY. FIELD ROUTE AND SUPPORT ALL CONDUITS. REFER TO MCC VENDOR DATA TO IDENTIFY LOCATION OF STARTERS IN MCC. ALL CONDUIT SHALL BE GRS. USE FLEX CONNECTIONS AT ALL LOADS. USE 3/4" MINIMUM SIZE CONDUIT.
5. -UG- DENOTES UNDERGROUND CONDUIT.
6. WIRE EXHAUST FAN THERMOSTAT BACK TO STARTER CUBICLE FOR EXHAUST FAN.
7. PIT-1=SUCTION TRANSMITTER-0-20mA OUTPUT.

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BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
PUMP STATION WIRING PLAN

Sheet reference number:

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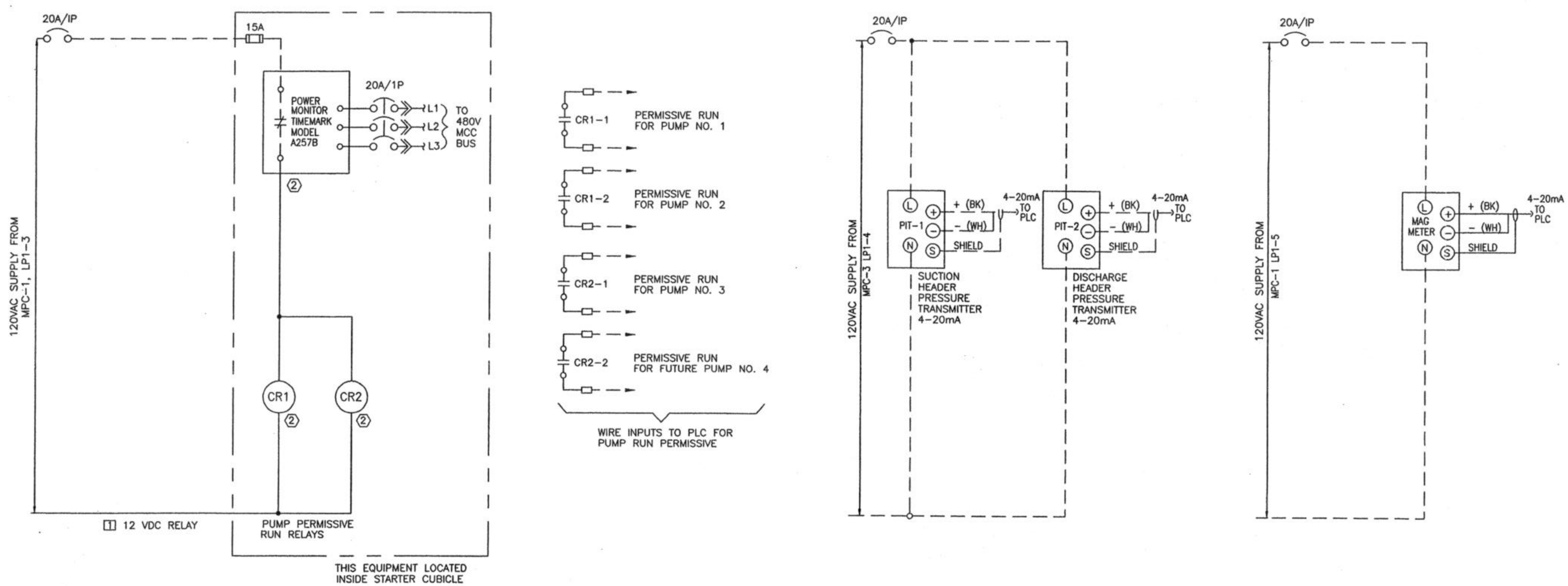
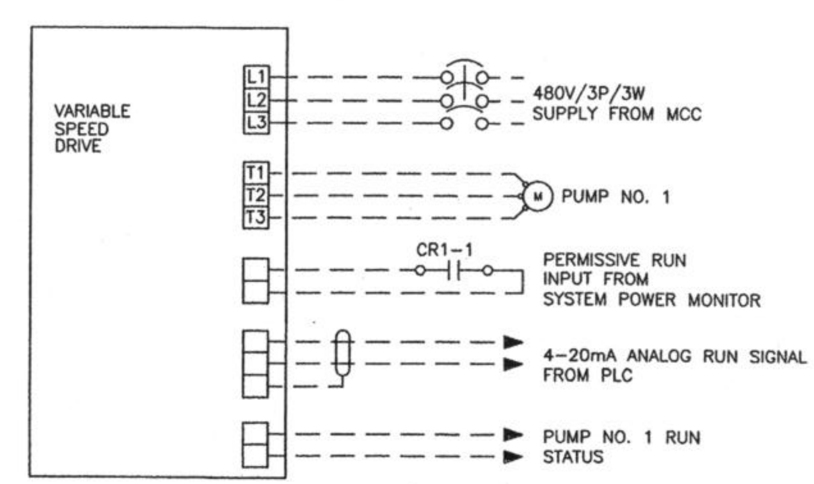


SYSTEM INTERCONNECT SCHEMATICS



TYPICAL SYSTEM SCHEMATIC FOR PUMP STARTER

PUMP NO. 1 SHOWN. PUMPS NO. 2-4 SIMILAR

1. ALL INSTRUMENT/CONTROL WIRING SHALL BE #14 AWG MINIMUM WITH MAX. 15A. FUSED SUPPLY.
2. POWER MONITOR AND CONTROL RELAYS CR1 & CR2 TO BE LOCATED INSIDE MCC CUBICLE W/ 480V, 20A. SUPPLY BREAKER.
3. INSTALL A #12 AWG GROUND WIRE WITH ALL FIELD CIRCUITS.

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ENTIRE SHEET REISSUED 8/18/01

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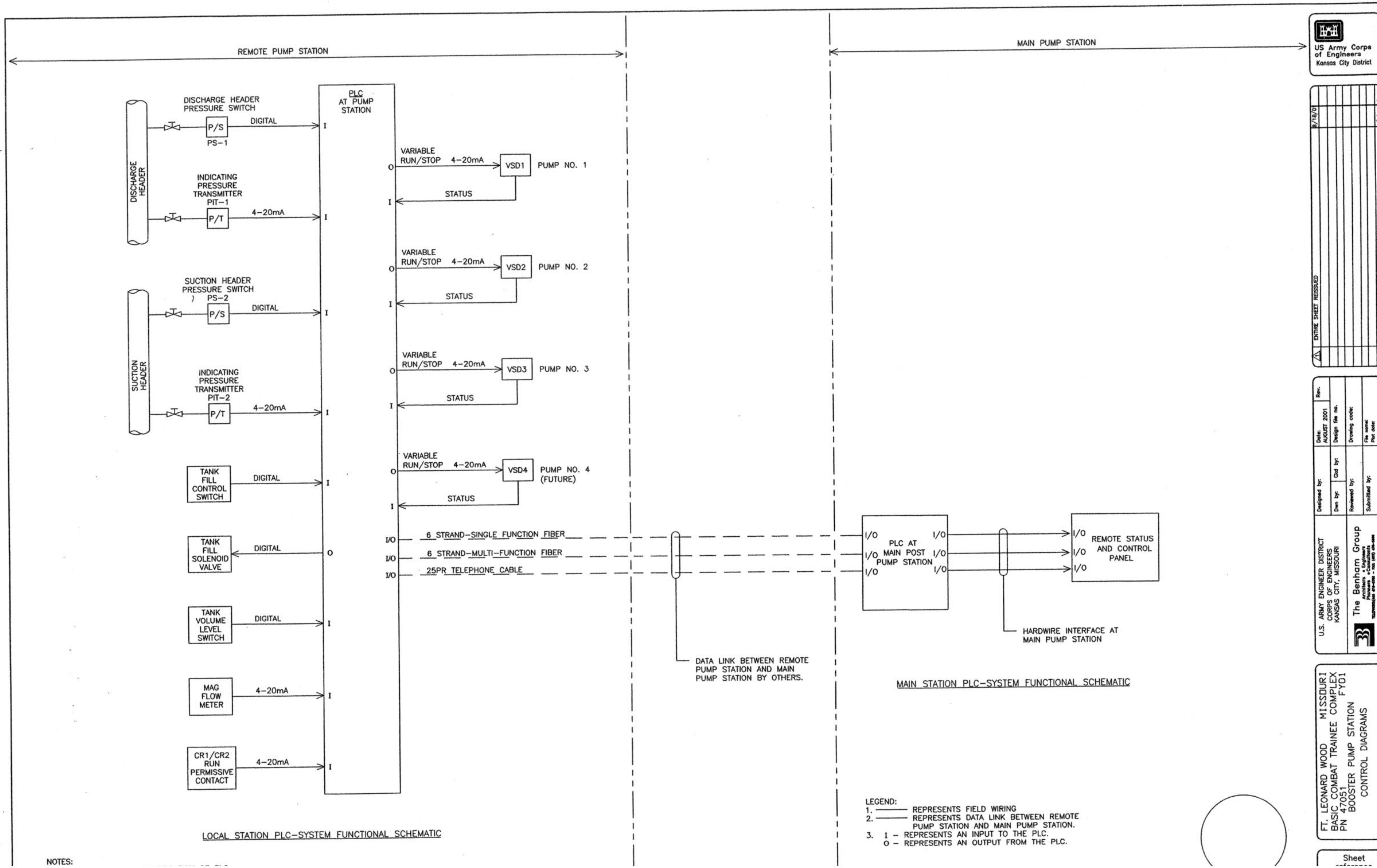
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
CONTROL DIAGRAMS

Sheet reference

Section:


REMOTE PUMP STATION
MAIN PUMP STATION
DISCHARGE HEADER
DISCHARGE HEADER PRESSURE SWITCH
P/S
PS-1
DIGITAL
INDICATING PRESSURE TRANSMITTER PIT-1
P/T
4-20mA
SUCTION HEADER
SUCTION HEADER PRESSURE SWITCH PS-2
P/S
DIGITAL
INDICATING PRESSURE TRANSMITTER PIT-2
P/T
4-20mA
TANK FILL CONTROL SWITCH
DIGITAL
TANK FILL SOLENOID VALVE
DIGITAL
TANK VOLUME LEVEL SWITCH
DIGITAL
MAG FLOW METER
4-20mA
CR1/CR2 RUN PERMISSIVE CONTACT
4-20mA
PLC AT PUMP STATION
VARIABLE RUN/STOP 4-20mA
VSD1
PUMP NO. 1
STATUS
VARIABLE RUN/STOP 4-20mA
VSD2
PUMP NO. 2
STATUS
VARIABLE RUN/STOP 4-20mA
VSD3
PUMP NO. 3
STATUS
VARIABLE RUN/STOP 4-20mA
VSD4
PUMP NO. 4 (FUTURE)
STATUS
6 STRAND-SINGLE FUNCTION FIBER
6 STRAND-MULTI-FUNCTION FIBER
25PR TELEPHONE CABLE
DATA LINK BETWEEN REMOTE PUMP STATION AND MAIN PUMP STATION BY OTHERS.
PLC AT MAIN POST PUMP STATION
REMOTE STATUS AND CONTROL PANEL
HARDWIRE INTERFACE AT MAIN PUMP STATION
LOCAL STATION PLC-SYSTEM FUNCTIONAL SCHEMATIC
MAIN STATION PLC-SYSTEM FUNCTIONAL SCHEMATIC
LEGEND:
1. ——— REPRESENTS FIELD WIRING
2. ——— REPRESENTS DATA LINK BETWEEN REMOTE PUMP STATION AND MAIN PUMP STATION.
3. I - REPRESENTS AN INPUT TO THE PLC.
O - REPRESENTS AN OUTPUT FROM THE PLC.
NOTES:
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PN 47051
BOOSTER PUMP STATION
CONTROL DIAGRAMS
Sheet

Section:

.1.25

REF 95

Fort Leonard Wood BCT Booster Pump Station
Control Parameters and Logic Table
Third Edition dtd October 16, 2003

Following items have been developed pursuant to our controls group conference call of October 1, 2003, the draft of the Logic Table issued October 6, 2003, and Electrique letter dated October 15, 2003.

Parameter Label	Parameter Description	Sensor or Adjustment Range	If-Then Logic		
			If Statement	Then Action	
A	Discharge Header Pressure	Sense 25-85 psi	If A>85 psi	Ramp down pump(s) sequentially 3 to 1	
B1	Pump 1 Motor Speed	Set and Control 30-62 Hz	If A < 80 psi If A drops E psi in less than F seconds If B1 > 62	Turn on pump 1 Increase pump speed by G Hz Turn on Pump 2	
B2	Pump 2 Motor Speed	Set and Control 30-62 Hz	If A < 75 psi If B1 = 62 Hz and If A drops E psi in less than F seconds If B2>62	Enable pump 2 Turn on pump 2 Increase pump speed by G Hz Turn on Pump 3	
B3	Pump 3 Motor Speed	Set and Control 30-62 Hz	If A < 70 psi If A drops E psi in less than F seconds	Enable pump 3 Increase pump speed by G Hz	
C1	Pump 1 Nominal Motor Start Speed	Set 30-62 Hz	If Pump 1 is turned on	Start at C1 Hz	
C2	Pump 2 Nominal Motor Start Speed	Set 30-62 Hz	If Pump 2 is turned on	Start at C2 Hz	
C3	Pump 3 Nominal Motor Start Speed	Set 30-62 Hz	If Pump 3 is turned on	Start at C3 Hz	
D	Nominal Peak Station Discharge Pressure	Set 60-85 psi	If discharge pressure is > A	Phase down pump(s) to lowest flow	
E	Nominal Minimum Station Suction Header Pressure	Sense 0-10 psi	If E < 1 psi If E > 1 psi	Shut off pumps Enable pumps	
F	Incremental Discharge Pressure Change Interval	Set 0-20 psi	If discharge pressure varies by >F	Increase or decrease pump speed(s)	
G	Incremental Pump Speed Change Interval	Set 0-5 Hz	If pump speed change is required	Change speed by G Hz	
H	Not Used				
1	Pump 1 Speed Change Time Increment	Set and control 2-300 seconds	If change in pump 1 speed more than I1 seconds ago	Enable pump speed change	
2	Pump 2 Speed Change Time Increment	Set and control 2-300 seconds	If change in pump 2 speed more than I2 seconds ago	Enable pump speed change	
3	Pump 3 Speed Change Time Increment	Set and control 2-300 seconds	If change in pump 3 speed more than I3 seconds ago	Enable pump speed change	
	Station Discharge Flow	Sense 0-6100 gpm	If J = or > 0	Enable all pumps	
1	Pump Control Valve 1 Closure Time	Set and control 2-20 seconds	If pump is turned off	Close control valve in less than K1 seconds	
2	Pump Control Valve 2 Closure Time	Set and control 2-20 seconds	If pump is turned off	Close control valve in less than K2 seconds	
3	Pump Control Valve 3 Closure Time	Set and control 2-20 seconds	If pump is turned off	Close control valve in less than K3 seconds	

ump 1= 50 Hp
ump 2= 100 Hp
ump 3= 150 Hp

omments following keyed to referenced Electrique letter:

. The suction header pressure range is between 0 and 5 psi and is solely for the urpose of ascertaining available water in the tank and therefore availability of water to e pumped. The tank level is maintained separately.

. Yes, scale the suction header pressure transmitter signal over the full range, 0 to 5 si, or as determined in the field once the tank is full. See parameter E above. The ange is quite small.

. Suction header pressure correlation with pump operation is as shown in Parameter E bove.

. Discharge header pressure range is Parameter A and should be able to range etween 25 and 85 psi. Under normal operating conditions the actual range should ary between the maximum desired discharge pressure which is the cutoff pressure of e pumps, approximately 85 psi, and the Post low pressure system which operates in e range of 50 psi.

5. See item 4 and Parameter A. The discharge header pressure should range between 25 and 85 psi but must be able to be adjusted in the field.

6. The basic idea is to be able to sequence pumps on and off using two schemes.

The primary scheme is to turn on the small pump (referred here as Pump 1) at an adjustable start speed and operate below or ramp-up to 62 Hz. The second pump would come on when the first pump is at its design point while the discharge pressure continues to drop or remains flat. The second pump would then ramp up from its start point to full speed. If the condition continues the third pump would come on. This scheme is shown as Parameters B1, B2 and B3.

An alternative scheme, which must be permissible under the established logic, is to permit Pump 1 to come on and ramp-up to a speed producing up to half its rated flow and then turn on Pump 2 which would in turn ramp up to half its rated flow. (The speed of the pumps would be different.) As the flow requirement increases, Pump 2 would continue to ramp up and Pump 1 would ramp down. This second scheme would conceivably smooth flows.

7. Time delays are provided for as shown in the logic table. The key is to permit time delays both for the increase and decrease in speed. See Parameters B, C, and I1, I2, and I3.

8. Desired time delays are noted in item 7 and must be field adjustable. Likewise, the speed increment for each pump must be adjustable (Parameter G). It is more desirable to be able to adjust the pump speed change time upwards more rapidly and less rapidly downward however this should be adjusted in the field. Likewise, we may wish to operate the pumps in different speed ranges therefore a pump speed parameter is needed for each pump (Parameters B1, B2, and B3).

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PUMP STATION OPERATION AND CONTROL NOTES 2

INTRODUCTION

PURPOSE OF THE BOOSTER PUMP STATION. THE PURPOSE OF THE PUMP STATION IS TO PROVIDE DOMESTIC WATER TO THE ENTIRE BCC COMPLEX, PHASES 1 AND 2. THE STATION DOES SO BY DRAWING WATER UNDER PRESSURE FROM THE MAIN POST WATER DISTRIBUTION SYSTEM INTO THE PUMP STATION STORAGE TANK LOCATED ADJACENT TO THE PUMP FACILITY AND THEN PUMPING WATER AS REQUIRED FROM THE STORAGE TANK INTO THE BCC COMPLEX DISTRIBUTION SYSTEM.

MAJOR SYSTEM COMPONENTS. THE "BOOSTER PUMP STATION" CONSISTS OF 1) A GROUND STORAGE TANK OF APPROXIMATELY 175,000 GALLONS; 2) A BOOSTER PUMP STATION CONSISTING OF 3 PUMPS WITH AN INITIAL TOTAL CAPACITY OF APPROXIMATELY 4000 GPM AT 185 FEET TOTAL DYNAMIC HEAD, WITH ROOM FOR AN ADDITIONAL PUMP TO RAISE THE NOMINAL STATION CAPACITY TO 6000 GPM; 3) A SYSTEM OF WATER DISTRIBUTION LINES, PIPEAGE, VALVES AND RELATED APPURTENANCES TO SERVE THE BCT COMPLEX FACILITIES; AND 4) A SUBSYSTEM OF CONTROLS AND RELATED MECHANICAL AND ELECTRICAL COMPONENTS WHICH POWER, CONTROL AND MONITOR THE OPERATION OF THE OVERALL SYSTEM AND PUMP STATION ITSELF.

WORK REQUIRED. THE WORK INCLUDED IN THIS PORTION OF THE BCT COMPLEX PROJECT ENCOMPASSES ALL STRUCTURES, COMPONENTS, DEVICES, CONTROLS, WIRING, PIPEAGE AND INSTALLED EQUIPMENT, ALONG WITH THE SERVICES, EQUIPMENT, AND LABOR NECESSARY TO CONSTRUCT AND TO BRING INTO OPERATION THE ENTIRE "BOOSTER PUMP STATION" SYSTEM.

BOOSTER PUMP STATION LAYOUT AND OPERATION

STORAGE TANK. A 10-INCH LINE FROM THE POST'S MAIN DISTRIBUTION SYSTEM IS TO BE CONNECTED TO THE MAIN STORAGE TANK THROUGH A TANK CONTROL VALVE SITUATED IN A 1200 MM (48") DIAMETER VALVE VAULT (RCP) ADJACENT TO THE STORAGE TANK. THE VALVE IS TO OPEN FULL WHEN THE LEVEL IN THE TANK BEGINS TO DROP AND REMAIN OPEN UNTIL THE TANK IS FULL. THE REQUIRED TANK LEVEL SENSOR MUST ACTUATE THE VALVE WHEN THE LEVEL IN THE TANK DROPS BY MORE THAN 25 MM (1"). THE TANK STRUCTURE INCLUDES AN OVERFLOW PIPE, TANK DRAIN PIPE, AIR VENT, ACCESS HATCH WITH STAINLESS STEEL LADDER, AND INTERIOR CONCRETE BAFFLES. THE TANK DRAIN PIPE IS USED TO EMPTY THE TANK FOR MAINTENANCE AND IS MANUALLY CONTROLLED BY A 8-INCH GATE VALVE OUTSIDE THE TANK. THE TANK AND STATION ARE CIRCUMSCRIBED BY AN 8-INCH PVC PIPE FOUNDATION DRAIN LINE.
VALVES AND PIPEAGE. WATER FROM THE STORAGE TANK IS DRAWN BY SUCTION FROM ONE OR MORE OPERATING PUMPS IN THE PUMP ROOM. FLOW IS THROUGH THE COMMON WALL BETWEEN THE STORAGE TANK AND PUMP ROOM BY MEANS OF A 600 MM (24-INCH) STEEL PIPE AND MANIFOLD. FLOW FROM THE SUCTION MANIFOLD TO THE DISCHARGE MANIFOLD THROUGH EACH PUMP WILL BE THROUGH A GATE VALVE, ECCENTRIC REDUCER, PUMP, PUMP CONTROL VALVE WITH INTEGRAL CHECK VALVE, AND GATE VALVE.

DETAILS FOR VALVES AND PIPEAGE. THE CONTRACTOR SHALL ADJUST AND DETAIL PIPEAGE BETWEEN SUCTION AND DISCHARGE MANIFOLDS IN ORDER TO FACILITATE SHOP FABRICATION, ACCOMMODATE VARYING DIMENSIONS OF SELECTED PUMPS, VALVES AND FITTINGS, AND FACILITATE FIELD ASSEMBLY. SUCH ADJUSTMENTS AND DETAILS SHALL BE APPROVED BY SUBMITTAL OF SHOP DRAWINGS IN ACCORDANCE WITH THESE NOTES AND THE SPECIFICATIONS.

PUMP SELECTION AND LAYOUT. THE STATION PUMPS UNDER THIS PHASE OF THE PROJECT CONSIST OF THREE CENTRIFUGAL PUMPS, WITH A COMBINED OUTPUT OF 4000 GPM AT 185 FEET TOTAL DYNAMIC HEAD, WITH SPACE TO ADD A FOURTH PUMP OF 2000 GPM AT A LATER DATE. PUMP CHARACTERISTICS SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS. THE PUMP DISCHARGE IS TO BE CONTROLLED BY A PUMP CONTROL VALVE WITH INTEGRAL CHECK VALVE THAT MODULATES START-UP FLOW AND SHUTDOWN SEQUENCE. A COMBINATION PRESSURE RELIEF AND PRESSURE SUSTAINING VALVE ON THE DISCHARGE MANIFOLD REDIRECTS EXCESS FLOW AND SURGE PRESSURE TO THE STORAGE TANK AND SUCTION HEADER OF THE STATION.

SENSORS. PRESSURE GAUGES AND TRANSMITTERS ARE TO BE PROVIDED AND INSTALLED BY THE CONTRACTOR ON THE SUCTION AND DISCHARGE HEADERS, THE OUTPUT OF WHICH SHALL BE USED TO CONTROL PUMP SEQUENCING, SPEED AND OUTPUT. NOMINAL DISCHARGE PRESSURE AT THE PUMP DISCHARGE HEADER SHALL BE 75 PSI, WITH SUBSEQUENT ADJUSTMENTS MADE DURING PUMP STATION COMMISSIONING. A TANK LEVEL SENSOR, NOTED HEREIN ABOVE, SHALL BE PROVIDED AND INSTALLED ON THE STORAGE TANK, THE OUTPUT OF WHICH SHALL BE USED TO CONTROL THE TANK LEVEL VALVE.

PUMP SEQUENCING. PUMP SEQUENCING, RUN TIME, AND RUN SPEED SHALL BE CONTROLLED BY THE STATION MAIN PROGRAMMABLE LOGIC CONTROLLER (PLC). THE LOGIC AND CONTROL PARAMETERS SHALL BE OPTIMIZED BY THE PLC INSTALLER TO MINIMIZE PUMP CYCLING AND BALANCE RUN TIME AMONG PUMPS WHENEVER POSSIBLE AND MAINTAIN HIGH FLOWS AND PRESSURE BY THE LARGEST PUMP AVAILABLE.

PLC AND STATUS PANEL. THE MAIN PLC SHALL BE PROVIDED AND INSTALLED IN THE BOOSTER PUMP STATION ADJACENT TO THE MOTOR CONTROL CENTER; AND PROVIDED WITH, AT THE CONTRACTOR'S OPTION, A HARD-WIRED STATUS AND SWITCH PANEL OR OPERATOR INTERFACE PANEL AND MONITOR, PROVIDING PUMP SELECTION SWITCHES, AND METERS DENOTING CURRENT SUCTION PRESSURE, DISCHARGE PRESSURE, AND TANK LEVEL. AN OPERATOR INTERFACE PANEL AND MONITOR SHALL BE PROVIDED AND INSTALLED IN THE MAIN POST PUMP STATION AT A LOCATION TO BE DESIGNATED BY THE CONTRACTING OFFICER.

PLC. THE PROGRAMMABLE LOGIC CONTROLLER TO BE PROVIDED, INSTALLED AND INTEGRATED INTO THE STATION SYSTEM SHALL BE AN ALLEN-BRADLEY PLC-5 SYSTEM OR APPROVED EQUIVALENT. THE PLC SHALL BE FURNISHED WITH MAIN AND REMOTE BLOCK-BASED INPUT/OUTPUT EQUIPMENT AND MODULES SUFFICIENT TO RECEIVE, PROCESS, AND CONTROL EXISTING PLANT SIGNALS, COMPONENTS, AND PUMPS. PROCESSOR SHALL HAVE NO LESS THAN 16K MEMORY TO HANDLE AN I/O COUNT OF UP TO 512 (INPUT + OUTPUT). MODULES SHALL INCLUDE COMMUNICATIONS MODULES TO CONNECT THE BOOSTER STATION WITH THE MAIN PUMP STATION UTILIZING AVAILABLE COPPER OR FIBER OPTIC EQUIPMENT.

POWER. POWER FOR THE PUMP STATION FACILITY SHALL BE PROVIDED FROM THE MAIN POST DISTRIBUTION SYSTEM TO AN ON-SITE PAD-MOUNTED TRANSFORMER AS SHOWN ON THE DRAWINGS. WORK COMMENCES AT AND INCLUDES THE CONNECTION FROM THE TRANSFORMER TO THE STATION.

EMERGENCY POWER. EMERGENCY POWER FOR THE STATION SHALL BE PROVIDED BY A NOMINAL 300 KW STANDBY DIESEL GENERATOR SET. THE GENERATOR SET SHALL PROVIDE STANDBY POWER FOR SELECTED LOADS OF THE PUMP STATION THROUGH AN AUTOMATIC TRANSFER SWITCH IN THE PUMP STATION.

PLC SYSTEM		LOCAL STATION	MAIN STATION
SUCTION HEADER PRESSURE-PIT	4-20mA	I/O	I
SUCTION HEADER PRESSURE SWITCH	PULSE	I	I
DISCHARGE HEADER PRESSURE-PIT	4-20mA	I/O	I
DISCHARGE HEADER PRESSURE SWITCH	PULSE	I	I
FLOW RATE	4-20mA	I/O	I
TANK LEVEL	4-20mA	I/O	I
PUMP #1 STATUS	PULSE	I/O	I
PUMP #2 STATUS	PULSE	I/O	I
PUMP #3 STATUS	PULSE	I/O	I
PUMP #4 STATUS (FUTURE)	PULSE	I/O	I
PUMP #5 STATUS	PULSE	I/O	I
PUMP #1 H-O-A	PULSE	I/O	I
PUMP #2 H-O-A	PULSE	I/O	-
PUMP #3 H-O-A	PULSE	I/O	-
PUMP #4 H-O-A	PULSE	I/O	-
VSD #1 RUN/STOP SIGNAL	4-20mA	I	O
VSD #2 RUN/STOP SIGNAL	4-20mA	I	O
VSD #3 RUN/STOP SIGNAL	4-20mA	I	O
VSD #4 RUN/STOP SIGNAL	4-20mA	I	O
TANK FILL VALVE (ON/OFF)		I/O	I
TANK LEVEL SWITCH (FLOAT)		I/O	I
TANK FILL SOLENOID VALVE		I/O	-

COMMUNICATION-AVAILABLE
- 1-6 FIBER SINGLE MODE CABLE
- 1-6 FIBER MULTIMODE
- 1-25PR TELEPHONE CABLE

2 PER RFI # 253

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
2	ADDED PUMP STATION NOTES	8/31	

Designed by: | Dwn by: | Ckd by: | Reviewed by: | Submitted by:
Date: AUGUST 2001 | Rev. 2 | Design file no. | Drawing code: | File name: | Plot date: | Plot scale:

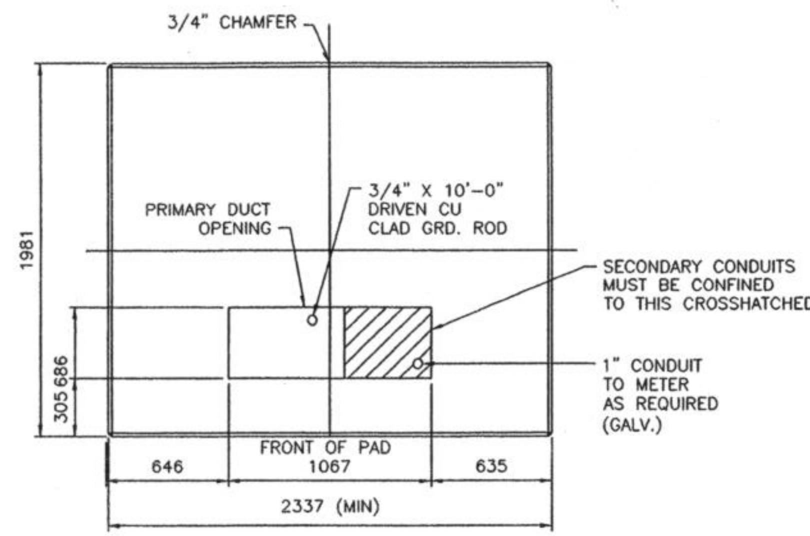
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

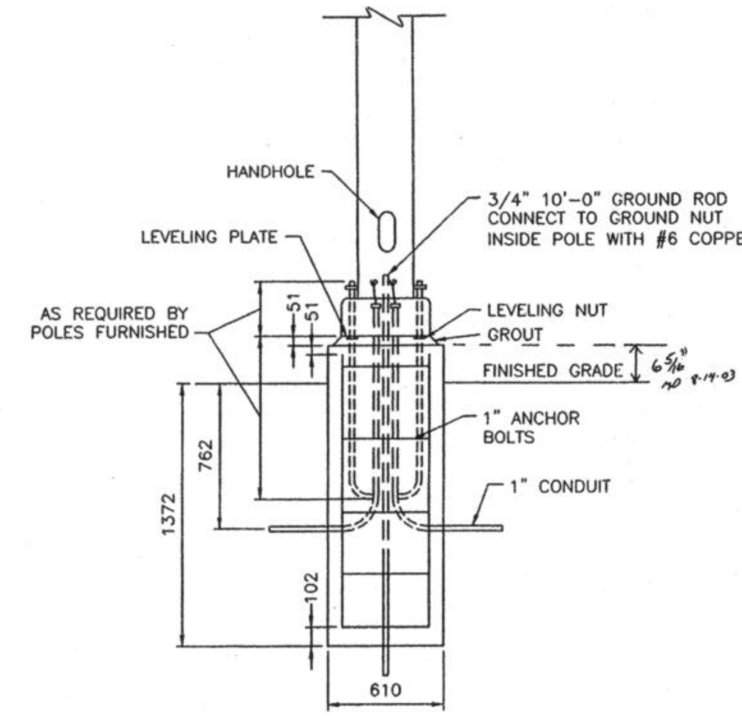
FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
PLC SYSTEM CHART
AND MISCELLANEOUS NOTES

Sheet reference number:

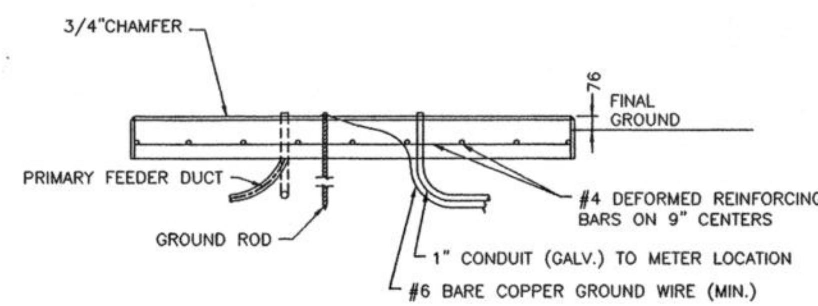
Section:



2 E9 PLAN VIEW
SCALE: 1=20

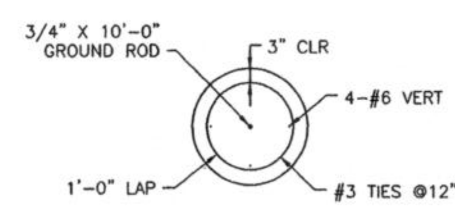


1 E9 DETAIL
SCALE: 1:20



3 E9 TRANSFORMER PAD DETAIL
SCALE: 1:20

NOTES:
1. ALL REINFORCING STEEL SHALL BE NO.4 ROUND DEFORMED BARS.
2. CONCRETE SHALL BE 3000 LB. TEST
3. PAD MUST BE 3 FT. MINIMUM FROM BUILDING



4 E9 SECTION
SCALE: 1:20

METRIC UNITS

US Army Corps of Engineers
Kansas City District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group

Designed by: | Dwn by: | Ckd by: | Reviewed by: | Submitted by:
Date: JULY 2001 | Design file no. | Drawing code: | Rev.

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX
PN 47051 FY01
BOOSTER PUMP STATION
ELECTRICAL PLAN DETAILS

Sheet reference

Section:

CIVIL LEGEND

EXISTING | NEW

- BUILDINGS
- ROADS
- CURBS AND GUTTER
- WALKS
- --12-- —12— CONTOURS
- +77.2 •77.2 SPOT GRADE ELEVATIONS
- DIRECTION OF DRAINAGE
- —SD— —SD— STORM DRAIN
- —R.D.— ROOF DRAIN
- —W— —W— WATER LINE
- —FW— FIRE LINE
- —SS— —SS— SANITARY SEWER
- MANHOLE SELF EXPLANATORY DEPENDING ON TYPE OF UTILITY LINE
- CURB INLET
- AREA INLET
- FIRE HYDRANT
- GATE VALVE AND VALVE BOX
- DH-2 BORE HOLE
- PIV PIV POST INDICATOR VALVE
- HEADWALL
- REMOVAL OF ITEM LISTED
- LIMITS OF DEMOLITION
- BM CONTROL POINT
- •CO CLEANOUT
- FLOOR DRAIN
- EXTERIOR SIGN
- GUARDPOST
- ASPHALT PAVING
- CONCRETE PAVING

N

STANDARD NORTH ARROW

LANDSCAPE

- QUICK COUPLER AIR AND VALVE
- LIMITS OF SOD
- DRIP IRRIGATION

ARCHITECTURAL LEGEND

- NON-EXPANSIVE FILL
- COMPACTED SUBGRADE
- CONCRETE
- CRUSHED ROCK
- CAPILLARY WATER BARRIER
- CONCRETE MASONRY UNITS (PLAN)
- CONCRETE MASONRY UNITS (SECTION)
- CERAMIC TILE-AS INDICATED
- ACOUSTIC CEILING TILE
- BRICK
- WOOD (ROUGH)
- WOOD (FINISH)
- BLANKET INSULATION
- PERIMETER INSULATION
- METAL
- GYPSUM WALL BOARD-AS INDICATED
- RIGID INSULATION
- MINERAL FIBER INSULATION
- GLASS
- METAL STUD PARTITION

ARCHITECTURAL REFERENCE SYMBOLS

X XXXX XXXX

SECTION NUMBER

SHEET NUMBER OF DRAWING WHERE SECTION IS SHOWN.*

SHEET NUMBER OF DRAWING WHERE SECTION IS CUT.*

* SHEET NUMBERS OMITTED IF SECTION IS CUT AND DETAILED ON SAME DRAWING.

SECTION IDENTIFICATION

X XXXX XXXX

SECTION NUMBER

SHEET NUMBER OF DRAWING WHERE SECTION IS SHOWN.*

SHEET NUMBER OF DRAWING WHERE SECTION IS CUT.*

MILLWORK ELEVATION

ELEVATION IDENTIFICATION

N

STANDARD NORTH ARROW

- PARTITION TYPE
- DOOR NUMBER
- ROOM NO. ROOM NAME AND NUMBER

MECHANICAL LEGEND

REFER SHEET M1100

ELECTRICAL LEGEND

REFER SHEET ????

GENERAL NOTES

1. THESE LEGENDS ARE COMPOSED OF STANDARD SYMBOLS AND ARE PERTINENT TO THE CONDITIONS ON THIS SET OF DRAWINGS TO THE ECTAENT APPLICABLE.
2. ADDITIONAL LEGENDS AND/OR ANOTHER LEGEND SHEET MAY APPEAR IN THIS SET OF DRAWINGS TO INDICATE SPECIFIC CONDITIONS IN LIEU OF SYMOLS SHOWN ON THIS SHEET.
3. EXISTION GACILITIES TO BE REMOVED ARE INDICATED BY USE OF THESE SYMBOLS AND HACHURED THUSLY.
4. DESIGN AND PROVIDE A CATHODIC PROTECTION (CP) SYSTEM FOR THE WATER AND GAS SYSTEMS IN ACCORDANCE WITH SPECIFICATION
5. THE CONTRACTOR SHALL DESIGN AND PROVIDE THE COMPLETE LIGHTNING PROTECTION SYSTEM.
6. LETTERS "WP" ADJACENT TO ANY SYMBOL INDICATES WEATHERPROOF ENCLOSURE.
7. FOR ANY STRUCTURE INSTALLED IN NEW OR EXISTING RIGID PAVEMENT, THE PAVEMENT SLAB SHALL BE REINFORCED WITH WWF PROVIDING A MINIMUM OF 0.06% STEEL IN BOTH DIRECTIONS.
8. ELECTRIC LIGHT FIXTURES ARE IDENTIFIED BY A CAPITAL LETTER OR FIXTURE DESIGNATION INSIDE OR ADJACENT TO SYMBOL TO INDICATE FIXTURE TYPE FOR EACH FIXTURE PER FIXTURE SCHEDULE.
9. GWB PARTITIONS ARE DIMENSIONED TO THE FACE OF GYP WALL BOARD.
10. DOORS ARE NUMBERED ALPHABETICALLY BY ROOM OR SPACE INTO WHICH THEY SWING. FOR OUT-SWINGING EXTERIOR DOORS, DOORS ARE NUMBERED ALPHABETICALLY BY THE ROOM OR SPACE FROM WHICH THEY SWING.
11. HORIZONTAL JOINT REINFORCEMENT AND OTHER MASONRY ANCHORS ARE NOT SHOWN ON THE DRAWINGS FOR CLARITY.

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.
	NEW SHEET	8/16/01	

Date: AUGUST 2001 | Design file no. | Drawing code: | File name: | Plot date: | Plot scale:

Designed by: | Dwn by: WRC | Ckd by: | Reviewed by: | Submitted by:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

The Benham Group
Architects • Engineers • Planners • Consultants

FT. LEONARD WOOD MISSOURI
BASIC COMBAT TRAINEE COMPLEX FY01
PN 47051
BOOSTER PUMP STATION
LEGEND

Sheet reference number:

APPENDIX E

Environmental Information

ENVIRONMENTAL REQUIREMENTS

ENVIRONMENTAL DIVISION

STANDARD CONTRACT LANGUAGE (revision of 21 December 2009)

1. **NATIONAL ENVIRONMENTAL POLICY ACT (NEPA):** NEPA requires that all Army facilities complete an environmental impact analysis according to 32 Code of Federal Regulations Part 651 and Army Regulation 200-2, for proposed actions. This analysis considers the anticipated direct, indirect, and cumulative impacts of the specific proposed action on the natural, human, and socioeconomic environment. This project was reviewed by the DPW Environmental Division and a NEPA document prepared which contains a site analysis and site specific requirements. This is a legally binding document and the requirements contained in it must be adhered to in addition to the Standard Environmental Contract Language. The contractor shall reference the NEPA review documents and shall contact the Environmental Division (596-0882) for clarification of any requirement: The documentation will be at the Environmental Division if none is available in the contract, and the contractor shall seek out that information if it has not otherwise been provided prior to the beginning of any contracted activities.

2. **NATURAL RESOURCES:**

   2.1. **Forest Products** – If the work area contains trees that must be removed, the area must be surveyed for salvageable forest products, which must be disposed of in accordance with AR 405-90, Disposal of Real Estate, and AR 200-1, Environmental Protection and Enhancement. At such time as the project limits are established, the DPW Natural Resource Branch (NRB) must conduct a survey and provide a map and fair market value of the timber.

   2.2. **Threatened & Endangered Species** – If the area contains potential roost trees (dead or dying trees with sloughing bark) for the Indiana bat, a federally endangered species, these trees may only be removed during the period of 01 November through 31 March of the following year.

   2.3. **Cultural Resources** – The Contractor shall protect existing historical, archaeological, and cultural resources within the work area and shall be responsible for their preservation during the life of the Contract. Work affecting these resources is not allowed unless prior approval is received by the Fort Leonard Wood DPW Natural Resources Branch. If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered of found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this include but are not limited to any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other unexpected constructed feature; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made.

3. **WATER QUALITY:**

   3.1. **Spill Prevention and Response Plan** – A Spill Prevention and Response Plan is required and shall include the procedures, instructions, and reports to be used in the event of a spill of a substance regulated by 40 CFR 112, 40 CFR 265, and/or regulated under State or Local laws and regulations. This plan shall include the name of the individual who will report any spills or hazardous substance releases, and the individual who will follow up with complete documentation.

   3.2. **Spill Response** – Spills of hazardous materials/wastes, and spills of petroleum/oil/lubricants, shall be immediately reported and cleaned up to the satisfaction of the Fort Leonard Wood Environmental Branch at the Contractor's expense. Spills must be reported immediately to the local Fire Department (911), the Fort Leonard Wood Environmental Branch (573/596-0882), and the Contracting Officer (CO/COR). The Contractor shall cease all activity in the area of the spill or in the area of discovered contamination and shall not commence work in that area until so directed by the CO/COR. Contractor shall provide verification, as required, that Contractor employees are properly trained in spill response and cleanup in accordance with all Federal, State, Local, and Fort Leonard Wood laws and regulations and guidance. The

Contractor shall prepare the “Fort Leonard Wood Spill Report” form, Attachment 1. The completed form shall be submitted to the Environmental Branch via the CO/COR.

3.3. **Secondary Containment** – All petroleum, oil, lubricants, hazardous materials, and hazardous wastes in 55-gallon containers or larger must have secondary containment capable of holding at least 110% of the capacity of the single largest container. This also applies to animal-based and vegetable-based grease commonly associated with dining facilities.

3.4. **Rinsate –** Rinsate from cement trucks must be contained on site and not allowed to discharge from the site.

3.5. **Backflow Preventers** – All facilities must have backflow preventers on service lines plus potential cross contamination sources.

3.6. Stormwater Runoff and On-site Erosion and Sediment Control – All sites with land disturbing activities, regardless of size, must install erosion and sediment control measures to prevent erosion and sediment from leaving the land disturbance site. Land disturbing activities 1-acre or greater require a Permit from the Missouri Department of Natural Resources. All sites must be final stabilized through re-vegetation or medium such as gravel or rock.

3.6.1. **Stormwater Runoff** – Section 438 of the Energy Independence and Security Act of 2007 requires "The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow.”

3.6.2. **On-site Erosion and Sediment Control** – All sites with land disturbing activities less than 1-acre must install erosion and sediment control measures to prevent erosion and sediment from leaving the land disturbance site and be restored per the approved FLW Excavation Permit, (“Dig Permit”) FLW Form 364. Land disturbing activities 1-acre or greater require a Land Disturbance Permit from the Missouri Department of Natural Resources. Refer to Section 6.6 for the Land Disturbance Permit requirements.

4. TOXIC SUBSTANCES:

4.1. **Lead-Based Paint** – No lead-based paint (LBP) or materials containing LBP may be used at Fort Leonard Wood. With a demolition or renovation, if the presence of lead-based paint (LBP) is unknown, it should be assumed to be present, especially in structures built prior to 1980. Demolition of structures containing LBP must be done using precautions to prevent the release of the hazardous substance, such as whole component removal. If whole components containing LBP are removed or if a building is demolished, Missouri Department of Natural Resources (MDNR) Solid Waste Regulations require disposal in a State-permitted demolition or sanitary landfill. Or, a structure may be remediated by removing the lead-based paint using lead-safe work practices; however, any lead-based paint removed or recovered from the site must be handled as Hazardous Waste IAW Federal, State, Local, and FLW Regulations. For additional information, contact the DPW Environmental Branch (573/596-0882).

4.1.1. For any lead-based paint remediation performed by a Contractor other than the Base Maintenance Contractor, all lead-based paint and/or other hazardous wastes must be packaged, labeled, marked, and disposed of by the Contractor performing the work according to Federal, State, Local, and FLW Regulations. All hazardous waste manifests must be signed by the FLW Hazardous Waste Program Manager. Manifests shall be provided at least 48 hours prior to the expected shipment date. Under no circumstances will hazardous waste be handled or removed from the site without first consulting with the FLW Hazardous Waste Program Manager. The appropriate test method to make a non-hazardous determination, should the Contractor elect to have the waste tested, is the Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311, which is described in Appendix 11, 40 CFR Part 261. All test results shall be provided to the FLW Hazardous Waste Program Manager for review. This includes TCLP testing and any other analytical testing performed that impacts the determination of wastes from this site.

4.2. **Non-Liquid Polychlorinated Biphenyls** – PCBs may be present in the caulk used in windows, door frames, masonry columns and other masonry building materials in many buildings, including schools, built or renovated between 1950 and 1978. The contractor shall coordinate all potential NLPCB related work (i.e., work on such facilities and structures as described above) with the FLW environmental office, who must approve all sampling and work. No PCBs may be used at Fort Leonard Wood. If building materials containing PCBs are to be removed, a PCB Removal Plan shall be submitted to the Fort Leonard Wood Environmental Branch for approval prior to commencement. Contact the Fort Leonard Wood Environmental Branch at 573/596-0882 for further clarification.

4.3. **Asbestos Containing Materials –** No Asbestos Containing Materials (ACMs) may be used at Fort Leonard Wood. All 9-square-inch floor tile is assumed to contain asbestos and some 12-square-inch tile contains asbestos, therefore, floor tile that is broken, in poor condition, or is to be disturbed needs to be tested for asbestos content prior to beginning work. Furthermore, if any suspect ACMs are discovered, the project must stop, and the suspect material must be tested for asbestos content. If applicable, the Contractor is responsible for testing and must coordinate the testing with the Fort Leonard Wood DPW Environmental Branch. The testing may be done only by certified individuals. If testing confirms that asbestos is present, then the ACMs may be removed only by individuals certified to remove ACMs, and the ACMs must be disposed of in accordance with all applicable Federal, State, and Local regulations, including Fort Leonard Wood policies. Upon conclusion of the Asbestos removal, the Contractor is required to complete the “Fort Leonard Wood Asbestos Project Compliance and Completion” form, Attachment 2, and submit the completed form to the Environmental Branch via the CO/COR. Contact the Fort Leonard Wood DPW Environmental Branch at 573/596-0882 for more information.

5. WASTE MANAGEMENT:

5.1. **Debris Burning** – Fort Leonard Wood restrictions do not allow construction materials, demolition materials, or any debris to be burned.

5.2. **Solid Wastes –** Solid wastes (excluding land clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling, storage, and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill shall be the minimum acceptable off-site solid waste disposal. The Contractor shall verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. The Contractor shall comply with Federal, State, local laws and regulations and Fort Leonard Wood guidance pertaining to the use of landfill areas.

5.3. **Contractor Generated Hazardous Wastes/Excess Hazardous Materials** – Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 – 178. The Contractor shall, at a minimum, manage and store hazardous waste in compliance with 40 CFR 262. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. The Contractor shall segregate hazardous waste from other materials and wastes, shall protect it from the weather by placing it in a safe covered location, and shall take precautionary measures such as berming or other appropriate measures against accidental spillage. The Contractor shall be responsible for storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 – 178, State, and local laws and regulations. The Contractor shall transport Contractor generated hazardous waste off Government property in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. The Contractor shall dispose of hazardous waste in compliance with Federal, State, and local laws and regulations. Spills of hazardous or toxic materials shall be immediately reported to the local Fire Department (911), the Fort Leonard Wood Environmental Branch (573-596-0882), and the Contracting Officer Representative. Cleanup and cleanup costs due to spills shall be the Contractor’s responsibility. The disposition of Contractor generated hazardous waste and excess hazardous materials are the Contractor’s responsibility.

5.4. **Disposition of Materials –** All materials removed and not reused or designated as salvage material in this project shall become the property of the Contractor. The Contractor shall dispose of such materials at a State and Resource Conservation and Recovery Act approved Treatment, Storage, and Disposal Facility or permitted off-post landfill licensed by the state of Missouri. The Contractor shall lawfully dispose of such materials at the Contractor’s sole expense in accordance with the following rules. On a case by case basis, and only with written permission from DPW Environmental Branch and also direction from the

Contracting Officer (CO) or Contracting Officer's Representative (COR), natural land clearing wastes and or clean fill may be allowed to remain on Fort Leonard Wood (FLW) property. Any costs contained in the contract for off site (FLW) disposal shall be reimbursed to the government when disposition of natural land clearing waste and or clean fill is authorized for use on FLW property.

5.5. Recyclable Materials – The Contractor shall recycle products whenever possible and to the fullest extent practicable. Recycling shall be in accordance with all Federal, State, Local, and Fort Leonard Wood laws and regulations and guidance. The Contractor shall deliver all uncontaminated recyclable materials to the Fort Leonard Wood Recycling Center, Building 2549 during normal business hours M-F 0800-1630. Current recyclable materials include clean corrugated and non-corrugated cardboard, plastic and aluminum. Wood pallets in good condition shall be recycled during normal business hours M-F 0800-1630 (see Recycle Center attendant before unloading pallets). Unusable pallets shall be broken up and placed in dumpsters. Materials not currently recyclable by the Fort Leonard Wood Recycling Center shall be disposed of as provided below.

5.6. Disposal of Waste, Natural Materials.

5.6.1. Burning of Woody Natural Materials. Burning of woody natural materials, logs, stumps, limbs etc is allowed only with an Air Curtain Destructor or equivalent high efficiency equipment and only with written approval by the DPW Environmental Branch. The DPW Environmental Branch will review the proposal to determine the potential impact to the Installation's Air Quality Permit and Air Monitors. If authorization is granted, the Contractor will still be subject to shut-down if deemed necessary by the DPW Environmental Branch in order to prevent impacts to training and operations and/or avoid Air Quality Permit compliance impacts. Tonnage of woody natural materials burned will be recorded on the FLW Construction and Demolition waste management report, Attachment #3. All ash generated will be disposed of in accordance with all federal, state, local and FLW guidance and regulations at the contractors expense.

5.6.2. Cantonment – The Contractor shall dispose of leaves and grass clippings (removed from bags) generated by this project at the Fort Leonard Wood Compost Area or off of FLW property and in accordance with all federal, state, local laws and FLW regulations and guidance. The Contractor shall dispose of logs greater than 6 inches in diameter either by disposal at a Fort Leonard Wood Fire Wood Cutting Site (or other designated location on Fort Leonard Wood after written approval is provided by the DPW Environmental Branch and direction is provided by the CO or COR), or by sale or retention for sale, or off of FLW property in accordance with all federal, state, local laws and FLW regulations and guidance. The Contractor shall dispose of wood chips, tree stumps and logs, limbs and brush less than 6 inches in diameter and all other natural waste material off of FLW property, in accordance with all federal state local laws and Fort Leonard Wood regulations and guidance. Or on a case by case basis a site on FLW property may be provided for disposition. Written permission from DPW Environmental must be obtained prior to disposition which will only be done at the direction of the CO or COR. Natural chipped materials may also be beneficially reused on the project site to include permanent on-site erosion control berms only per the NPDES permit not to exceed three (3) feet high by six (6) feet wide, or for disposition or sale as mulch.

5.6.3. **Range and Training Areas, potentially containing metal residue from munitions firing** - As determined by DPW Environmental Branch and DPTM, all waste natural materials potentially containing metal residue from munitions firing shall remain on site and shall not be mulched, chipped or placed in drainage ways. Any other disposition of materials from these areas shall be in accordance with all federal, state, local laws and FLW regulations and guidance.

5.6.4. **Range and Training Areas, without metal residue from munitions firing -** Logs greater than 6 inches in diameter *may b*e sold or placed at a designated location on Fort Leonard Wood after written approval is provided by the DPW Environmental Branch and direction is provided by the CO or COR). Stumps and Brush less than 6 inches in diameter shall be disposed off of FLW property and in accordance with all federal, state, local laws and FLW regulations and guidance. Wood chips may be used for onsite erosion control berms not to exceed (3) feet high by (6) feet wide, used as mulch or sold. Whole Stumps may be used on site for erosion control in drainage areas or as project design features such as lane markers. No natural Materials listed in 5.6.3 may be brought on to the Training Areas (TAs) or Ranges from other sites for disposition unless they are to be used on site for erosion control or project design features. The Contractor shall remove and dispose of all unused natural waste material from FLW property in accordance with all federal, state, local laws and FLW regulations and guidance before the contract is completed.

5.7. **Disposal of Waste, Fill Materials –** The Contractor shall dispose of clean waste fill materials (unpainted cinder block, brick and concrete with no exposed steel, rock, asphalt, and clean soil with no organic material) at a landfill off-Post licensed by the State of Missouri to accept such waste, or on a case by case basis and only with written approval by DPW Environmental Branch and also with direction from the CO or COR may use the Fort Leonard Wood Clean Fill site or other sites on FLW approved for use by the DPW and DPW Environmental Branch. Concrete shall have no exposed or protruding steel. The Contractor shall dispose of contaminated waste fill materials at al landfill off-post licensed by the State of Missouri to accept such waste. The Contractor shall provide all necessary information for disposal to the landfill operator, including any required testing of materials and completion of forms required by the Missouri Department of Natural Resources (MDNR).

5.8. **Disposal of Demolition Waste –** The Contractor shall recycle all construction and demolition waste to the fullest extent possible. The Contractor shall complete the “Fort Leonard Wood Construction and Demolition Waste Management Report”, Attachment 3, as specified in the document and comply with all guidance contained in the document. The completed form shall be submitted to the Environmental Branch via the CO/COR. In accordance with Executive Order 13423 “Strengthening Federal Environmental, Energy and Transportation Management” January 24, 2007 a minimum of 50% by weight of the total project solid waste shall be diverted from the landfill. The Contractor shall dispose of demolition waste at a landfill off-post licensed by the State of Missouri to accept such waste. Disposal of demolition waste shall be in accordance with 10 CSR Chapter 80-4. The Contractor shall provide all necessary forms and information for the disposal to the landfill operator and MDNR.

5.9. **Disposal of Hazardous Waste** – The contractor shall be responsible for the costs of testing and disposal of hazardous waste; all hazardous wastes must be packaged, labeled, marked and disposed of by the contractor performing the work IAW Federal, State, Local, and FLW Regulations. All hazardous waste manifests must be signed by the FLW Hazardous Waste Program Manager. Manifests shall be provided at least 48 hours prior to the expected shipment date. Under no circumstances will hazardous waste be handled or removed from the site without first consulting with the FLW Hazardous Waste Program Manager. The appropriate test method to make a non-hazardous determination, should the contractor elect to have the waste tested, is the Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311, which is described in Appendix 11, 40 CFR Part 261. All test results shall be made available to the FLW Hazardous Waste Program Manager for review. This includes TCLP testing and any other analytical testing performed which impacts the determination of wastes from this site. The Contractor shall dispose of any wastes classified as hazardous wastes under the Resource Recovery and Conservation Act (RCRA) in accordance with all Federal, State, local, and Fort Leonard Wood laws and regulations and guidance regarding storage, manifesting, shipment, treatment and disposal of such materials. The storage, containerization, characterization, labeling, placarding, documentation, transportation and final disposition of all hazardous waste will be accomplished in accordance with all Federal, State, local, and Fort Leonard Wood laws and regulations and guidance. The Contractor will procure all necessary licenses, permits and authorizations. All mercury containing thermostats and switches, PCB ballasts and fluorescent lighting will be disposed of through the Fort Leonard Wood base maintenance Contractor according to the Fort Leonard Wood SOP “Lighting and Thermostat Recycle/Disposal Guidance.” The Contractor shall lawfully dispose of materials at the Contractor’s sole expense. Notification and approval by the Contracting Officer and the Fort Leonard Wood Environmental Coordinator is required 10 business days prior to any action related to the disposal of hazardous waste. The Government will have and exercise full and complete control over determining suitability of the Treatment, Storage, and Disposal Facility (TSDF).

5.10. **Disposal of Other Waste** – The Contractor shall dispose of any wastes not specifically covered here at a landfill off-post licensed by the State of Missouri to accept such waste.

5.11. **Waste Management Documentation** – The Contractor shall document all wastes disposed of outside of Fort Leonard Wood by delivering to the CO/COR a landfill disposal form signed and dated by the landfill operator which shows the nature, amount and location of materials delivered to the landfill. In case of sale of logs or retention for sale of logs, the Contractor shall provide a signed statement indicating the disposition of the logs. Construction and Demolition debris will be documented on the Fort Leonard Wood Construction and Demolition Waste Management Report form, attached.

5.11.1. When applicable, the Contractor shall provide the generator, at each site, a properly prepared, typed and error-free, hazardous/special waste manifest and the Toxic Characteristic Leaching Procedure (TCLP) EPA method 1311 analysis appropriate to the waste and current waste profile from the TSDF each time waste is offered for transportation off site. A written Land Disposal Restriction Notice shall accompany each hazardous/special waste manifest, as required. The Contractor shall ensure the completed manifest is returned to the generator within 35 days from the initial transporter's date of signature. The Contractor shall provide the generator at each site a certification of disposal statement for each hazardous/special waste manifest initiated. The Contractor shall also document all waste disposals by delivering to the CO/COR copies of the landfill disposal form signed and dated by the landfill operator which shows the nature, amount, and location of materials delivered to the landfill. In case of sale of logs or retention for sale of logs, the Contractor shall provide a signed statement indicating the disposition of the logs. Copies of this documentation shall be provided to the Contracting Officer prior to requesting final payment on the affected order(s). The work outlined above is a subsidiary portion of the contract work, and is assigned a value of 5% of the value of each affected project. The Contractor shall assign a value of that amount in the breakdown for progress payments. If the Contractor fails to maintain and provide environmental documentation as required herein, the Government will consider that satisfactory progress has not been achieved, thereby requiring the retention of 5% from any request for progress payment, on top of any other retainage applied for cause.

6. **PERMITS:** It shall be the responsibility of the Contractor to obtain *all* permits/licenses required for performance of the contract. The Contractor shall be responsible for determining the fee basis and paying all filing fees and taxes. Payment of fines, penalties, and associated fees for noncompliance or improper performance of applicable work shall be the responsibility of the Contractor. The Contractor shall perform all work in compliance with the Permit. The Contractor shall allow entry to State and Federal regulatory agency inspectors. The Contractor shall be responsible for any fines and penalties associated with non-compliance. The Contractor Copies of the permit applications and associated documentation shall be routed through the Contracting Officer/Contracting Officer Representative to the appropriate DPW Divisions for review and approval prior to submittal. A transmittal letter signed by the current DPW Director will be provided as the Missouri Department of Natural Resources (MDNR) will not accept or process the application for the associated permit without the signed transmittal letter. This is a time consuming effort and the Contractor should begin the permit process well in advance of the Notice to Proceed in order to avoid delaying the start of the project. A copy of all approved permits shall be submitted to the Contracting Officer/Contracting Officer Representative and the Environmental Branch (573/596-0882).

6.1. **Drinking Water Permits** – Should a water main extension or a fire hydrant be installed required as part of this contract, or any modification to the water system that would require a permit as outlined in 10 CSR 60-3, the Contractor is responsible for obtaining that permit from MDNR. Water permits are issued from the Jefferson City Office. In addition to the permit application, eight sets of DRAFT professional engineer stamped plans and specifications must be submitted for the DPW to review prior to final approval from the Director. Government comments must be resolved prior to preparation of final documents. Once approved, two sets of Final Missouri Professional Engineer stamped plans and specifications, along with the completed permit application forms, are submitted to the DPW Operations Division. Once the cover letter has been signed by the DPW Director, the Contractor will then forward plans/specs/permit application/fees to MDNR. Should MDNR require additional information, the same procedures will be followed prior to forwarding to the State. A copy of the permit must be provided to the DPW Environmental Branch for official records within five (5) business days of receipt. Any permit application fees are to be paid by the Contractor. The Contractor is responsible for full compliance with all terms and conditions of the permit. This work may not proceed until the State issued permit is provided and posted at the job site as required by the permit. Once the project is complete, the Contractor's Professional Engineer will complete the "Statement of Work Completed" form, furnished with the permit and provide the signed form to the DPW Environmental Branch for forwarding to MDNR.

6.2. **Waste Water Permits** – Should a waste water main extension or a Lift Station be installed as part of this contract, or any modification to the wastewater system that would require a permit as outlined in 10 CSR 20-6.010, the Contractor is responsible for obtaining that permit from MDNR. Waste water permits are issued from the Rolla Satellite Office. In addition to the permit application, eight sets of DRAFT professional engineer stamped plans and specifications must be submitted for the DPW to review prior to final approval from the Director. Government comments must be resolved prior to preparation of final documents. Once approved, two sets of Final Missouri Professional Engineer stamped plans and specifications, along with the completed permit application forms, are submitted to the DPW Operations

Division. Once the cover letter has been signed by the DPW Director, the Contractor will then forward plans/specs/permit application/fees to MDNR. Should MDNR require additional information, the same procedures will be followed prior to forwarding to the State. A copy of the permit must be provided to the DPW Environmental Branch for official records within five (5) business days of receipt. Any permit application fees are to be paid by the Contractor. The Contractor is responsible for full compliance with all terms and conditions of the permit. This work may not proceed until the State issued permit is provided and posted at the job site as required by the permit. Once the project is complete, the Contractor's Professional Engineer will complete the "Application for Letter of Authorization" form, furnished with the permit, and provide the form to the DPW Environmental Branch to be submitted to MDNR. If a waste water Lift Station is required as part of this contract, a backup generator is required for support in the event electrical power becomes unavailable.

6.3. **Air Permits** – Air emissions sources require construction permits in Missouri. Air permits are issued for the specific design and equipment (stacks, vents, exhaust systems, open vats, storage tanks (sources of evaporation), incinerators, boilers, generators (i.e., any combustion equipment), etc.). It is the Contractor's responsibility to obtain permits before construction starts and ensure compliance with the permit. Route all air permit requests through the CO/COR.

6.4. **Land Disturbance Permits (National Pollutant Discharge Elimination System Permits)** – Land disturbance is defined as any activity that disturbs the root zone of vegetation or disturbs compacted soil to an erodible state such as clearing, grubbing and grading. Should the project entail land disturbance of 1-acre or greater, but less than 5-acres, State Form O must be completed (in accordance with 10 CSR 20-6.200) and provided to the Contracting Officer/Contracting Officer Representative. For projects that cause land disturbance of 5 acres or more, State Forms E and G must be completed (in accordance with 10 CSR 20-6.200) and provided to the Contracting Officer/Contracting Officer Representative (CO/COR). In addition, a Storm Water Pollution Prevention Plan (SWPPP) must be provided (in accordance with 10 CSR 20-6.200) that includes a site specific sketch/drawing showing all planned erosion control devices. In addition to the appropriate State forms, a USGS 1" = 2,000' scale map showing the exact location of the project is required. Once approved, a signed cover letter from the Director of Public Works will be provided to the Contractor to include with the application. The Contractor will forward the permit application/drawings/fees to the MDNR. Any permit application fees are to be paid by the Contractor.

6.4.1. The Contractor is responsible for compliance with all terms and conditions contained in the permit until the Permit is formally terminated by the Missouri Department of Natural Resources. Earth disturbing activities may not proceed until the State issued permit is obtained and posted at the job site as required by the permit. Attachment 4 provides a sample copy of a Permit.

6.4.2. Each site with a Land Disturbance Permit must provide copies of the completed weekly inspection reports and completed inspection reports no more than 48-hours after a rain event. The Contractor must also complete and submit monthly the "Fort Leonard Wood Land Disturbance Permit Compliance Self Certification" form, Attachment 5. All inspection reports and monthly Compliance Certification submittals are required until the Permit is terminated by the Missouri Department of Natural Resources. All submittals are to be provided within 5-days of completion to the DPW Environmental Branch via the CO/COR.

6.4.3. Interim soil stabilization is required until final stabilization is met. All sites must be final stabilized as per the Missouri Permit: "The project is considered to be stabilized when perennial vegetation, pavement, buildings, or structures using permanent materials cover all areas that have been disturbed. With respect to areas that have been vegetated, vegetative cover shall be at least 70% of fully established plant density over 100% of the disturbed site." Use of Missouri native perennial vegetation is highly encouraged.

6.5. Missouri Separate Storm Sewer (MS4) Permit – Construction activities occurring on Department of Army Fort Leonard Wood property are regulated by a Municipal Separate Storm Sewer System (MS4) Permit. This is a permit, regulated by the Environmental Protection Agency under the Clean Water Act and administered by the Missouri Department of Natural Resources, legally mandates that Fort Leonard Wood decrease the quantity and increase the quality of stormwater runoff through improved site design, and selection and maintenance of Best Management Practices that minimize point and non-point pollution sources. This permit requires that Fort Leonard Wood maintain a rigorous land disturbance oversight program that proactively enforces adherence to land disturbance permit requirements regulating pre- and post-construction runoff from permitted activity, and report the status of compliance annually.

7. **ENERGY AND SUSTAINABILITY:** The Federal government is committed to designing, locating and constructing, maintaining, and operating its facilities in an energy efficient and sustainable manner. It shall be the responsibility of the Contractor to comply with all of the following federal energy and sustainability executive orders and policies. The Contractor shall be responsible for determining the applicability of each of these for their project. Copies of each of these requirements can be obtained from the Contracting Officer/Contracting Officer Representative or the Environmental Branch (573/596-0882).

7.1. **Heating, Ventilation, Air Conditioning (HVAC)** – The Army standard is that no Class I or Class II ozone-depleting substances (ODSs) may be used and that any alternative refrigerants must have a Toxicity Clearance through the Center for Health Promotion and Preventive Medicine (CHPPM). Contractors may access the list of CHPPM Toxicity Clearances at the following website: http://chppm-www.apgea.army.mil/tox/product.aspx

7.2. **DoD Green Procurement Program (GPP) –** The DoD GPP requires green products and services to be purchased to the maximum extent practicable. The Contractor shall comply with applicable Federal Acquisition Regulations (FARs). The Contractor shall consult with the contracting official to determine the applicability of the GPP to their project.

7.3. **Executive Order 13423 – Strengthening Federal Environmental, Energy, and Transportation Management, 26 Jan 07 –** The Federal Government is required to adhere to the environmental, energy and transportation requirements outlined in the state executive order. Therefore, Contractors must be able to work with the federal government to comply with these requirements. Examples of required goals include improved energy efficiency and reduced green house gas emissions, reduced water consumption, green procurement, and high performance building requirements.

7.4. **Energy Policy Act of 2005** – The Contractor shall support the Federal Energy Reduction Goals as required by the Energy Policy Act of 2005. Contractor must adhere to the regulations and specifications contained within this Act. Contractor must consider the cost of required energy reductions when preparing Request for Proposal.

7.5. **Energy Independence and Security Act of 2007** – The Contractor shall support the Federal requirement that all lighting in Federal Buildings use Energy Star products. The Contractor shall ensure compliance with Subtitle C – High-Performance Federal Buildings. This requirement has applications to building energy use and HVAC systems as well as the following stormwater requirements. Refer to Section 3.6.1 for the stormwater requirements.

7.6. **Army's Sustainable Design and Development (SDD) Policy**

7.6.1. Military Construction Program – All vertical construction projects with climate-controlled facilities (mechanically heated or cooled for human comfort) must achieve the SILVER level of Leadership in Energy and Environmental Design – New Construction (LEED-NC). This requirement applies to all construction on Ft. Leonard Wood, including Army Reserve, Army Readiness Centers and Armed Forces Reserve Centers, regardless of funding source and including BRAC. All LEED projects must be registered with the US Green Building Council and must be certifiable by the USGBC. Five percent of Army building projects are chosen for validation, in which case, certification is required. Associated costs shall be captured in the DD Form 1391.

7.6.2. Garrison-level Approved Projects – Projects authorized to be approved by the Garrison Commander - shall incorporate SDD features to the maximum extent possible but are exempt from meeting the minimum score requirement for the SILVER level of LEED. Incorporating SDD can increase energy efficiency and reduce energy costs, increase the tonnage recycled minimize pollution

7.6.3. Exemptions

7.6.3.1. Horizontal construction projects (ranges, roads, airfields, etc.) shall incorporate SDD features to the maximum extent possible, but are exempt from meeting the minimum score requirement for the SILVER level of LEED.

7.6.3.2. The requirement to achieve the SILVER level of LEED applies to permanent facility construction only; required interim facilities are exempt. An interim facility requirement is a short-term urgent requirement for facilities lasting three years or less, normally.

7.6.3.3. Renovation and Repair projects are required to incorporate SDD features and be scored using LEED-NC, but are exempt when they do not exceed the garrison commander authority or they have a repair to replacement ratio less than or equal to 25%.

7.7. **Conformance with the Fort Leonard Wood ISO 14001 Environmental Management System** - The Contractor shall perform work under this contract consistent with the policy and objectives identified in the Fort Leonard Wood ISO 14001 Environmental Management System (EMS). The Contractor shall perform work in a manner that conforms to all appropriate Environmental Management Programs and Operational Controls identified by the Fort Leonard Wood EMS. In the event of an environmental nonconformance or noncompliance associated with the contracted services, the Contractor shall take corrective and/or preventative actions. In the case of a noncompliance, the Contractor shall respond and take corrective action immediately. In the case of a nonconformance, the Contractor shall respond and take corrective action based on the time schedule established by the EMS Coordinator. In addition, the Contractor shall ensure that their employees are aware of the roles and responsibilities identified by the SMS and how these requirements affect their work performed under this contract. Information can be found in the Contractor Section of the DPW Environmental Division Website.

7.7.1. All on-site Contractor personnel shall complete FLW EMS awareness training, and as is identified in the Training Requirements of the Contractor Section of the DPW Environmental Division Website (www.wood.army.mil/dpwenv).

	Fort Leonard Wood **Directorate of Public Works** **Environmental Division**	

Spill Report

Any spill or release of POLs, hazardous waste, or hazardous material into the environment must be reported immediately by calling 911. Within 3 days of the incident, complete and submit this Spill Report Form to the DPW Environmental Branch in Building 2101, which is located at the intersection of 2nd Street and Replacement Avenue. The form may also be submitted via fax (573-596-0869) or email (angela.rinck@us.army.mil). For more information, call 573-596-0882 during duty hours.

Report to DPW made by:

Name: ______________________ Signature: ______________________

Title: ______________________ Location: ______________________

Date: ______________________ Time: ______________________

Material spilled: ______________________

Volume spilled: ______________________

Location of spill: ______________________

Date, time, and duration of spill: ______________________

Cause of spill (Attach additional pages if necessary):

Corrective action taken to control and/or mitigate the effects of the spill (Attach additional pages if necessary):

Plan for preventing recurrence (Attach additional pages if necessary):

Other contacted, i.e. Fire Department:

Name: ______________________ Date/Time: ______________________

Name: ______________________ Date/Time: ______________________

Name: ______________________ Date/Time: ______________________

Fort Leonard Wood
Directorate of Public Works
Environmental Division

Construction and Demolition (C&D) Waste Management Report

The contractor shall make all reasonable efforts to recycle and recover C&D waste from this project. A minimum of 50%, by weight, of total project solid waste shall be diverted from the landfill in accordance with Executive Order 13423 "Strengthening Federal Environmental, Energy, and Transportation Management", 24 January, 2007. Waste management consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project mandates. Companies and facilities used for recycling, reuse, and disposal shall be appropriately permitted for the intended use to the extent required by federal, state, and local regulations. The contractor shall provide on-site instructions for separating, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project. Records shall be maintained to document the quantity of waste generated, the quantity of waste diverted through sale, reuse, or recycling, and the quantity of waste disposed of by landfill or incineration. This form shall be used to record the information. The contractor shall submit this report of all non-hazardous C&D waste generation no later than 10 days after each fiscal quarter ends, starting the first quarter that C&D waste is generated. This report shall be submitted through the contracting officer or representative to the Directorate of Public Works Solid Waste Program Manager 573-596-0882, Building 2101. Contractor shall provide an electronic or paper copy.

Project name: ____________________ Location: ____________________

Contract number: ____________________ Report period covered: __________ to __________

Contractor: ____________________ Prepared by: ____________________

Gov't contract inspector: ____________________ Date: ____________________

Email: ____________________ Phone: ____________________

Waste Type	**Total Generated** (by weight in tons)	**Management Method** (by weight in tons)	
		Recycled or Salvaged	**Disposed**
Examples: Concrete	505,000	500,000 crushed for reuse at ___________	5,000 to landfill
Mixed debris	1,000	0	1,000 to landfill
Scrap metal	10	10 recycled to A1 metals	0
Wall board/Sheet Rock			
Stumps, Brush, Wood Chips (beneficially reused on site)			
Stumps, Brush, Wood Chips (off FLW)			
Scrap Metal			

Waste Type	**Total Generated** (by weight in tons)	**Management Method** (by weight in tons)	
		Recycled or Salvaged	**Disposed**
Concrete			
Clean fill (FLW clean fill)			
Clean fill (off FLW)			
Compost (FLW compost)			
Compost (off FLW)			
Other			
TOTAL			

Landfill name:

Comments:

Example Waste Types:

Wallboard	Recycled to manufacturer.
Stumps & Brush	Logs less than 6 inches in diameter, all limbs, twigs, stumps and other brush.
Concrete	Contaminated concrete will be disposed of at an off-post authorized landfill.
Clean fill	Uncontaminated soil, rock, sand, gravel, concrete unpainted and with no exposed steel, unpainted brick, unpainted cinderblock, asphalt, and NO organic material.
Compost	Leaves, grass, and straw removed from trash bags (absolutely no trash or trash bags).
Scrap metal	Turned in as recyclable material.
Wood chips	

Specific guidance for disposition of C&D and Land Clearing materials is contained in the Environmental Requirements section of each project contract.

	Fort Leonard Wood Directorate of Public Works Environmental Division	

Land Disturbance Permit Compliance Self Certification

The permit below is in compliance with all stipulations of the State of Missouri Land Disturbance Permit:

Permit number: ____________________

Project name or description: ____________________

Project building number or location: ____________________

Contract number (if applicable): ____________________

I certify that all of the Best Management Practices, including performing Weekly Site Inspections, under this State of Missouri Land Disturbance Permit are currently maintained in compliance with applicable federal law (40 CFR Section 319 of the Federal Clean Water Act) and the site specific Storm Water Pollution Prevention Plan.

Check only one:

☐ There is **no** outstanding compliance issues remaining on this site.

☐ There are compliance issues which will be corrected within seven days per the Permit.

Print and Sign Land Disturbance Permit Continuing Authority	Compliance Self Certification Date
Print and Sign Land Disturbance Site Manager (if applicable)	Compliance Self Certification Date

This certification must be submitted to the following address within 15 days from the end of each month until the permit is terminated by the Missouri Department of Natural Resources.

Fort Leonard Wood Directorate of Public Works
Environmental Compliance Branch (LMNE-LNW-PWEE)
Storm Water Program Manager
1334 First Street
Fort Leonard Wood, MO 65473

Fort Leonard Wood
Directorate of Public Works
Environmental Division

Construction Permit Application Review Process

The following is Directorate of Public Works review process for all permit applications. This process must be followed to ensure timely review of permit applications.

1. Contractor shall provide the completed application and supporting documentation (including the Professional Engineer stamped drawings for water and waste water main extensions) to the Contracting Officer Representative (COR). Note this is a time consuming effort and the contractor should begin the permit process well in advance of the NTP in order to avoid delaying the start of the project.

2. The COR will submit the above to the Fort Leonard Wood Directorate of Public Works (DPW).

3. Appropriate staff of Fort Leonard Wood DPW (Planning Division, Operations Division, Engineering Division, and Environmental Division) will review.

4. DPW staff comments and/or approves.

5. DPW returns plans/specifications to COR/Contractor with the application transmittal letter signed by the Director of Public Works. This letter serves as the official Permit request. The Missouri Department of Natural Resources (MDNR) *will not* process any permit application for projects located on Fort Leonard Wood without this DPW transmittal letter.

6. Contractor submits documents, application, and Permit fee to the MDNR.

7. MDNR reviews/comments/issues Permit. Note: MDNR will not issue a Permit until their comments, if any, are adequately addressed.

8. Contractor provides copy of correspondence and Permit to the Fort Leonard Wood DPW Environmental Branch to maintain in the compliance file.

9. Construction may begin.

10. All permitted activities will be inspected for compliance by staff from Fort Leonard Wood, the Missouri Department of Natural Resources, and/or the Environmental Protection Agency, Region VII.

11. As the Permit holder, the Contractor is responsible for full compliance, and all fines, penalties, or other stipulations.

Fort Leonard Wood
Directorate of Public Works
Environmental Division
State Permit – Review Processing

The following table provides a short list of contracted actions that generally require an additional environmental compliance review or require a permit or other document. This is not an all-inclusive list. If in doubt, please contact the Environmental Division for assistance at 573-596-0882 or visit the Environmental Division Web page at www.us.army.mil/dpwenv

REGULATORY AREA	DOCUMENT, PERMIT or NOTIFICATION	COST (estimated)	STATE PROCESSING TIME (estimated)	FLW CONTACT
Asbestos Work: Required for all Friable Asbestos projects	Notification 10-days prior to work start	$0	none	Keith Duncan
Land Disturbance- Erosion Control: Any earth disturbance 1-acre or greater	Erosion Control Permit	$300	Up to 6-months from date State receives application and fee payment	Shannon Kelly
Drinking Water: New/changes to the systems to include distribution system	Water Permit to “Construct”	$50-$3K	Up to 6 months from date State receives application, with plans/specs, and fee payment. PE stamp required	Carl Stenger
Waste Water: New/changes to: systems to include collection system	Water Permit to “Construct”	$50-$3K	Up to 6 months from date State receives application, with plans/specs, and fee payment. PE stamp required	Carl Stenger
Tanks- Underground: New/changes to: Underground Storage Tanks	Notification required	$100	Minimum 30-days upon receipt of notice and fee payment, prior to work start	Carl Stenger
Tanks-Aboveground: New/changes to Aboveground Storage Tanks	Permit to “Construct”	$150	Approx 60-days from date State receives request for permit determination and receives fee payment	Carl Stenger
Tanks: Install new fuel storage tanks	Permit to “Construct”	$150-$10K	Up to 9-months from date State receives application with plans/specs and fee payment	Carl Stenger
Utilities: Install new/replace emergency generators	Air Permit to “Construct”	$150-$10K	Up to 9-months from date State receives application with plans/specs and fee payment	Steve Flier
Utilities: New/changes to: large facility HVAC systems	Air Permit to “Construct”	$150-$10K	Up to 9-months from date State receives application with plans/specs	Steve Flier
Utilities: Replace Boiler or install new boiler(s)	Air Permit to “Construct”	$150-$10K	Up to 9-months from date State receives application with plans/specs	Steve Flier

APPENDIX

PROCEDURE FOR COORDINATION OF TREE REMOVAL

FORT LEONARD WOOD, MISSOURI

The following is a process for the coordination of tree removal on all Fort Leonard Wood projects.

- During the charette an initial discussion on the removal of trees shall be conducted. As the site plan is developed during the charette a preliminary determination shall be made on the removal of trees. The civil design engineer is responsible for coordinating this issue with FLW DPW personnel. At a minimum this shall include Dan James (573-596-2814), Brian Nelson (573-596-0901), and Thomas Glueck (573-596-2814) of the FLW DPW staff.

- Early in the design process (10-35%) the civil designer shall conduct a site visit to verify the survey shows all trees and their location.

- Upon completion of the 35% design the civil engineer shall coordinate closely with FLW DPW in regards to the removal of trees. This will require a site visit, which at a minimum will include Dan James, Brian Nelson, and Thomas Glueck of the DPW staff. The civil engineer shall ensure that FLW DPW fully understands the trees to remain and the trees to be removed during construction. Any site plan changes recommended based on the site visit shall be coordinated through the project manager for coordination with all stake holders and PDT members.

- At the 65% design submittal the civil engineer will coordinate any changes from the 35% submittal with the appropriate DPW personnel. This includes adjustments to the site layout, final grading, storm drainage, and utility impacts on the removal of trees. A site visit shall be conducted if deemed necessary.

- At the final design submittal the civil engineer will coordinate any changes from the 65% submittal with the appropriate DPW personnel. This includes adjustments to the site layout, final grading, storm drainage, and utility impacts on the removal of trees. A final plan-in-hand shall be conducted by the civil engineer to ensure that DPW personnel are in agreement on trees to be removed and those to remain. The site visit shall include DPW personnel and a representative from the Corps construction office. This shall be coordinated with Jesse Vance (816-389-3529).

- Prior to the start of construction one final site visit shall be held by the Corps construction office (Jesse Vance) to mark trees for removal. This shall include all necessary DPW staff to include at a minimum Dan James and Thomas Glueck.

Missouri Department of Natural Resources

Managing Construction and Demolition Waste

Solid Waste Management Program fact sheet
7/2006

This guidance is provided primarily for construction and demolition contractors, construction and demolition waste haulers, roofing contractors, remodeling businesses, homebuilders and homeowners. Cities and counties that issue building permits may also find the information helpful. The guidance covers only those residuals commonly produced during building construction and demolition. You may obtain information about managing other wastes by contacting the sources listed on the last page of this fact sheet.

This fact sheet is not intended for guidance on the management of surface coatings removed from bridges, water towers or other similar outdoor structures.

Waste types

During building construction and demolition, you may produce one or more of the following types of residuals:

1. Clean fill
2. Recovered materials
3. Regulated construction and demolition waste
4. Hazardous materials and hazardous wastes, or
5. Asbestos-containing materials.

Management requirements differ for each of these.

1. Clean fill is “uncontaminated soil, rock, sand, gravel, concrete, asphaltic concrete, cinder blocks, brick, minimal amounts of wood and metal and inert (nonreactive) solids...for fill, reclamation or other beneficial use” [§260.200(4), RSMo].

Minimal means the smallest amount possible. For example, concrete containing wire mesh or rebar may be used as clean fill. However, exposed rebar should be removed before use. Under no circumstances are roofing shingles, sheet rock, wood waste or other construction and demolition wastes defined as clean fill.

Concrete, cinder blocks, bricks or other clean fill materials that are painted with non-heavy metal-based paints are also considered clean fill. Before use as clean fill, it is the generator’s responsibility to determine if the painted materials are hazardous wastes. The most typical contaminants are lead and other heavy metals. This determination can be made by representative sampling or by applying historical knowledge of the materials in question. If asphaltic concrete is to be used as clean fill; it is generally recommended that it not be crushed or ground any smaller than necessary. This will help to minimize the leaching of chemicals found within the asphaltic material. Although not regulated as waste, placement of clean fill materials may be subject to requirements of the department’s Water Protection Program if it is placed in contact with surface or subsurface waters of the state, or would otherwise violate water quality

PUB002045

Recycled Paper

standards. Contact the department's Water Protection Program at (573) 751-1300 if you have any questions regarding this approval. Local requirements concerning the use of clean fill may apply as well. Contact the Hazardous Waste Program at (573) 751-3176 for questions on determining whether materials intended as clean fill may be hazardous and disposal options.

2. Recovered materials are those removed for reuse (lumber, doors, windows, ceramic tile and glass) and those removed to be recycled into new products.

Potentially recyclable construction and demolition wastes may include scrap metals, asphalt shingles, sheet rock, lumber, glass and electrical wire. However, it is important to remember that recovered waste must be used in some way. Separating out certain wastes to be recycled into new products without having a market for them is expensive and pointless. Storing recovered materials indoors is expensive. Storing them outdoors may lower their value, since most will degrade or deteriorate when exposed to the weather. Depending on how they are stored, they may harbor rodents, provide breeding grounds for insects or be a potential fire hazard. Recyclables may not be collected and dumped on the ground while waiting for markets to develop. Therefore, before you deliver recyclable materials to a processing or recovery facility, be sure the facility is legitimate. The Planning Unit of the department's Solid Waste Management Program (SWMP) has information about many recycling facilities in Missouri. You may contact the Planning Unit at (573) 751-5401.

If you plan to remove reusable or recyclable materials from construction and demolition waste, the sorting must take place at the construction or demolition site.

The wastes cannot be hauled from the site and dumped for later sorting, except at a permitted processing facility or at a facility that has received a permit exemption from SWMP. Although the Missouri Department of Natural Resources strongly encourages the recovery of potential waste materials whenever possible, these activities must be done legally.

3. Regulated construction and demolition wastes are those that are not classified as clean fill and that are not being reused or recycled. Regulated non-hazardous construction and demolition wastes must be disposed of at a permitted landfill or transfer station. They must not be burned to avoid violating air and solid waste laws. They must not be buried (except at a permitted landfill). They must not be hauled to private or public property and dumped or buried, even with the landowner's permission. If that happens, everyone involved, including the contractor(s), subcontractor(s), the hauler(s) and the landowner(s) can and will be held liable for the illegal disposal (§§260.210, 260.211 and/or 260.212, RSMo). If you are a building contractor, you need to know that burying construction waste from a building anywhere on the property is illegal (§260.210.1, RSMo). See page four for a description of penalties for illegal disposal of construction and demolition waste.

4. Hazardous Materials and Hazardous Wastes. Although you may find a variety of hazardous materials in old buildings, lead-based paint and asbestos are the most common ones that demolition contractors need to deal with. Asbestos is discussed in the next section of this document.

Recent studies conducted by the U.S. Agency for Toxic Substances and Disease Registry, and by independent researchers, show that the health effects of lead exposure are greater than previously thought. Children are especially vulnerable to the effects of lead poisoning. Because lead and other toxic heavy metals may be contained in the wastes noted above, they require careful management and disposal.

For many years, lead-based paint was used in residences and businesses for its stable coating properties. Although lead-based paint was virtually banned by the Consumer Product Safety Commission in 1978 for residential application, it is often encountered when buildings are renovated or demolished. Also, lead-based paint is still manufactured and sold for corrosion or rust inhibition on steel structures and for other industrial purposes. In older buildings, lead was also used for roofs, cornices, tank linings, and electrical conduits. In plumbing, soft solder, an alloy of lead and tin, was used for soldering tinplate and copper pipe joints.

Additional guidance for handling demolition waste containing lead-based paint or other heavy metals (such as cadmium or chromium) is available by calling the department's Hazardous Waste Program at (573) 751-3176.

Hazardous waste requirements for demolition wastes - Demolition-related waste categories typically include

- Paint Residue - Paint chips, paint scrapings, and paint-contaminated blast residue from building renovations or demolition projects,
- Demolition Debris - Masonry, metal and boards that have been painted with lead-based (or other heavy metal-based) paint, and
- Scrap Metal - Metal objects that contain lead or other heavy metals.

For households, the following management options apply, whether or not a contractor is doing the work for you.

- Paint Residue - Paint residue may be placed in the household trash. Before disposal, wrap tightly in a plastic bag or other container. It will be picked up by your trash hauler and taken to a sanitary landfill for disposal.
- Demolition Debris - May be placed in your household trash. It may be picked up by your trash hauler and taken to a sanitary or demolition landfill for disposal.
- Scrap Metal - Scrap metal should be taken to a salvage yard operator for recycling. If this is not possible, the metal may be placed in your household trash and picked up by your waste hauler for disposal at a sanitary or demolition landfill.

For generators other than households - This category includes commercial and business enterprises, institutions and industrial buildings, and other structures not specifically identified.

Paint Residue - Paint residue must be laboratory tested before disposal. The appropriate test method is the Toxicity Characteristic Leaching Procedure (TCLP), EPA Method 1311, which is described in Appendix 11 of the Code of Federal Regulations, Title 40, Part 261 (40 CFR Part 261). The test must include the eight metals noted in 40 CFR Part 261.24 (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver).

Environmental laboratories capable of conducting a TCLP may be found in the telephone Directory's *Yellow Pages*. If one or more of analytical limits meets or exceeds the regulatory limit, the waste is hazardous. Hazardous wastes must be managed, transported, and disposed of according to the Missouri Hazardous Waste Management Law and Regulations.

This may require that the generator send paint residue to a permitted hazardous waste disposal facility. In some cases, a lead smelter may accept lead-based paints for use in their lead production processes.

If laboratory analysis shows that the paint residue is non-hazardous, it must be disposed of at a sanitary landfill as "special waste". Paint residue may not be disposed of in a demolition landfill.

Procedures for managing special wastes are included in the guidance, titled *Special Waste* technical bulletin (PUB2050). The landfill may require you to complete a special waste disposal request form, and provide the results of testing on the paint waste to show that it is not hazardous before accepting the waste.

Demolition Debris - Demolition debris painted with heavy metals need not be tested before disposal. Such wastes may be disposed of in either a sanitary or a demolition landfill in Missouri.

Scrap Metal - Scrap metal painted with heavy metals may be sent to a salvage yard for recycling. If this is not possible, the metal may be disposed of at a sanitary or demolition landfill.

5. Asbestos. All public, institutional, or commercial buildings (and in some instances, residential structures) must be inspected for asbestos before renovation or demolition activities begin. Before planning a demolition project, bidding a project, letting a bid or beginning the demolition, it is important to know if the building has any asbestos-containing materials (ACM) and who is responsible for removing them. Buildings may contain asbestos in materials such as ceiling or floor tile, as insulation or soundproofing on ceilings, pipes, ductwork or boilers, or on the outside as transite siding or in shingles. The presence of ACM cannot be confirmed just by looking. A thorough inspection of any regulated building must be conducted by a Missouri certified asbestos inspector to determine the presence and condition of ACM. Depending upon the results of the inspection, a registered asbestos abatement contractor may be required. Contact the department's Air Pollution Control Program's Asbestos Unit at (573) 751-4817 for more specific information about managing ACM. Visit www.dnr.mo.gov/env/apcp/Asbestos.htm for more information about asbestos requirements.
If the ACM is to go to a landfill or transfer station, contact the facility in advance to see if they accept ACM and if they have any special handling or packaging requirements.

Penalties for illegal disposal of construction and demolition wastes The Missouri Solid Waste Management Law provides for civil penalties for persons who dispose of or allow the disposal of regulated construction and demolition wastes in unpermitted areas.

The law also contains criminal provisions for some types of illegal construction and demolition waste disposal. There may be additional penalties for violations of Air and Hazardous Waste Laws depending on the situation and means of disposal. For Solid Waste Management Law violations alone:

1. Civil Penalties: Any person who disposes of construction and demolition waste or allows the disposal of construction and demolition waste in an area not permitted for such disposal may be assessed a civil penalty of up to $1,000 per day per violation (§260.240, RSMo).
2. Criminal Penalties: Any person who purposely or knowingly disposes of or causes the disposal of regulated quantities of construction and demolition waste or other solid waste may be prosecuted for violating the criminal provisions of §§260.211 and 260.212, RSMo. Convictions may include fines of $20,000 or more, community service, and/or clean up of the illegally dumped waste. In some cases, persons convicted of illegal dumping have served time in jail.
3. The Missouri Air Conservation Law and regulations provide for civil penalties of up to $10,000 per day per violation for persons who violate the requirements for handling, packaging, transporting or disposing of ACM. The federal Clean Air Act also contains civil and criminal penalties for violations. The same penalties apply for persons who illegally dispose of construction and demolition waste by burning.

Other requirements

Other legal requirements related to managing construction and demolition wastes include:

1. Anyone engaged in building construction, modification or demolition must maintain a record of all sites used for construction and demolition waste disposal for one year. The records must be made available to department staff upon request (§260.210.7, RSMo).
2. Cities and counties that issue building permits are required to notify each permittee, in writing, of the legal requirements for construction and demolition waste disposal (§260.210.8, RSMo).
3. A person shall be guilty of conspiracy...if he knows or should have known that his agent or employee has violated the civil or criminal provisions of the law related to illegal disposal of construction and demolition waste or other solid waste (§260.212.9, RSMo).
4. Anyone selling, conveying or transferring property that contains construction and demolition waste or other solid waste (whether buried or not), must disclose the existence and location of the waste disposal site to a potential buyer early in the negotiation process (§260.213, RSMo).
5. Anyone hauling materials that could fall or blow off a vehicle, including construction and demolition waste, must cover the load or secure it so that none of it can become dislodged and fall from the vehicle (§307.010, RSMo). In addition, many landfills and transfer stations in Missouri require all incoming loads to be covered. Some facilities accept open loads, but may charge you extra for them.
6. A person commits the crime of littering if they throw or place, or cause to be thrown or placed, any garbage, trash, refuse or rubbish of any kind on the right-of-way of any public road or highway, in or on any waters of the state or the stream banks, and on any public or private property (owned by another without their consent) (§577.070, RSMo).

Additional information

You may obtain additional information about properly managing construction and demolition wastes from the sources listed below.

Missouri Department of Natural Resources

Air Pollution Control Program (573) 751-4817
Hazardous Waste Program (573) 751-3176
Solid Waste Management Program (573) 751-5401
Water Protection Program (573) 751-1300

Regional Offices

Kansas City Regional Office (816) 622-7000
Northeast Regional Office (Macon) (660) 385-8000
St. Louis Regional Office (314) 416-2960
Southeast Regional Office (Poplar Bluff) (573) 840-9750
Southwest Regional Office (Springfield) (417) 891-4300
Solid Waste Management Program (573) 751-5401

On the Web

Construction and Demolition information is available from the Solid Waste Management Program at www.dnr.mo.gov/env/swmp/index.html.
Environmental publications are available at www.dnr.mo.gov/pubs/.

Additional considerations and sources

Hazardous waste requirements are found in the Missouri Hazardous Waste Management Laws, Sections 260.345 through 260.575 of the Revised Statutes of Missouri (RSMo).

The Missouri Hazardous Waste Regulations are found in Title 10, Division 25 of the Code of State Regulations (CSR). Most of the federal environmental requirements in Title 40 of the Code of Federal Regulations (CFR) is adopted by reference into the Missouri regulations.

Solid waste requirements are found in the Solid Waste Management Law in Sections 260.200 through 260.345 RSMo, and the regulations in Title 10, Division 80 in the CSR. Copies of the Revised Statutes of Missouri are available through the Reviser of Statutes at (573) 526-1288, or are available online at www.moga.mo.gov.

Copies of the Missouri Code of State Regulations are available through the Missouri Secretary of State at (573) 751-4015, or are available online at www.sos.missouri.gov/adrules/csr/csr.asp.

Federal regulations may be viewed at federal depository libraries or may be purchased from a U.S. Government Bookstore, the U.S. Government Printing Office, or from a commercial information service such as the Bureau of National Affairs. Federal Regulations are also available online at www.gpoaccess.gov/cfr/index.html.

Other Guidance

The Missouri Department of Health and Senior Services - Office of Lead Licensing and Accreditation may be contacted for information regarding training, licensure and work practice standards for lead abatement activities. Disposal is an abatement activity. See Missouri Revised Statutes 701.300 and 701.338.

Please note that many municipalities have their own additional requirements that might be more strict than those discussed above.

For more information, call or write

Missouri Department of Natural Resources
Hazardous Waste Program
P.O. Box 176, Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-7560 office
(573) 751-7869 fax
www.dnr.mo.gov/env/hwp/index.html

Missouri Department of Natural Resources
Solid Waste Management Program
P. O. Box 176, Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-5401 office
(573) 526-3902 fax
www.dnr.mo.gov/env/swmp/index.html

Missouri Department of Natural Resources
Air Pollution Control Program
P.O. Box 176, Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-4817 office
(573) 751-2706 fax
www.dnr.mo.gov/env/apcp/index.html

Missouri Department of Health and Senior Services
Office of Lead Licensing and Accreditation
P.O. Box 570, Jefferson City, MO 65102-0570
1-888-837-0927 or (573) 526-5873
(573) 526-0441 fax
www.dhss.mo.gov/Lead/

Fort Wood Daily Pesticide Report Sheet

Agency/Company:
Applicator:
Building or Area:

Date:
Building or Exterior Control Type:
Building Construction Type:

Page: ____ of ____

Control Area Description	Area Size or Acres	Target Pest	Infestation Level	Control Operation/& Work Origin	Pesticide Used-EPA #	Formulation Type & %	Application Rate per Unit Area	Gals. H_2O	Finish Spray Concentration %	Amount of Spray Solution	Labor Time	Total of Chemical Concentrate Used	Product Unit

Measurement Units: a x b = Feet x Feet
AC = Acres
MSF = 1000 Square Feet
LF = Linear Feet
MCF = 1000 Cubic Feet

Work Origin: SW = Scheduled Work
WR = Work Request
TC = Trouble Call
RI = Routine Inspection

Formulation: A = Aerosol B = Bait
D = Dust E = Emulsion F = Fumigant
GL = Gel GR = Granules W = Wetable Pwdr.
L = Liquid S = Solution WG = Wetable Granule

APPENDIX F

Architectural Concept

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APPENDIX G

GIS Standards

Appendix
Spatial Data Standard for Facilities, Infrastructure and Environment (SDSFIE) Guide for GIS Deliverables Created as Part of Military Design and Construction Projects

Fort Leonard Wood, Missouri

Introduction

This Appendix provides guidance for implementing Engineering and Construction Bulletin (ECB) No. 2006-15, "Standardizing Computer Aided Design (CAD/CADD) and Geographic Information Systems (GIS) Deliverables for all Military Design and Construction Projects" (http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2006_15.pdf). This guidance establishes the requirements for geospatial data deliverables produced as part of design, design-build, or design-bid-build contracts for Fort Leonard Wood, Missouri. It includes description of the:

- Coordinate System and Datums;
- Data Quality Standard;
- Deliverables;
- SDSFIE-Compliant GIS Deliverable Specification; and
- Metadata.

Coordinate System and Datums

All geospatial deliverables (CADD or GIS format), whether obtained via survey or any other data collection process, shall be measured in meters. The coordinate system for all geospatial data will be UTM Zone 15. The vertical datum, if applicable, will be North American Vertical Datum 1988 (NAVD 88). The horizontal datum will be WGS84.

Precise specifications of the UTM Coordinate System, are as follows:

Grid Coordinate System Name: Universal Transverse Mercator

UTM Zone Number: 15

Transverse Mercator Projection

Scale Factor at Central Meridian: 0.999600

Longitude of Central Meridian: -93.000000

Latitude of Projection Origin: 0.000000

False Easting: 500000.000000

False Northing: 0.000000

Planar Coordinate Information

Planar Distance Units: meters

Coordinate Encoding Method: coordinate pair

Coordinate Representation

Abscissa Resolution: 0.000032

Ordinate Resolution: 0.000032

Geodetic Model

Horizontal Datum Name: D_WGS_1984

Ellipsoid Name: WGS_1984

Semi-major Axis: 6378137.000000

Denominator of Flattening Ratio: 298.257224

Data Quality Standard

As Built Survey

An as-built condition survey should be performed to capture the information listed in this Appendix. All relevant features shall be identified on as-built drawings and shall be GPS or conventional surveyed to the level of accuracy specified below.

Coordinate Accuracy

The Contractor shall use conventional surveying and other methods, such as a total station or GPS for field data collection at an accuracy level in accordance with “Geospatial Positioning Accuracy Standards, Part 4: Architecture, Engineering Construction, and Facilities Management. Published by the FGDC and available at http://www.fgdc.gov/standards/standards_publications/index_html.

Horizontal and vertical accuracy of features, where vertical coordinates are collected, shall be +/- 2cm.

Surveyor Certification Requirement

The surveyor shall verify the survey for accuracy and a statement will be provided to the government stating the level of accuracy for the data being reported (in metric units). In addition to the accuracy statement, the following information should be provided in a survey report:

- Coordinate system & datum used;
- Projection;

- Units of measure (vertical and horizontal);
- Attribute description (GPS data dictionary—features, attributes and attribute values);
- Source - Receiver type, antenna type, receiver settings, number of positions per point feature, correction method and any field other relevant field procedures utilized;
- Survey method;
- Equipment list;
- Calibration documentation;
- Description of control points and control diagrams;
- Field notes; and
- Field-collected data (in addition to the post-processed final data used to prepare the geospatial data deliverable).

Utilities

Underground and aboveground utility lines shall be surveyed at a minimum of two points along every straight run, at every change of direction, at every tie in point, and at any change in line size.

Deliverables

The intent of the deliverable set is to provide the Installation with comprehensive geospatial information about the facility footprint and site features that exist outside the building(s). The electronic deliverables must be in the file format and data standard used by the Installation's Operations and Maintenance System (as noted in "Coordinate System and Datums", above).

The Installation requires deliverables in the following software formats:

- GIS Files
    - ESRI geodatabase file.
    - The coordinate system, projection, datum(s) and units will be defined for the layer and will be documented in the metadata.
    - Where captured, vertical coordinate information will be stored as a feature attribute as meters above mean sea level. Polygon-z, polyline-z, and point-z formatted files are not requested.
- CADD Files
    - MicroStation DGN files in A/E/C CADD format, using the coordinate system, projection, datum, and units specified in the RFP.

100% Design (Design Complete)

Final design deliverables for each design package should consist of (A) the drawings and specifications, and (B) the GIS file(s):

- 100% complete drawings, specifications, calculations/design analysis, and a list of all comments and their resolution for that work package. All final design drawings will be in the A/E/C CADD Standard format, current version as agreed upon by the government and the contractor. The A/E/C CADD Standard is available at https://tsc.wes.army.mil/products/standards/aec/aecstdweb.asp. Metadata shall be delivered with each CADD file, and will meet the standard specified in this Appendix.
- A corresponding SDSFIE-compliant GIS deliverable for the feature layers listed in Table 1 of this Appendix. For each listed layer the contractor should provide either a GIS deliverable or a statement that no features in that layer will be constructed, be modified, or pose a design constraint for the project. The SDSFIE standard is available at http://www.sdsfie.org. Metadata shall be delivered with each GIS data layer and will meet the standard specified in this Appendix.

As-Built (Construction Complete)

Final construction deliverables shall consist of (A) the as built drawings and specifications, and (B) the GIS file(s). The contractor will provide a submittal of the CADD and GIS files that depict the as-built condition of the site. The data layers to be delivered, the coordinate accuracy of the features, the required attribution, and the metadata will meet the standards specified in this Appendix.

For each layer listed in Table 1, the contractor will provide either a GIS deliverable or a statement that no features in that layer were constructed or modified. The tie in to a utility main line is considered a modification of the utility main line, and the portions of main lines that were exposed should therefore be included in the deliverable.

SDSFIE-Compliant Deliverable Specification

Geodatabase Template

Upon request the government will provide the contractor with an SDSFIE-compliant GIS layer template to be used for populating the GIS deliverables required under the contract. The contractor shall populate the layers without modifying the template. The contractor shall ensure that layers to be delivered but not included in the template, should the template not be complete, are fully compliant with the current SDSFIE standard.

There may be circumstances in which SDSFIE compliance cannot be maintained. In such circumstances, proposed deviations with the standard must be communicated by the contractor and reviewed by the government. Approval for the deviation shall be documented.

Data Integrity Check

The contractor shall utilize a topology build and clean routine and assure the following:

- No erroneous overshoots, undershoots, dangles or intersections in the line work;
- Lines should all be continuous, i.e. do not create dashed lines with many small line segments;
- Point features should be digitized as points, not graticules, cells, symbols or icons;
- No sliver polygons;
- All polygons completely close and have a single unique centroid; and
- Digital representation of the common boundaries for all graphic features must be coincident, regardless of feature layer.

Required GIS Data Layers and Required Attributes

Table 1 lists the SDSFIE-compliant GIS data layers that are to be delivered as part of this contract. The list is based on a review of the type(s) of facility(s) being constructed. However, it is possible that some layers in the list will not be used.

Metadata

The contractor shall prepare metadata conforming to the most current version of the Federal Geospatial Data Committee's (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM) at http://www.fgdc.gov/standards/standards_publications. Appendix A of the ECB, http://www.wbdg.org/ccb/ARMYCOE/COEECB/ecb_2006_15.pdf, is the FGDC metadata profile for Army Installations and should be followed as closely as possible. An ESRI Metadata Stylesheet for Army Geospatial Data is posted at https://gis.hqda.pentagon.mil. Metadata content will accompany all electronic geospatial data submissions. This includes both CADD and GIS formats. A metadata file shall accompany, at minimum, each CADD data set and/or each GIS data set. Metadata should be prepared to FGDC standards and delivered in XML format readable by software applications that use the FGDC XML format standard (such as ESRI ArcMap 9.x).

Table 1. SDSFIE Layer Names and Required Attributes.

Note: Required attributes, where specified, are listed following the SDSFIE layer name. Elevation information, reported as meters above mean sea level, is required for layers where "coord_z" is listed as a required attribute.

airfield_light_point
airfield_surface_centerline
airfield_surface_edge_line
airfield_surface_marking_area
airfield_surface_marking_line
airfield_surface_site

> area_size (acres); area_u_d (area unit of measure, acres); perim (meters); perim_u_d (perimeter unit of measure, meters); coord_x (centroid, WGS84 UTM); coord_y (centroid, WGS84 UTM); paved_d (paved code, Yes/No); feat_name (airfield name)

athletic_court_area
athletic_field_area
athletic_miscellaneous_area
borrow_area
breakline
building_floor_area
building_room_area
building_space_area
canopy_pavilion_site
communications_amplifier_point
communications_antenna_site

> coord_X (WGS84 UTM), coord_y (WGS84 UTM), area_size(acres), area_u_d(area unit of measure), perim(perimeter dimension, meters), perim_u_d(perimeter unit of measure, meters)

communications_coaxial_line
communications_device_point
communications_equip_point
communications_fiberoptic_line
communications_handhole_point
communications_manhole_site
communications_pedestal_site
communications_splitter_point
communications_telephone_point
communications_terminator_point
communications_twisted_pair_line
communications_vault_site

Table 1. Continued

compressed_air_pipe_line
control_point
culvert_centerline
curb_line
digital_elevation_model_point
easement_right_of_way_area
electrical_cable_line
dispostn_d (disposition code, domain); instl_ty_d (installation type code, domain)
electrical_capacitor_point
electrical_ductbank_line
electrical_generator_point
electrical_junction_site
electrical_meter_point
electrical_motor_point
electrical_pedestal_point
electrical_regulator_point
electrical_substation_site
dispostn_d (disposition code, domain); sst_ty_d (type of service label, domain)
electrical_switch_point
electrical_transformer_bank_point
electrical_transformer_vault_point
elevation_contour_line
fence_line
fuel_fitting_point
fuel_flow_direction_arrow
fuel_hydrant_point
fuel_junction_site
fuel_line
fuel_meter_point
fuel_pump_booster_station_point
fuel_source_point
fuel_tank_site
gate_line
gate_point
hazardous_materiels_storage_area
hsb_cat_d (the general nature of hazardous waste, domain); area_size (acres); area_u_d(area unit of measure, acres); perim (perimeter dimension), perim_u_d (meters); coord_x (WGS84 UTM); coord_y (WGS84 UTM);

Table 1. Continued

hazardous_materiels_storage_location_site
heat_cool_anchor_point
heat_cool_flow_direction_arrow
heat_cool_junction_site
heat_cool_line
heat_cool_marker_point
heat_cool_meter_point
heat_cool_plant_area
heat_cool_pump_point
heat_cool_rectifier_point
heat_cool_regulator_point
heat_cool_valve_point
hospital_structure_site
industrial_waste_fitting_point
industrial_waste_flow_direction_arrow
industrial_waste_grit_chamber_point
industrial_waste_junction_point
industrial_waste_lagoon_area
industrial_waste_line
industrial_waste_meter_point
industrial_waste_neutralizer_point
industrial_waste_oil_water_separator_site
industrial_waste_tank_point
industrial_waste_treatment_plant_area
industrial_waste_valve_point
natural_gas_fitting_point
natural_gas_flow_direction_arrow
natural_gas_junction_point
natural_gas_light_point
natural_gas_line
natural_gas_marker_point
natural_gas_meter_point
natural_gas_rectifier_point
natural_gas_regulator_reducer_point
natural_gas_valve_point
pedestrian_sidewalk_centerline
pipeline_line
piprod_d (pipeline product code, domain); oper_nm (operator name, mixed case)

Table 1. Continued

radar_site
railroad_bridge_centerline
railroad_centerline
tot_len (total length of track, meters); length_u_d (length unit of measure, meters); feat_name (name of railroad, mixed case); cond_d (condition code, domain); traf_vol_d (traffic volume code, domain)
railroad_feature_point
railroad_station_site
railroad_yard_area
recreation_park_area
recreation_trail_centerline
regulated_aboveground_storage_tank_site
regulated_storage_tank_farm_area
regulated_underground_storage_tank_site
road_bridge_area
road_bridge_centerline
road_centerline
category_d; num_lanes; feat_len; length_u_d; feat_name; road_name; alt_name; rou1_typ_d; rou1_name; rou2_typ_d; rou2_name; rou3_typ_d; rou3_name
road_feature_point
road_guardrail_line
road_site
slab_area
solid_waste_compactor_point
solid_waste_dump_area
solid_waste_incinerator_point
solid_waste_landfill_area
solid_waste_material_recovery_facility_point
solid_waste_stockpile_area
solid_waste_transfer_station_point
spill_containment_feature_area
spill_containment_tank_point
spot_elevation_point
storm_culvert_site
storm_sewer_armor_point
storm_sewer_culvert_line
storm_sewer_downspout_point
storm_sewer_fitting_point

Table 1. Continued

storm_sewer_flood_area
storm_sewer_flow_direction_arrow
storm_sewer_headwall_line
storm_sewer_inlet_point
storm_sewer_junction_point
storm_sewer_line
storm_sewer_oil_water_seperator_site
storm_sewer_open_drainage_area
storm_sewer_open_drainage_line
storm_sewer_pump_point
storm_sewer_reservoir_point
structure_existing_site
structure_future_site
tower_site
tunnel_centerline
utility_electric_utility_site
utility_pole_guy_point
utility_pole_tower_point
utility_pole_tower_site
vehicle_parking_area
wastewater_discharge_point
wastewater_filtration_bed_area
wastewater_fitting_point
wastewater_flow_direction_arrow
wastewater_grease_trap_point
wastewater_grit_chamber_point
wastewater_junction_point
wastewater_lagoon_area
wastewater_line
wastewater_neutralizer_point
wastewater_oil_water_separator_site
wastewater_pump_ejector_station_site
wastewater_pump_point
wastewater_septic_tank_point
wastewater_treatment_plant_site
wastewater_valve_point
water_fire_connection_point
water_fitting_point

Table 1. Continued

water_hydrant_point
water_junction_point
water_line
water_marker_point
water_meter_point
water_pump_point
water_regulator_reducer_point
water_reservoir_area
water_tank_site
water_valve_point
water_vent_point

APPENDIX H

Exterior Signage

Exterior Signs must be approved through DPW.
POC: Kyong Rainbolt 573-596-0900

11.4 EXTERIOR SIGN STANDARD

Signs have a major effect on the appearance of Fort Leonard Wood and the professionalism or its units. The number of signs on the installation shall be held to the absolute minimum required for directions, identification, and customer service. This section establishes standards for standardizing sign material, color, style, types, and placement throughout the installation.

Standardized signage systems facilitate movement, provide a sense of orientation, and reinforce standards of excellence and visually communicate information. Signs are highly visible features that must be attractive and compatible with their surroundings. Careful consideration must be given to what a sign says, how it is said, its visual appearance and organization, its location, structural support system, and relation to other signs within the installation.

Signage creates a unifying element throughout FLW that visually ties the installation visual zones and themes together and builds a ~~reference and continuity that translates into~~ confidence and ~~reassurance when traveling throughout~~ the installation. The standards to apply for signage color, type, and sizing are found in Technical Manual (TM) 5-807-10, *Signage* (See Section 9, paragraph 9.6 Pavement Marking Standards.).

11.4.1 Sign System Characteristics

There are several basic design characteristics that, by serving to convey necessary information clearly and attractively, are an integral part of any successful signage system. These characteristics are:

Simplicity: Provide only needed information, avoid redundancy, and eliminate over-signing with resultant clutter and visual confusion. Sign messages must be clear, simple, and easy for individuals to process quickly.

Continuity: The system will be applied uniformly and consistently throughout the entire installation. The importance of consistent implementation extends from the larger issues of sign type and size down to accurate color continuity and matching typestyles.

Visibility: Signs will be located at significant decision points and oriented to provide clear sight lines for the intended user. Coordinate locations with respect to landscaping, utilities, adjacent signage, and various other street design elements to ensure long-term maximum visibility.

Legibility: Sign typestyle, line spacing, color, and size all combine to create the crucial design characteristics of legibility. Sign design will take into consideration users such as motorist, pedestrians, or bicyclists and the relative travel speed at which each type of user will be traveling when viewing the signs.

11.4.2 Vocabulary-Communications

A common language has been created for establishing a signing system. The different components that create the sign package have been named and referred to within the total signing system.

The creation of a "signage language" helps generate a unified bond within sign types that make up a signage family. This signage language may be considered in terms of the following:

- Information or Message
- Typography
- Presentation: height, shape, style, color, materials and graphics
- Architectural Influence: 3D qualities of the sign and the method of support such as a masonry base unit
- Graphic Architecture: the placement of the letters and artwork within the sign panel and their relationship to each other.

11.4.3 Types of Exterior Signs

There are six basic categories of exterior signs: Identification, Motivation, Guide, Mandatory/Prohibitory, Information, and Regulatory signs.

11.4.3.1 Identification Signs

There are four basic types of identification signs: Installation, Military Headquarters, Military Facility, and Community Facility Identification signs. These are signs that identify entrances to the installation, areas within the installation, major tenants, buildings, and organizational or functional components. They identify a location, and greet the visitor to that location. They should be compatible in scale and character with the architecture and also blend with the natural surroundings.

Wall mounted identification signs may be used instead of freestanding signs. Wall mounted signs eliminate visual clutter and minimize maintenance.

These signs are designed to include the following:

Typeface: Lettering is self-adhesive backing material.

- Building Title: Helvetica Medium, Upper and lower case
- Building Addresses: Helvetica Medium, Upper and lower case

Color:

- Panel: Dark Brown (Pantone 18-1027 TPX. See Supplemental Page L-4a)
- Lettering: White
- Post: Dark Brown
- Exposed panel backs and edges: Dark Brown
- All paint: Semi gloss

Materials

- Panel: Double-face 1/8" thick aluminum
- Post: Steel Pipe
- Foundation: Concrete pier or direct burial

See Technical Manual (TM) 5-807-10, *Signage*, for further sign specifications and for sign placement guidelines.

11.4.3.1.1 Installation Identification Signs

Installation identification signs name the installation and display the official US Army plaque. The designation "United States Army" must appear at the top of the sign in accordance with AR 420-70, para 2-7h. Every installation entrance shall have an installation identification sign displaying only the US Army plaque, with the words "United States Army, Fort (Name of Fort), and gate name as indicated in Figure 11.22, Installation Entrance Signs. The placement of Senior Mission Commander logo, unit crest, and other installation identification signs, monuments, or displays shall be located inside the installation beyond the cleared area of the Access Control Point (ACP) of entry. When used service-wide, these signs convey a uniform image of strength and

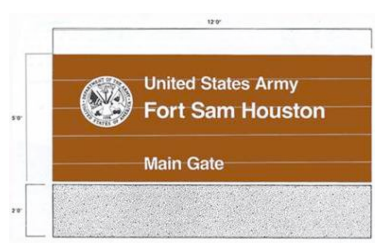


Fig. 11.22 – U.S. Army Standard Installation Entrance Sign

stability to the public. Emblems, branch colors, unit mottos, names, and titles of individuals are not to be displayed.

Installation identification signs consist of three types:

Sign Type A1 - Main Entrance Sign identifies the principal visitor entrance.

Sign Type A2 - Secondary Entrance Sign identifies entry points with relatively high volumes of visitor traffic.

Sign Type A3 - Limited Access Entry Gate Sign identifies entry points with limited public access.

See Technical Manual (TM) 5-807-10, *Signage*, paragraph 3-3, for sign specifications and paragraph 3-11 for sign placement guidelines.

11.4.3.1.2 Military Headquarters Identification Signs

Military head-quarters identification signs identify military activities and facilities and carry unit name information and street addresses
(Fig. 11.23).

Fig. 11.23 – Headquarters Identification Sign

Military headquarters identification signs consist of four types:

Sign Type B1 - Installation Headquarters Sign identifies the central administration of the installation.

Sign Type B2 - Command, Division, and Brigade Headquarters Sign

Sign Type B3 - Battalion Headquarters Sign

Sign Type B4 - Headquarters Building Entrance Sign identifies the building entrance for all levels of authority. In addition, Type B4 is used to identify a unit headquarters that has a special entry point other than the main entrance of a building.

Name plate attachments are prohibited. Insignias, emblems, branch colors, unit mottos, names, or titles of individuals will not be used on these signs.

Identify buildings with either a free-standing or building-mounted sign, but not both. Building mounted signs are preferred. Free-standing building identification signs should be kept to a minimum. A primary objective of the installation orientation system is to reduce the number of signs and to eliminate the visual clutter that results from the over use of signage. Locate signs only where they are needed to provide orientation. As a general rule, provide one sign for each building. An option to the standard building identification sign is the use of facility-mounted, individual letter-type signs affixed to the buildings. The size and location of these signs should be standardized throughout the installation, normally over the building main entrance. See Figure 11.24.

These signs are designed to include the following:

Typeface: The letter shall be mounted to the wall according to the manufacturers' specifications.

- Building Lettering Size: 2mm to 25mm (1/16" to 1") deep, Helvetica medium typeface.
- The depth separates them from the plane of the wall and gives them a crisp appearance, while the Helvetica medium typeface relates to other Army signs.

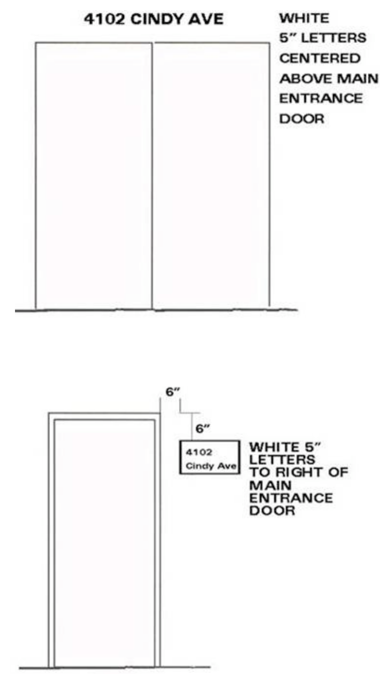


Fig. 11.24 - Street Address Location at Entrance Doors

Color:

- The color or finish of the letters should compliment the predominant color of the building while providing enough contrast with the background for visibility.
- Use a light-color or bright metallic finish for the lettering on dark buildings and a standard brown or dark bronze finish for the lettering on light colored buildings.

Materials:

- Several letter materials are available through sign manufacturers; however, rigid foam with aluminum facing is the preferred letter material.
- Letter material should be selected based on durability, architectural compatibility, and cost effectiveness.

11.4.3.1.3 Military Facility Identification Signs

Military facility identification signs are used to identify company level organizations and other military facilities not included in the installation identification or military headquarters sign types. Insignias, emblems, branch colors, unit mottos, names, or titles of individuals will not be used on these signs.

Military facility identification signs consist of seven types:

Sign Type C1 - Centralized Primary Facility Sign, identifies multiple service units in one or a complex of buildings. In addition, one service unit comprised of sub-services which are used by a large volume of military and civilian personnel may be identified by Type C1.

Sign Type C2 - Centralized Secondary Facility Sign, may be used where the volume of civilian traffic does not warrant the use of sign Type C1, such as military unit storage facilities.

Sign Type C3 - Primary Facility Sign, identifies a large scale facility serving a large volume of military and civilian personnel, but does not list individual services units or sub-services.

Sign Type C4 - Secondary facility Sign identifies company level organizations and individual service units.

Sign Type C5 - Primary Entrance Sign identifies the main entry points of a service facility.

Sign Type C6 - Secondary Entrance Sign, identifies the same information as Type C5, but is smaller in size.

Sign Type C7 - Restricted Facility Sign identifies the facility name or area which is restricted.

11.4.3.1.4 Community Facility Identification Signs

These identify activities and facilities used for non-military purposes. The standards for community signs also apply to signs for private firms operating on base. AAFES facilities and nationally recognized food chain franchises operated by AAFES may utilize their individual registered trademark signage in general compliance with these standards. These signs should be kept at a low profile and design and color should match the installation-wide system.

Community identification signs consist of seven types:

Sign Type D1 - Centralized Primary Facility Sign identifies several activities or organizations in one or a complex of buildings.

Sign Type D2 - Primary Facility with Changeable Message Board identifies an individual organization or facility and provides a changeable message board for information on activities.

Sign Type D3 - Primary Facility Sign identifies an organization.

Sign Type D4 - Secondary Facility Sign, identifies the same information as Type D3, but is smaller in size.

Sign Type D5 - Building Entrance Sign identifies the facility entrance and hours of operation.

Sign Type D6 - Recreation Facility Sign identifies an outdoor recreation or park facility and hours of operation.

Sign Type D7 - Bus Stop Sign identifies bus routes, stops, and schedules.

1

1.4.3.2 Motivation Signs

These signs are used to boost morale, improve safety, aid in recruiting, and accomplish other special objectives. Motivation signs are unique in appearance and do not have specified graphic layouts.

Motivation signs include three types:

Sign Type E1 - Installation Motivation Sign identifies the principle commends or divisions stationed at the installation.

Sign Type E2 - Standard Motivation Sign is used to support campaigns and special events.

Sign Type E3 - Unit Motivation Sign is used to express unit pride and display organizational insignias, emblems, and mottos.

11.4.3.3 Guide Signs

These signs are the essential means for locating destinations and routing travel to those destinations within a military installation. This includes site directory map signs at all entrance gates and other key points with the installation, large street name signs at all intersections, and large-lettered destination signs of not more than three lines. These signs provide the most efficient means of guiding traffic to destinations within the installation.

11.4.4.4 Mandatory/Prohibitory Signs

This category of signage is intended to maintain security and safety on the installation perimeter and at other specific secure areas. These signs notify visitors of restrictions, as well as other security procedures. The guidelines for design, fabrication, and placement of warming signs are found in Technical Manual (TM) 5-807-10, *Signage*, paragraph 3-9.

There are several types of installation warning signs as follows:

Sign Type G1 - Warning Sign is intended as a search and authorized personnel warning sign.

Sign Type G2 - Warning Sign is intended as a restricted area warning sign.

Sign Type G3 - Warning Sign, identifies general hazards, regulations and security information as Type G2, but is smaller in size.

Sign Type G4 - Safety Sign identifies specific dangers and warns personnel and visitors of physical hazards and unsafe practices.

Sign Type G5 and G6 - Parking Sign.
Handicapped parking signs should show the international handicapped symbol in white on the required blue background. Strictly limit reserved parking signs to visitors, customers, handicapped, key officials, and incentive award winners (NCO of the Quarter). Use metal signs approximately 4" high and mechanically fastened to the vertical curb face. Design and color should match the installation-wide system.

Sign Type G7 - Special Traffic Conditions Sign, such as tactical equipment limits and trail crossings, follow guidelines established in MTMC Pamphlet 55-14, *Traffic Engineering for Better Signs and Markings* and standards in the *Manual of Uniform Traffic Control Devices (MUTCD)*.

11.4.3.5 Information Signs

These are used to provide educational information and directional guidance for visitors. These signs is used to give priority to the destinations of facilities that are likely to have a great deal of first time traffic include the Commissary, Post Exchange, Clinic, Community Center, clubs, billeting, and major Army activities.

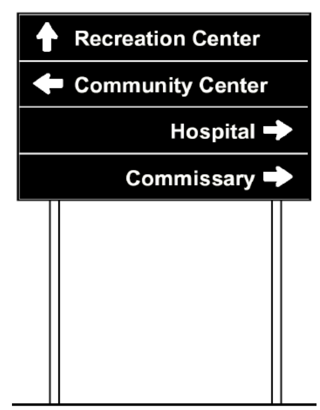


Fig. 11.25 – Guidance Signs Locate at Major Decision Points

These signs are designed to include the following:

Typeface: Lettering is self-adhesive backing material.

- Helvetica Medium, upper and lower case

Arrow:

- Place at the end indicating direction (Fig 11.25)
- Stoke width: Helvetica Medium cap

Color:

- Panel: Dark Brown (Pantone 18-1027 TPX. See Supplemental Page L-4a)
- Lettering: White
- Post: Black
- Exposed panel backs and edges: Dark Brown
- All paint: Semi gloss

Materials:

- Panel: Double-face, 1/8" thick aluminum
- Post: Black steel signposts are encouraged. Black vinyl sleeves for signpost and dark brown adhesive vinyl sheeting for the backs of signs provide a low-maintenance option.
- Foundation: Concrete pier or direct burial

There are two types of information signs:

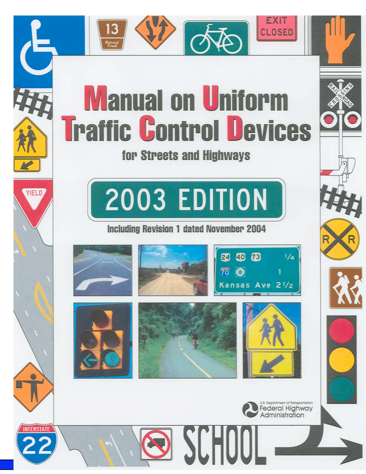
Sign Type H1 - Exhibit Information Sign.

Sign Type H2 - Guidance Sign provides direction guidance motorist or pedestrian in, around, and out of the installation. The legibility and placement of this sign, as well as the order of information, is critical to their effectiveness. These signs should be place in central locations and at major decision points along circulation routes.

Messages will be grouped in the following order according to their arrow direction: forward, left, and right. In addition, placement of the message on the sign panel is determined by the arrow direction. Destinations forward and left are listed first and have flush left messages. Destinations right are listed next and have flush right messages. The arrow is centered in the space between the message and the edge of the sign. Prioritize destinations to be listed by giving the highest priority to the destinations that are most often sought by people new to the garrison or that serve as highly visible landmarks on the garrison. Those who live or work on the garrison or who visit frequently do not need the degree of help required by a first time or infrequent visitor. These signs are designed to include the following:

11.4.3.6 Regulatory Signs

These signs provide the rules for travel and parking on the installation. They include highway signs, warning signs, parking



control signs, etc. Related to these signs are pavement markings and traffic signals. *Manual of Uniform Traffic Control Devices (MUTCD)* (Fig. 11.26) standardizes regulatory devices throughout the country to ensure that they mean the same to, and require the same action by, all motorists (Fig.11.27). Therefore, compliance with the MUTCD will contribute to the safe, orderly, and efficient movement of traffic. Also see MTMC Pamphlet 55-14, *Traffic Engineering for Better Signs and Markings*.

These signs are designed to include the following:

Typeface: Lettering is self-adhesive backing material.

- Helvetica Medium, upper and lower case

Color:

- Panel: Sign color, size and shape prescribed by the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)
- Post: Black
- Exposed panel backs and edges: Dark Brown

Material:

- Panel: Double-face, 1/8" thick aluminum
- Post: Steel breakaway pipe
- Foundation: Concrete pier or direct burial

Fig. 11.27 – MUTCD Regulatory Signs

11.4.4 Street Addresses

The addressing procedures prescribed in Department of Defense Manual (DODM) 4525.8-M, DoD Official Mail Manual are mandatory for use by all DoD components. DoD 4525.8-M, Chapter 3 prescribes the following:
All DoD addresses shall be assigned so they are compatible with the United States Postal Services automated delivery point sequencing (C3.3).

- The DoD installation is responsible for assigning city-style, street address on the installation (C3.3.2.2).
- Street addresses shall be assigned and used even though a DoD activity may deliver the mail to the addressee (C3.3.2.2.1).

- Only geographically locatable civilian-style street address (such as 4102 Cindy Avenue) shall be used (C3.3.2.2.4).
- Installations shall not use one street address for the entire installation and then use secondary unit designators such as "Building 123" to designate the delivery addresses on the installation (C3.3.2.2.5).
- Addresses such as "Building 123 Roberts Street" are not a valid address format and shall not be used (C3.3.2.2.6).

11.4.5 Address Placement Standards

- Place addresses by the front entrance of the building so they can be seen (C3.3.2.3.1).
- Place both the street name and address number on the building if both the building number and street address are visible from the street.
- Building identification signs will use street addresses.
- Buildings without identification signs shall have the address number and street name centered above the main entrance or located to the right side.

11.4.6 Circuit Running Trail Sign Standards

- Sign panel shall be fabricated of 1/8" thick aluminum or approved equal. All exposed surfaces of the sign panel including the reverse side and edges shall have a field or factory applied paint or enamel finish over primer.
- Signs shall be secured to posts with two 0.25 inch carriage bolts cut flush with the nut. Head of bolt shall be painted to match face of sign. Non-compatible metals shall be isolated by coating or gasket material so as to prevent galvanic action.
- Post shall be 3 x 3 wood or 3 inch diameter pipe or 3 inch tube. Post shall be treated to resist structural degeneration or corrosion. Finish on post may be either natural or white paint or factory applied white low sheen enamel.
- Post shall be set so that at least 60 centimeters (24 inches) of length is set firmly in earth. Type font shall be Helvetica Medium, 10 centimeters (4 inches) high, painted in white enamel on a colored panel.
- Unless otherwise directed, sign shall give distance in miles or quarter fractions thereof.

- Sign shall contain two lines of type. The upper line shall read "MILE". The lower line shall consist of a numeral/s indicating unit distance. Center each line on the sign panel.
  Example: MILE 3/4 MILE 3
- See Fig. 11.28 and Paragraph. 9.12.5 Recreational Running Trails for additional guidance.

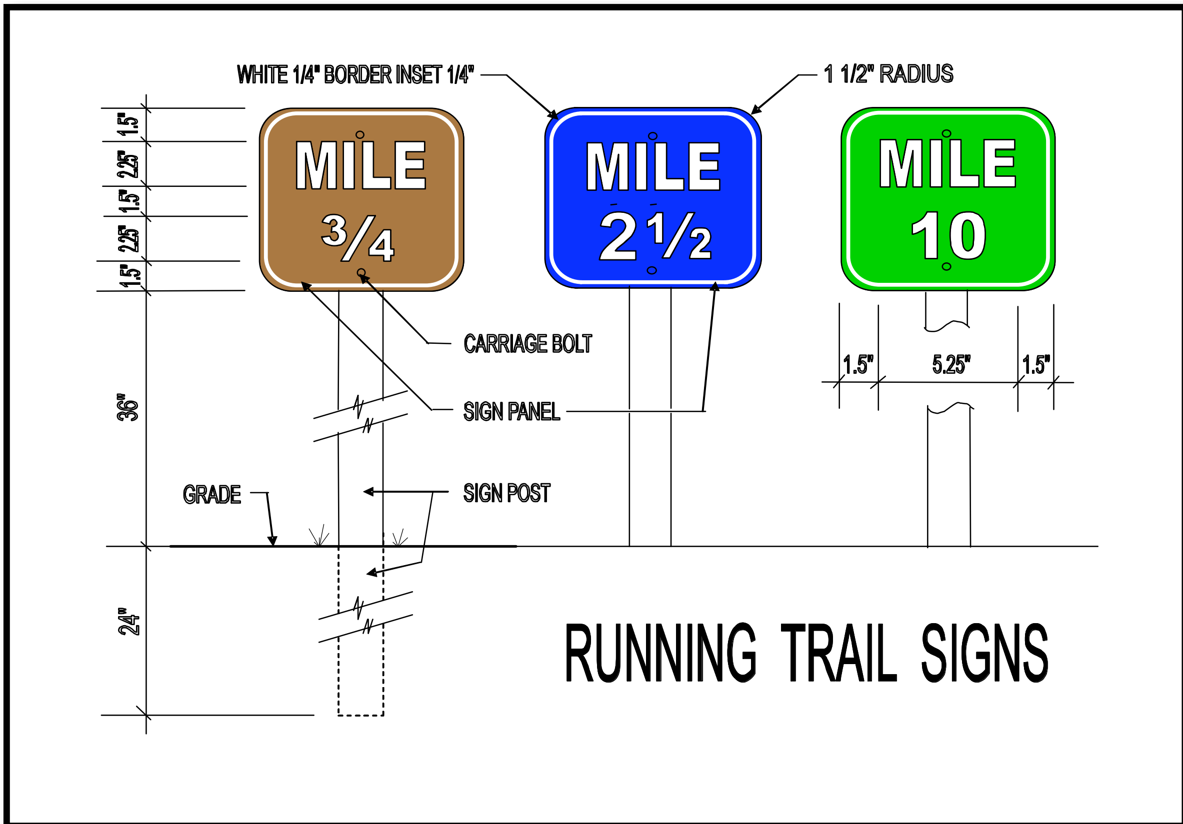


Fig. 11.28 - Signage for Circuit Running Trails Detail

11.4.7 Electronic Exterior Signs

All exterior flashing signs, traveling lights, or signs animated by lights of changing degrees of intensity or color are prohibited.

11.4.8 Housing Area Sign Standards

Street and address identification signs within housing areas should be complimentary to the architectural setting of the housing area and approved by the installation Real Property Planning Board. Housing numbers should be placed on the curb in front of the respective house and on the house where lighting will effectively light the numbering.

11.4.9 Street Sign Standards

Street name identification signs should be designed with the same lettering, color, and materials as other information signs (Fig. 11.29).

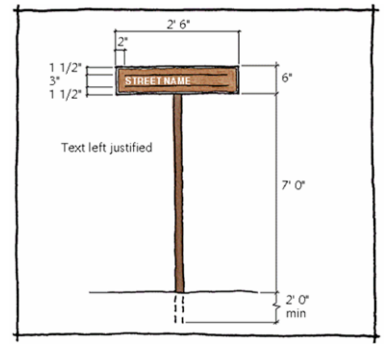


Fig. 11.29 - Typical Street Signs

11.4.10 Wheeled Electrical Signs

Wheeled electrical signs will have an attractive presentation. Temporary landscape elements should be used whenever possible. The siting of this type of sign will be approved by the RPPB. No sign of this type will be left in place for longer than six (6) months. After which time, the sign will be removed or turned into a permanent sign.

11.4.11 Sign Placement

Placement of signs differs according to the type of sign and the specific site constraints. The following guidelines apply to placement of the majority of signs.

- Do not place more than one sign at any location. Traffic rules are the exception to this rule.
- Place signs in areas free of visual clutter and landscape materials.
- Place signs in locations that allow enough time for the user to read and react to the message.
- Signs should not be placed to block sight lines at intersections.
- Place signs approximately 1.2 meters (4 feet) above ground level to be within 10 degrees the driver's line of vision (Fig 11-30). Provide proper placement to avoid a hazard to children.

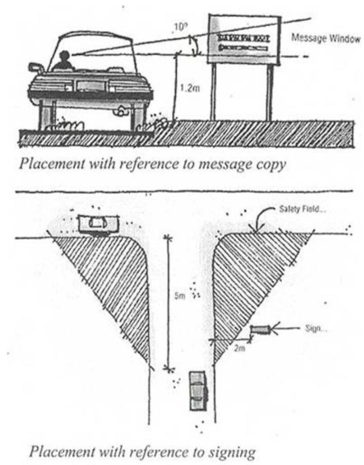


Fig. 11.30 - Placement Is Critical To Ensure Easy Readability

11.4.12 Sign System Typography

11.4.12.1 Military Emblems

The Army has a rich tradition of military heraldry. Military emblems are an important part of the soldiers' identity and the emblems have been carefully crafted over the years to express unit pride and unique history and function of the unit. The care and use of organizational emblems in a signage system can add visual interest as well as build pride and a sense of history. However, the overuse of miscellaneous emblems can lead to clutter and a dilution of their importance. Colors for military emblems must be in accordance with the Institute of Heraldry.

11.4.12.2 Department of the Army Plaque

The plaque should be displayed on installation identification signage to emphasize the heritage and professionalism of the United States Army. The design of the plaque must be in accordance with Army Regulation (AR) 840-1, *Department of the Army Seal, and Department of the Army Emblem and Branch of Service Plaques*, and must be reproduced in full color.

11.4.12.3 Insignias

The use of branch insignia, shoulder sleeve insignia, coat of arms, and/or distinctive insignia on headquarters signs is permitted. All military emblems must appear in full color. Motivational symbols or motifs will not be used.

11.4.13 Reduce Visual Clutter

Over-signing detracts form a uniform sign system and if left uncontrolled will eventually destroy the integrity of the system. (Fig. 11.31)

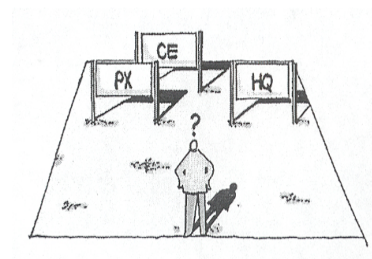


Fig. 11.31 - Visual Clutter Causes Confusion

Clutter creates confusion and ineffectiveness. Often motorist and pedestrians are confused by the bombardment of messages that have no relationship to each other, or the communication is on such a minimal level that the sign serves no purpose.

11.4.14 Location Maps

The location map is an integral element of an installation entrance. The location map display provides information and sense of place to the viewer. The design and construction should be of compatible architectural materials found throughout the installation (Fig. 11.32).

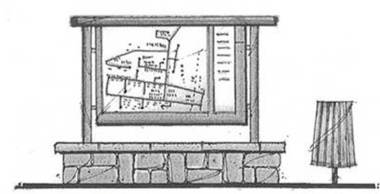


Fig. 11.32 - Location Maps Provide a Sense of Place

The location map will contain the following characteristics within the design.

- Plexiglas secured over map for protection against graffiti and the elements
- Architecturally compatible materials used for the base
- Paved walk-up area
- Litter receptacle

- Provide parking adjacent
- Provide current takeaway maps

9.6 PAVEMENT MARKING STANDARDS

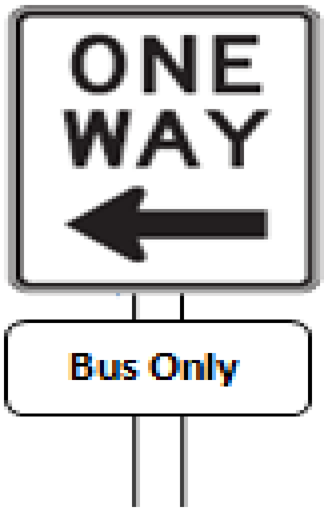
9.6.1 Pavement markings shall be as described in Part 3 of the Manual of Uniform Traffic Control Devices (MUTCD), also see Chapter 6, Site Elements, paragraph 6.4.4.3.4, for traffic related signage.

9.6.2 Concrete curbs and gutters shall not be painted. Markings shall be restricted to the pavement surface and marking paint shall not be applied to concrete curb, gutter, or any portion thereof including curb cuts for vehicle or wheelchair access.

9.6.3 Markings intended to prohibit parking shall be applied to the pavement surface parallel to the curb and gutter in a continuous band for the entirety of the restricted length of pavement.

9.6.4 Where appropriate a boxed area shall be created with diagonal lines to establish a no parking zone in street conditions such as curb side parking, etc.

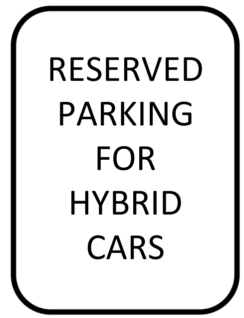
Exterior Signage Requirements for Exterior Parking/Direction Signs



18” W X 24

12” W X 18” H

12” W X 18” H



12” W X 18” H

12” W X 6” H

APPENDIX I

Acceptable Plant List

PLANT PALETTE

O.1 The visual image conveyed by a military installation is created by the architectural character site organization, and the landscape design. Section 10, *Landscape Design Standards* describes the required selection, placement, and maintenance of plant material at Fort Leonard Wood. Planted material includes trees, shrubs, bedding plants and ground covers such as grass for lawns. These plants collectively provide a simple and cost effective enhancement to the general appearance of the installation. Moreover plantings add an element of human scale to open spaces and can be used functionally to screen undesirable views, buffer winds, reinforce the hierarchy of the circulation system, or provide a visual transition between dissimilar land uses and enhance Force Protection measures. (See Fig. O.1 and Fig. O.2)

Fig. O.1 – Landscaping improves the overall visual quality of the installation

O.2 Plant selection and placement must be carefully considered for reasons of sustainabilitiy as discussed in Section 10 *Landscape Design Standards.*

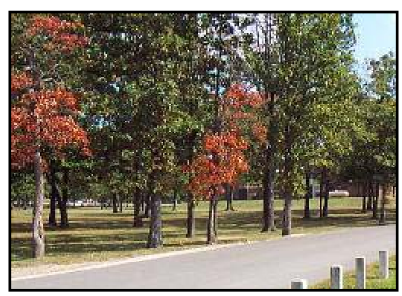


Fig. O.2 – Trees provide shade and visual interest including seasonal color.

O.3 A plant palette has been created to simplify this process of plant selection and placement. The plant slection list, which follow, have been created corresponding to each of the Visual Zones established in Section 5, *Visual Themes and Zones*. The Visual Zone Map and Table are included in this Appendix as Fig. O.3 and Table O-1.

Note: Print single sided only. Pages O-3 through O-93 will automatically print in landscape.

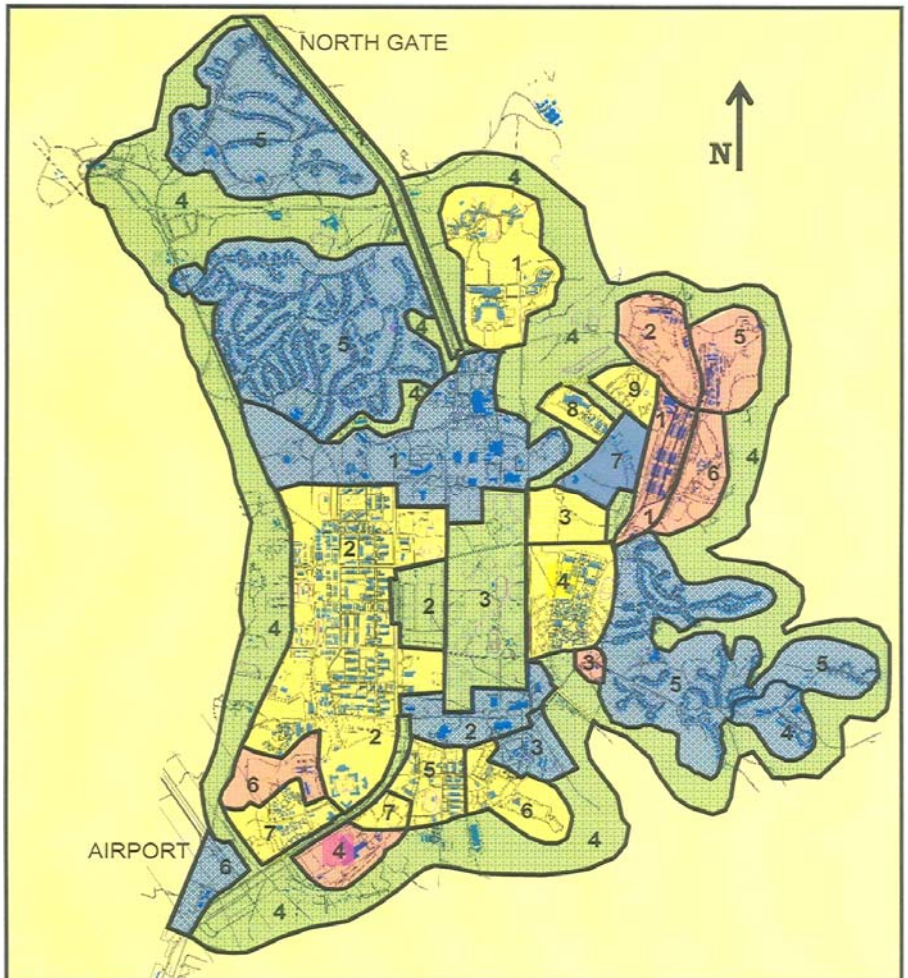


FIG. O-3 FORT LEONARD WOOD VISUAL ZONES MAP

TABLE O-1 VISUAL THEME AND ZONE RELATIONSHIP CHART

OPEN AREA THEME	**COMMUNITY LIFE THEME**	**MISSION THEME**	**INDUSTRIAL THEME**
Visual Zones	Visual Zones	Visual Zones	Visual Zones
1-Missouri Ave. Entry Corridor 2-Gammon Field 3-Outdoor Recreation 4-Natural Environment	1-Town Center 2-Community Activities Area 3- Preservation Area 4- Sturgis Heights 5-Family Housing 6-Airport Facilities 7-Tech Park	1-Maneuver Center 2-Initial Entry Training 3-Permanent Party Barracks 4-Specker Barracks 5-MP Troop Complex 6-US Army Reserve 7-Army Nat'l Guard 8-Battalion Reception 9- Special Training	1-Supply Facilities 2- Logistics 3-Water Treatment 4-TMP 5-Public Works 6-Vehicle Maintenance

PLANT SELECTION LIST Plant Material Suitability Matrix		Plant Type			Shape							Growth Rate			Flowering			Special Interest			Soil Conditions					Exposure			Tolerance			Functional Uses							
NATURAL ENVIRONMENT * Indicates poisonous	**Indicates thorned	Deciduous	Evergreen	Native	Conical	Columnar	Round/Oval	Weeping	Upright	Spreading	Irregular	Fast	Moderate	Slow	Spring	Summer	Fall	Foliage	Fruit	Fall Color	Moist	Average	Dry	Acidic	Alkaline	Sun	Part Shade	Full Shade	Pest Resistant	Drought Resistant	Pollution Tolerant	Specimen	Street Tree	Massing	Screen/Windbreak	Parking Lot	Park/Lawn	Barrier	
Botanical Name	**Common Name**	**Plant Characteristics**																			**Plant Culture**											**Landscape Use**							**Notes**
LARGE TREES																																							
Acer saccharum	Sugar Maple	▽		▽			▽							▽						▽		▽		▽			▽	▽				▽	▽	▽	▽		▽		Specify ‘Legacy’
Betula nigra	River Birch	▽		▽			▽						▽							▽	▽	▽		▽		▽	▽					▽			▽		▽		Specify ‘Heritage’, Soil pH 6.5 or less
Celtis laevigata	Sugar Hackberry	▽		▽			▽						▽							▽	▽			▽	▽	▽			▽	▽	▽		▽	▽	▽	▽	▽		Specify ‘All Seasons’ or ‘Magnifica’
Fraxinus americana	White Ash	▽		▽			▽						▽							▽	▽					▽							▽	▽		▽	▽		Specify ‘Autumn Applause’ or ‘Autumn Purple’
Fraxinus pennsylvanica	Green Ash	▽		▽							▽	▽								▽	▽	▽	▽	▽		▽				▽	▽		▽	▽	▽	▽	▽		Specify ‘Summit’ or ‘Marshall Seedless’
Ginkgo biloba*	Ginkgo (male)	▽									▽			▽				▽		▽	▽	▽		▽	▽	▽			▽	▽	▽	▽		▽	▽		▽		
Liquidambar styraciflua	American Sweetgum	▽		▽			▽					▽								▽	▽			▽		▽						▽		▽	▽		▽		
Liriodendron tulipifera	Tuliptree	▽		▽			▽					▽			▽					▽		▽		▽		▽						▽		▽	▽		▽		
Quercus palustris *	Pin Oak	▽		▽	▽							▽								▽	▽			▽		▽								▽	▽				Develops iron chlorosis in high pH soils
Quercus phellos *	Willow Oak	▽		▽			▽						▽							▽	▽	▽				▽	▽		▽			▽	▽	▽	▽	▽	▽		
Quercus rubra *	Northern Red Oak	▽		▽			▽					▽								▽		▽		▽		▽			▽			▽	▽	▽	▽	▽	▽		Develops iron chlorosis in high pH soils
Pinus ponderosa*	Ponderosa Pine		▽		▽								▽								▽	▽	▽		▽	▽				▽	▽			▽	▽		▽		
Pinus strobus	White Pine		▽	▽	▽							▽									▽	▽		▽		▽	▽							▽	▽		▽		Develops iron chlorosis in high pH soils
Taxodium distichum	Bald Cypress	▽		▽	▽								▽								▽	▽	▽	▽		▽				▽	▽	▽		▽	▽		▽		
MEDIUM TREES																																							

PLANT SELECTION LIST
Plant Material Suitability Matrix

NATURAL ENVIRONMENT

* Indicates poisonous **Indicates thorned

Botanical Name	Common Name	Plant Type			Shape							Growth Rate			Flowering			Special Interest			Soil Conditions					Exposure			Tolerance			Functional Uses							Notes
		Deciduous	Evergreen	Native	Conical	Columnar	Round/Oval	Weeping	Upright	Spreading	Irregular	Fast	Moderate	Slow	Spring	Summer	Fall	Foliage	Fruit	Fall Color	Moist	Average	Dry	Acidic	Alkaline	Sun	Part Shade	Full Shade	Pest Resistant	Drought Resistant	Pollution Tolerant	Specimen	Street Tree	Massing	Screen/Windbreak	Parking Lot	Park/Lawn	Barrier	
		Plant Characteristics																			Plant Culture											Landscape Use							
Acer platanoides	Norway Maple	▽				▽							▽		▽					▽	▽	▽	▽	▽	▽	▽				▽				▽	▽		▽		Specify 'Columnare' or 'Summershade'
Acer rubrum*	Red Maple	▽		▽			▽						▽		▽					▽	▽	▽		▽			▽					▽		▽	▽		▽		Specify 'Red Sunset', 'October Glory', or 'Armstrong'
Carpinus caroliniana	American Hornbeam	▽		▽							▽			▽						▽	▽	▽					▽	▽				▽		▽	▽	▽	▽		Smooth "beech-like" bark
Gleditsia triacanthos 'inermis' *	Thornless Honeylocust	▽		▽						▽		▽								▽	▽	▽				▽				▽	▽		▽	▽		▽	▽		Specify 'Moraine' or 'Shademaster'
Koelreuteria paniculata	Goldenrain Tree	▽					▽						▽			▽			▽	▽		▽	▽		▽	▽			▽	▽	▽	▽	▽	▽	▽	▽	▽		
Nyssa sylvatica	Black Gum (Tupelo)	▽		▽			▽							▽					▽		▽	▽		▽		▽	▽					▽		▽	▽		▽		Not wind tolerant, Needs soil pH 5.5 –6.5
Picea abies	Norway Spruce		▽		▽								▽									▽				▽	▽			▽				▽	▽		▽		
Pinus thunbergii	Japanese Black Pine		▽		▽								▽									▽				▽				▽				▽	▽				Short-lived, Salt tolerant
Quercus acutissima*	Sawtooth Oak	▽		▽			▽						▽		▽					▽		▽				▽	▽		▽					▽	▽		▽		Develops iron chlorosis in high pH soils
SMALL TREES																																							
Acer ginnala	Amur Maple	▽					▽						▽		▽				▽	▽		▽		▽	▽	▽	▽					▽		▽	▽		▽		Specify 'Flame' or 'Red Rhapsody'
Amelanchier laevis	Serviceberry	▽		▽			▽						▽		▽				▽	▽	▽	▽		▽		▽	▽					▽		▽	▽		▽		Also Amelanchier arborea
Cercis canadensis	Redbud	▽		▽						▽			▽		▽					▽		▽		▽	▽	▽	▽					▽		▽	▽		▽		'Forest Pansy' purple leaf form
Crataegus crus-galli inermis	Thornless Cockspur Hawthorn	▽		▽			▽							▽	▽				▽	▽		▽	▽	▽	▽	▽					▽	▽		▽	▽			▽	
Crataegus phaenopyrum**	Washington Hawthorn	▽		▽			▽							▽	▽				▽	▽		▽	▽	▽	▽	▽					▽	▽		▽	▽		▽	▽	Red berries, Thorns
Crataegus viridis 'Winter King'**	Winter King Hawthorn	▽		▽			▽							▽	▽				▽	▽		▽	▽	▽	▽	▽					▽	▽		▽	▽		▽	▽	Red berries, Thorns

PLANT SELECTION LIST
Plant Material Suitability Matrix

NATURAL ENVIRONMENT

* Indicates poisonous **Indicates thorned

Botanical Name	Common Name	Plant Type			Shape							Growth Rate			Flowering			Special Interest			Soil Conditions					Exposure			Tolerance			Functional Uses							Notes
		Plant Characteristics																			Plant Culture											Landscape Use							
		Deciduous	Evergreen	Native	Conical	Columnar	Round/Oval	Weeping	Upright	Spreading	Irregular	Fast	Moderate	Slow	Spring	Summer	Fall	Foliage	Fruit	Fall Color	Moist	Average	Dry	Acidic	Alkaline	Sun	Part Shade	Full Shade	Pest Resistant	Drought Resistant	Pollution Tolerant	Specimen	Street Tree	Massing	Screen/Windbreak	Parking Lot	Park/Lawn	Barrier	
Magnolia x virginiana	Sweet Bay Magnolia		▽	▽						▽			▽		▽			▽			▽	▽		▽		▽	▽	▽				▽							Semi-evergreen, tolerates wet sites
LARGE SHRUBS																																							
Aronia arbutifolia 'Brilliantisima'	Red Chokeberry	▽		▽					▽					▽	▽				▽	▽	▽	▽	▽			▽	▽							▽			▽		
Aronia melanocarpa	Black Chokeberry	▽		▽					▽					▽	▽				▽		▽	▽	▽			▽	▽							▽	▽		▽		'Autumn Magic', Iroquois Beauty', 'Viking'
Cornus sericea	Redosier Dogwood	▽		▽						▽		▽			▽				▽	▽	▽	▽				▽	▽	▽						▽	▽				Specify 'Cardinal', 'Baileyi', 'Coloradenis' or 'Cheyenne' for reddest bark color
Forsythia intermedia 'Compact'	Border Forsythia	▽							▽			▽			▽							▽		▽	▽	▽					▽			▽	▽		▽		Specify 'Karl Sax' or 'Spring Glory'
Hydrangea quercifolia*	Oakleaf Hydrangea	▽		▽					▽					▽		▽				▽		▽					▽		▽					▽			▽		Specify 'Snow Queen'
Ilex deciduas*	Possumhaw	▽		▽							▽		▽						▽			▽				▽	▽	▽						▽	▽				Needs male and female for fruiting effect
Rhus typhina	Staghorn Sumac	▽		▽						▽		▽							▽	▽		▽	▽			▽				▽				▽	▽				Specify 'Dissecta' or 'Laciniata'
Viburnum x burkwoodii	Burkwood Viburnum	▽		▽						▽			▽		▽				▽	▽		▽		▽		▽	▽							▽	▽		▽		
Viburnum x dentatum	Arrowwood Viburnum	▽		▽						▽			▽		▽				▽	▽		▽		▽		▽	▽			▽	▽			▽		▽			
Viburnum opulus	Cranberrybush Viburnum	▽		▽					▽				▽		▽				▽		▽	▽		▽	▽	▽	▽							▽	▽	▽	▽		Specify 'Compactum' for smaller shrub
MEDIUM SHRUBS																																							
Berberis thunbergii atropurpurea**	Japanese Red Barberry	▽					▽						▽		▽			▽	▽	▽		▽	▽			▽				▽	▽			▽	▽	▽	▽	▽	Specify 'Crimson Pygmy' 'Rose Glow'
Rhus aromatica	Fragrant Sumac	▽		▽							▽			▽					▽	▽		▽		▽		▽	▽							▽					Specify 'Green Globe'

PLANT SELECTION LIST
Plant Material Suitability Matrix

NATURAL ENVIRONMENT

* Indicates poisonous **Indicates thorned

Botanical Name	Common Name	Plant Type			Shape							Growth Rate			Flowering			Special Interest			Soil Conditions					Exposure			Tolerance			Functional Uses							Notes
		Deciduous	Evergreen	Native	Conical	Columnar	Round/Oval	Weeping	Upright	Spreading	Irregular	Fast	Moderate	Slow	Spring	Summer	Fall	Foliage	Fruit	Fall Color	Moist	Average	Dry	Acidic	Alkaline	Sun	Part Shade	Full Shade	Pest Resistant	Drought Resistant	Pollution Tolerant	Specimen	Street Tree	Massing	Screen/Windbreak	Parking Lot	Park/Lawn	Barrier	
		Plant Characteristics																			Plant Culture											Landscape Use							Notes
Ilex glabra 'Compacta'*	Compact Inkberry Holly		▽	▽			▽							▽	▽				▽		▽					▽	▽	▽						▽	▽	▽	▽		Avoid high pH soils
Pinus mugo var. mugo	Mugo Pine		▽							▽				▽								▽			▽	▽	▽							▽	▽		▽		Tolerates calcareous soils
SMALL SHRUBS																																							
Juniperus procumbens	Japgarden Juniper		▽							▽				▽				▽				▽	▽	▽	▽	▽				▽	▽			▽		▽	▽		Specify ‘Nana’ or ‘Greenmound’
Rhus arommatica ‘Gro-low’	Gro-low Sumac	▽		▽							▽			▽	▽				▽	▽		▽		▽		▽	▽							▽			▽		
GROUND COVERS																																							
Coronilla varia	Crown Vetch	▽								▽			▽			▽					▽	▽				▽								▽		▽	▽		Low maintenance bank cover
Hemerocallis spp.	Daylilies	▽								▽			▽			▽						▽				▽	▽												
Lonica japonica ‘halliana’	Hall’s Honeysuckle	▽								▽		▽				▽			▽			▽				▽	▽							▽		▽			
GRASSES																																							
Schizachyrium scoparium	Little Blue Stem	▽		▽					▽				▽		▽		▽		▽		▽					▽								▽			▽		
Festuca elatior ‘Jaguar’*	Jaguar Turftype Tall Fesue	▽								▽			▽						▽		▽					▽											▽		
Andropogon gerardii	Big Bluestem	▽		▽					▽				▽		▽		▽		▽		▽					▽				▽				▽			▽		
Sporobolus heterolepis	Prairie Dropseed	▽		▽			▽						▽		▽		▽		▽		▽					▽								▽		▽	▽		
Sorgnastrum nutans ‘Sioux Blue’	Sioux Blue Indian Grass	▽		▽					▽				▽		▽		▽		▽		▽					▽				▽		▽		▽			▽		Specify ‘Sioux Blue’ for blue foliage

APPENDIX J

Drawings

US Army Corps
of Engineers
Kansas City
District

BASIC COMBAT TRAINING COMPLEX III-SOUTH
BCT III-SOUTH, PHASE I, B/COF CONTRACT

PN 51857, FY 2012
FORT LEONARD WOOD, MISSOURI

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Conceptual Draft RFP
June 2010

SHEET INDEX:

Sheet Number	Description	Revision
GENERAL		
G-001	COVER SHEET	*
G-002	SHEET INDEX - CIVIL LEGEND, ABBREVIATIONS, AND GENERAL NOTES	*
G-003	LOCATION AND VICINITY MAP	*
CIVIL		
CD101	SITE DEMOLITION PLAN	*
CS101	SITE IMPROVEMENT PLAN	*
CG101	SITE GRADING PLAN	*
CU101	SITE UTILITY PLAN	*

CIVIL LEGEND:

- EXISTING COMMUNICATION JUNCTION BOX
- EXISTING FIRE HYDRANT
- EXISTING GUY WIRE
- EXISTING LIGHT POLE
- EXISTING POWER POLE
- EXISTING SANITARY SEWER MANHOLE
- EXISTING STORM INLET
- STORM INLET/JUNCTION BOX
- SANITARY SEWER MANHOLE
- ELECTRIC TRANSFORMER
- ELECTRIC HANDHOLE/MANHOLE
- LIGHT POLE
- PROPOSED BUILDING (IN CONTRACT SCOPE)
- PROPOSED BUILDING (UNDER SEPERATE CONTRACT)
- FUTIRE PHASE BUILDING
- SIDEWALK

Line	Description
SSx — SSx	EXISTING SANITARY SEWER
Wx — Wx	EXISTING WATER MAIN
CUx — CUx	EXISTING COMMUNICATIONS DUCT BANK
Ex — Ex	EXISTING OVERHEAD ELECTRIC LINE
EUx — EUx	EXISTING UNDERGROUND ELECTRIC DUCT BANK
SS — SS	SANITARY SEWER MAIN & SERVICE LINE
— — — —	PERFORATED STORM PIPE
SD — SD	STORM DRAIN PIPE
W — W	DOMESTIC WATER MAIN & SERVICE LINE
F — F	FIRE SERVICE LINE
G — G	GAS MAIN
CU — CU	COMMUNICATIONS DUCT BANK
EU — EU	ELECTRIC DUCT BANK

US Army Corps of Engineers
Kansas City District

Date: JUNE 2010
Drawing Code: F-141-83-01
Project no. 51857
CADD File Name: FLW_BCOF_G-002
Designed by: K. DOYLE
Chkd. by: DER
Drawn by: BEC
Submitted by: C. ROPE
Plot scale: NO SCALE

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KANSAS CITY, MISSOURI

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FORT LEONARD WOOD, MISSOURI
BCT III-SOUTH, PHASE 1, BCOF CONTRACT
PN 51857

SHEET INDEX - CIVIL LEGEND, ABBREVIATIONS, AND GENERAL NOTES

Sheet reference number:
G-002

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DATE OF ISSUE JUNE 2010

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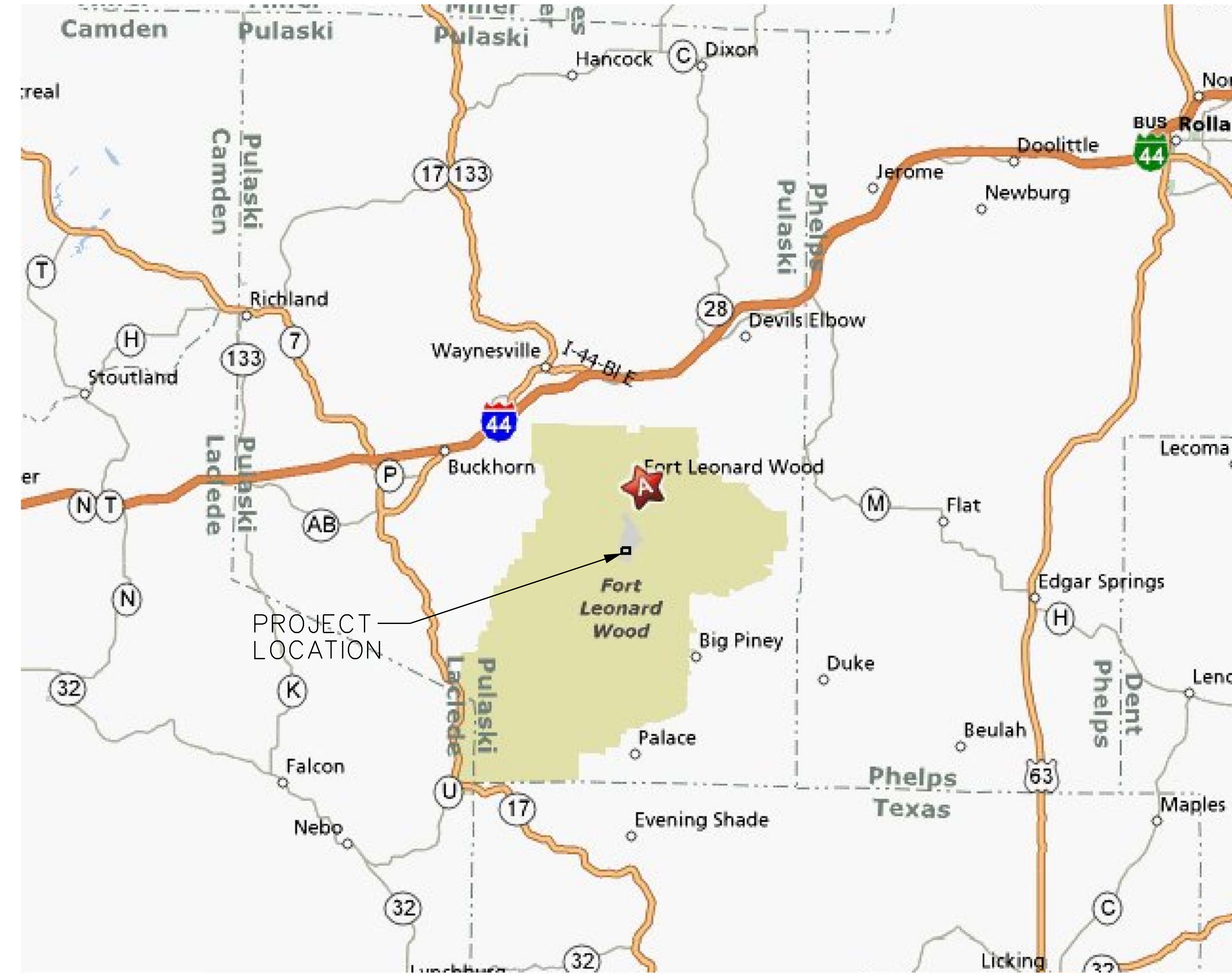
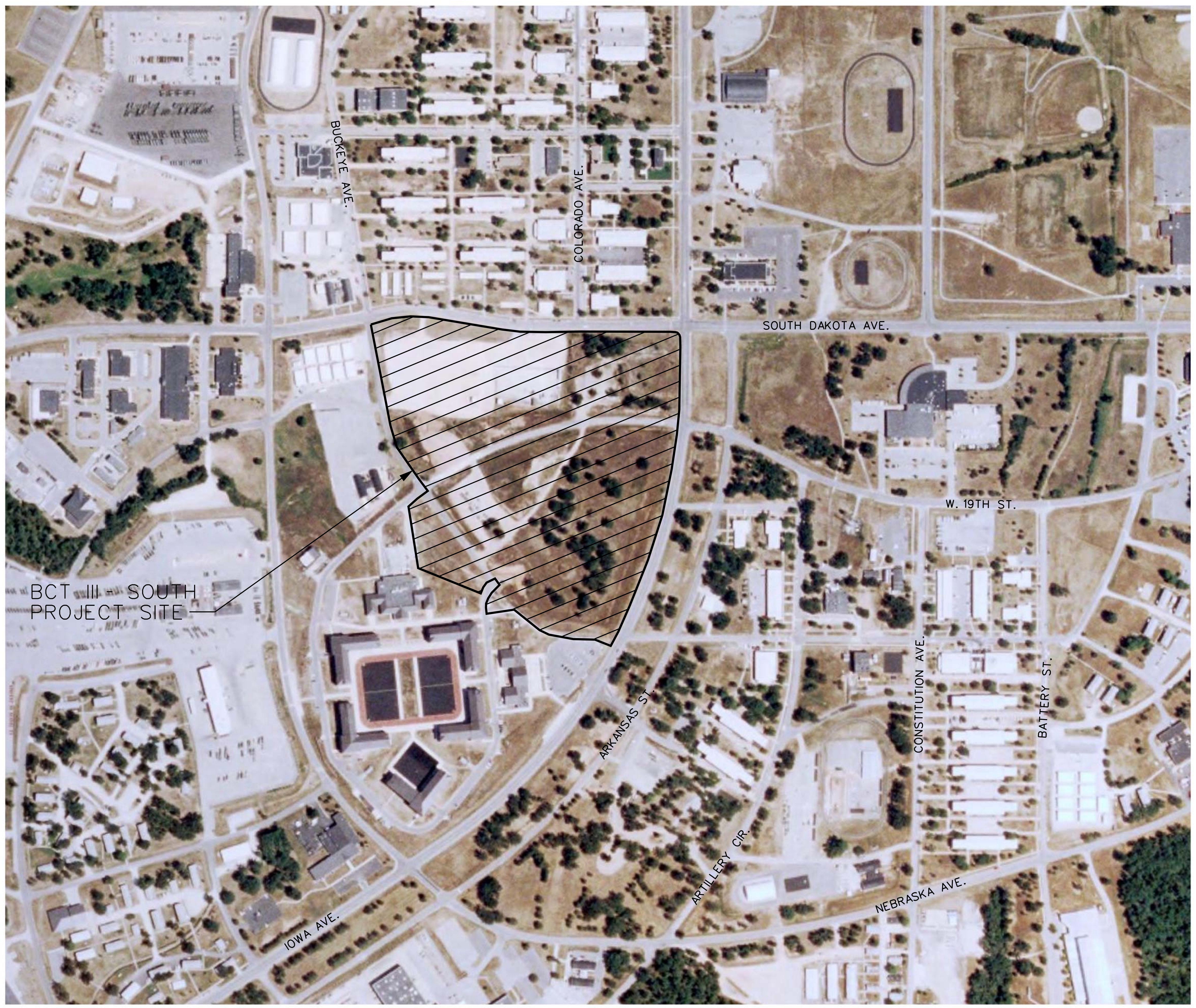


VICINITY MAP
N.T.S.

N



PROJECT LOCATION MAP
N.T.S.

N

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CONCEPTUAL
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DATE OF ISSUE JUNE 2010

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Kansas City District

Symbol

Date: JUNE 2010
Drawing Code: F-141-83-01
Project no. 51857
CADD File Name: FLW_BCOF_G-003
Designed by: K. DOYLE
Chkd. by: DER
Drawn by: BEC
Submitted by: C. ROPE
Plot scale: NO SCALE

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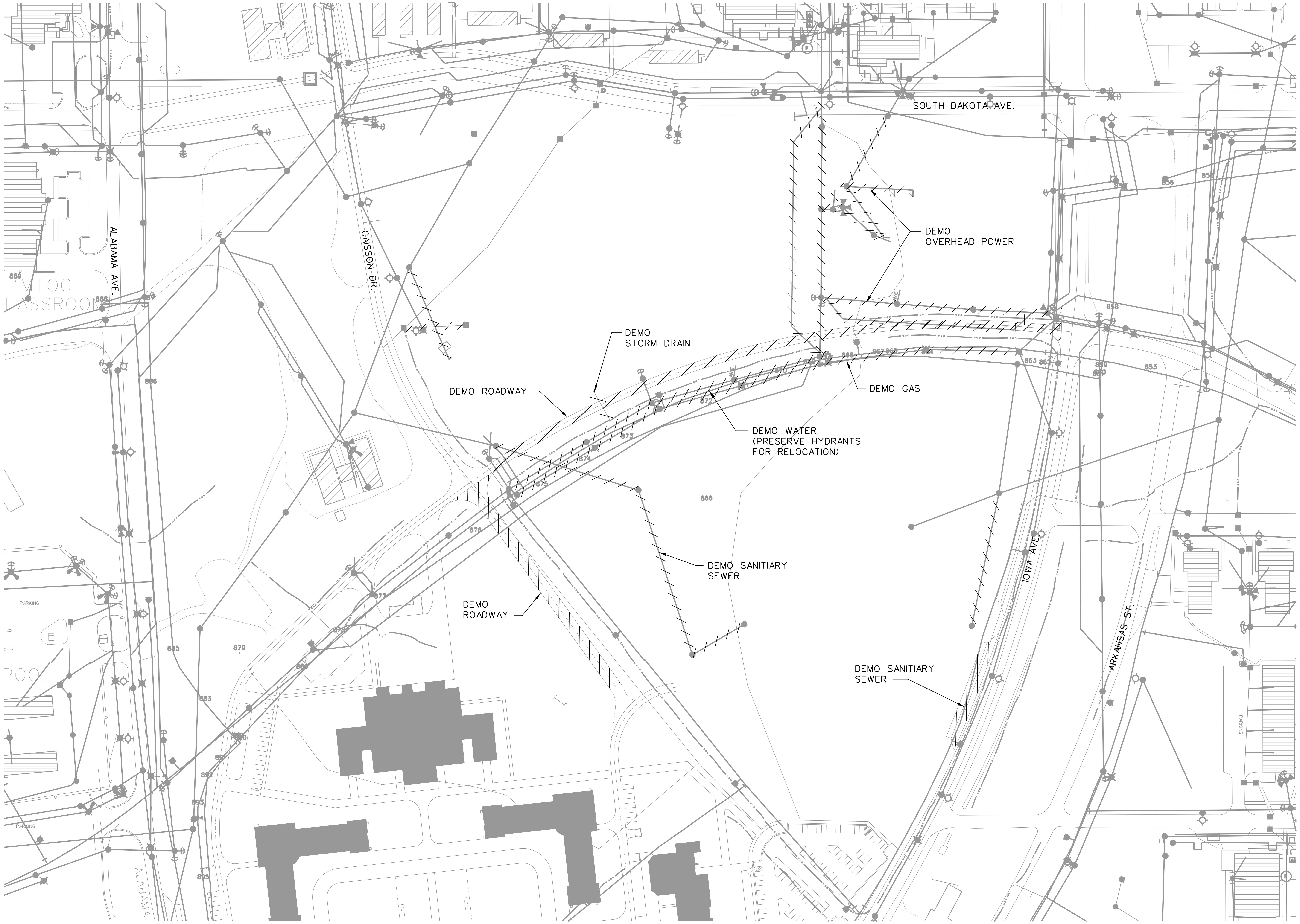
PN 51857

GENERAL
LOCATION AND VICINITY MAP

Sheet reference number:
G-003



NOTES:

1. FOR DRAWING INDEX, LEGEND, ABBREVIATIONS, AND GENERAL NOTES, SEE SHEET G-002.

N

100' 50' 0 100'

SCALE: 1" = 100'

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DATE OF ISSUE JUNE 2010

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Kansas City District

Symbol

Designed by: K. DOYLE	Date: JUNE 2010
Drawn by: BEC / Chkd. by: DER	Drawing Code: F-141-83-01
Submitted by: C. ROPE	Project no. 51857
Plot scale: 1" = 100'	CADD File Name: FLW_BCOF_CD101

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BCT III-SOUTH, PHASE 1, BCOF CONTRACT
PN 51857

CIVIL
SITE DEMOLITION PLAN

Sheet reference number:
CD101

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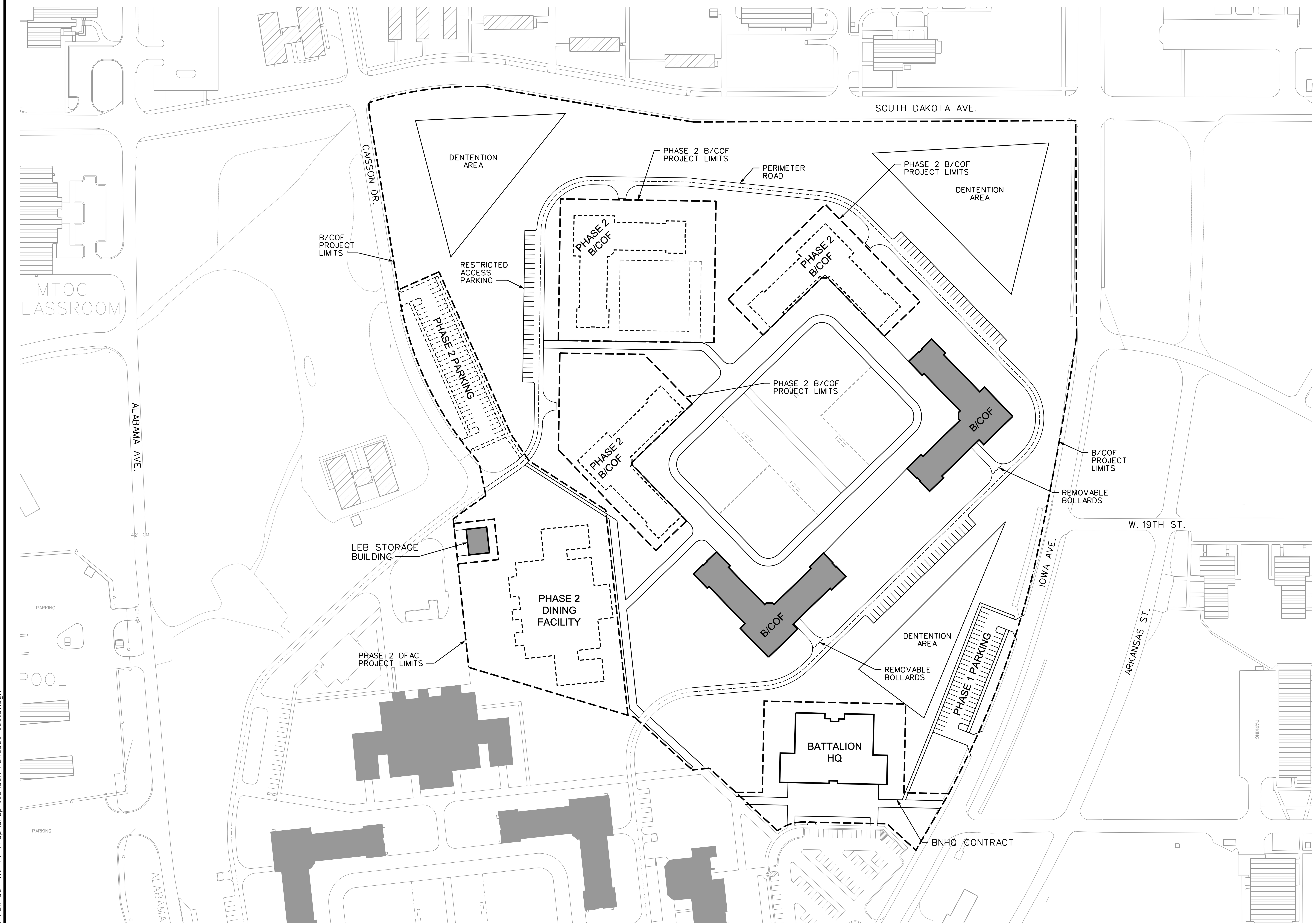
NOTES:

1. FOR DRAWING INDEX, LEGEND, ABBREVIATIONS, AND GENERAL NOTES, SEE SHEET G-002.



FOR REVIEW ONLY

CONCEPTUAL

NOT TO BE USED FOR CONSTRUCTION

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Symbol

Designed by: K. DOYLE	Date: JUNE 2010		
Drawn by: BEC	Chkd. by: DER	Drawing Code: F-141-83-01	
Submitted by: C. ROPE		Project no. 51857	
Plot scale: 1" = 100'		CADD File Name: FLW_BCOF_CS101	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

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FORT LEONARD WOOD, MISSOURI
BCT III-SOUTH, PHASE 1, BCOF CONTRACT
PN 51857

CIVIL
SITE IMPROVEMENT PLAN

Sheet reference number:
CS101

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NOTES:

1. FOR DRAWING INDEX, LEGEND, ABBREVIATIONS, AND GENERAL NOTES, SEE SHEET G-002.

US Army Corps of Engineers
Kansas City District

N

100' 50' 0 100'

SCALE: 1" = 100'

FOR REVIEW ONLY

CONCEPTUAL

NOT TO BE USED FOR CONSTRUCTION

DATE OF ISSUE JUNE 2010

Symbol

Designed by: K. DOYLE		Date: JUNE 2010
Drawn by: BEC	Chkd. by: DER	Drawing Code: F-141-83-01
Submitted by: C. ROPE		Project no. 51857
Plot scale: 1" = 100'		CADD File Name: FLW_BCOF_CG101

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PN 51857

CIVIL
ROUGH GRADING PLAN

Sheet reference number:

CG101

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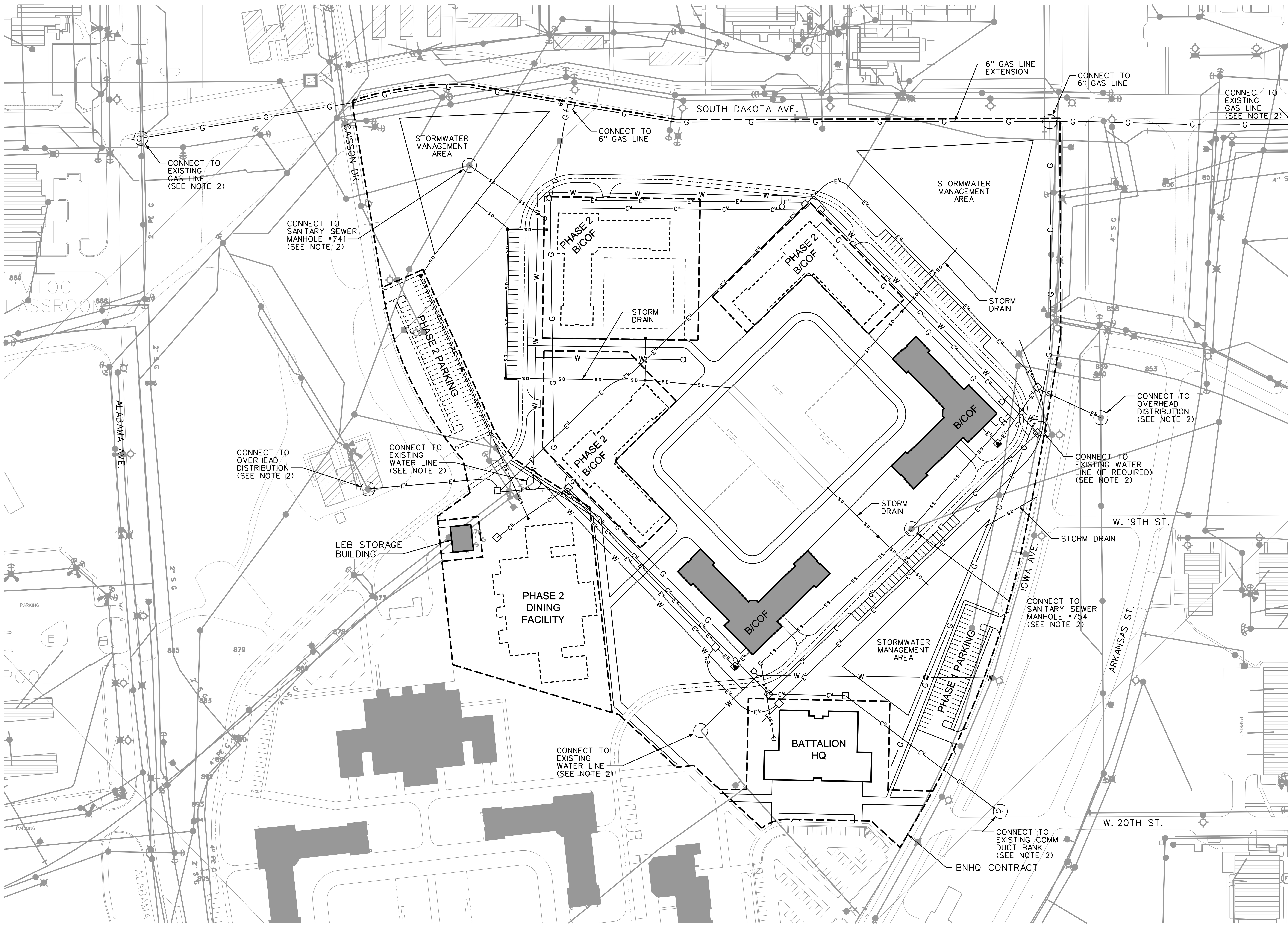
NOTES:

1. FOR DRAWING INDEX, LEGEND, ABBREVIATIONS, AND GENERAL NOTES, SEE SHEET G-002.
2. SITE IMPROVEMENTS AND UTILITY CONNECTIONS ARE SHOWN FOR REFERENCE ONLY. THE ACTUAL DESIGN IS THE RESPONSIBILITY OF THE CONTRACTOR. CONNECTION POINTS SHALL BE COORDINATED WITH THE UTILITY PROVIDER AND B/COF CONTRACTOR.
3. TRENCHING IS NOT PERMITTED ON IOWA AVENUE.



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CONCEPTUAL

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US Army Corps of Engineers
Kansas City District

Designed by: K. DOYLE	Date: JUNE 2010
Drawn by: BEC	Chkd. by: DER
Drawing Code: F-141-83-01	
Submitted by: C. ROPE	Project no. 51857
Plot scale: 1" = 100'	CADD File Name: FLW_BCOF_CU101

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PN 51857

CIVIL
SITE UTILITY PLAN

Sheet reference number:
CU101

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APPENDIX K
Utility Cost Information

The following utility rates for this installation are provided for the purpose of performing life cycle cost calculations in response to this solicitation and for design development in accordance with Section 01 33 16 Design After Award:

Utility "A" Rate		
Electric	0.0574	per kwh
LP Gas	1.8405	per gal
Water	0.9618	per Kgal
Sewer	1.1516	per Kgal
Trash	4.1929	per CuYd
Fuel Oil	2.8688	per gal
Natural Gas	12.4418	per mmbtu (Dth)

APPENDIX L

LEED Project Credit Guidance

LEED Project Checklist

APPENDIX L

LEED Project Credit Guidance (MAY 10)

This spreadsheet indicates Army required credits, Army preferred credits, project-specific ranking of individual point preferences, assumptions guidance for individual credits, and references to related language in the RFP for individual credits.

LEED Credit Paragraph **PAR**	**LEED Project Credit Guidance** **FEATURE**	**Army Guidance:** Required - Preferred - Avoid	**Project Preference Ranking**: (1=most preferred, blank=no preference, X=preference not applicable to this credit, Rqd=required)	**REMARKS**
SUSTAINABLE SITES				
SSPR1	Construction Activity Pollution Prevention (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
SS1	Site Selection		X	See paragraph LEED CREDITS COORDINATION.

SS2	Development Density & Community Connectivity - OPTION 1 DENSITY		X	See paragraph LEED CREDITS COORDINATION.
	Development Density & Community Connectivity - OPTION 2 CONNECTIVITY		X	See paragraph LEED CREDITS COORDINATION.
SS3	Brownfield Redevelopment		X	See paragraph LEED CREDITS COORDINATION.
SS4.1	Alternative Transportation: Public Transportation Access		X	See paragraph LEED CREDITS COORDINATION.
SS4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	Pref		Assume that non-transient building occupants are NOT housed on Post unless indicated otherwise.
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 1			Requires provision of vehicles, which cannot be purchased with construction funds. Assume Government will not provide vehicles unless indicated otherwise. Assume that 50% of GOV fleet is NOT alternative fuel vehicles unless indicated otherwise.
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 2	Pref		
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 3			Requires provision of vehicle refueling stations. Installation must support type of fuel and commit to maintaining/supporting refueling stations.
SS4.4	Alternative Transportation: Parking Capacity	Pref		

SS5.1	Site Development: Protect or Restore Habitat			
SS5.2	Site Development: Maximize Open Space	Pref		Assume AGMBC option for aggregated open space at another location on the installation is not available to the project unless indicated otherwise.
SS6.1	Stormwater Design: Quantity Control	Pref		See paragraph STORMWATER MANAGEMENT.
SS6.2	Stormwater Design: Quality Control	Pref		See paragraph STORMWATER MANAGEMENT.
SS7.1	Heat Island Effect: Non-Roof			
SS7.2	Heat Island Effect: Roof	Pref		Coordinate with nearby airfield requirements, which may preclude this credit.
SS8	Light Pollution Reduction	Pref		
WATER EFFICIENCY				
WEPR1	Water Use Reduction (Version 3 only)	Rqd	Rqd	All LEED prerequisites are required to be met.
WE1.1	Water Efficient Landscaping: Reduce by 50%	Pref		See paragraph IRRIGATION. Project must include landscaping to be eligible for this credit.
WE1.2	Water Efficient Landscaping: No Potable Water Use or No Irrigation	Pref		Project must include landscaping to be eligible for this credit.
WE2	Innovative Wastewater Technologies - OPTION 1			
WE2	Innovative Wastewater Technologies - OPTION 2			
WE3	Water Use Reduction	Pref		See paragraph BUILDING WATER USE REDUCTION.

ENERGY AND ATMOSPHERE				
EAPR1	Fundamental Commissioning of the Building Energy Systems (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
EAPR2	Minimum Energy Performance (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
EAPR3	Fundamental Refrigerant Management (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
EA1	Optimize Energy Performance	Rqd	1	Earning of LEED EA1 points as indicated in paragraph ENERGY CONSERVATION, as a minimum, is required.
EA2.1	On-Site Renewable Energy	Pref		See paragraph ENERGY CONSERVATION.
EA3	Enhanced Commissioning	Rqd		See paragraph COMMISSIONING. The Commissioning Authority may be provided through the Design-Build Contractor only if in accordance with USGBC Credit Interpretation Ruling (CIR) dated 9/15/06. Commissioning Authority activities begin during design phase and continue well beyond beneficial occupancy. Assume Government will not provide CxA post-occupancy activities unless indicated otherwise.
EA4	Enhanced Refrigerant Management			
EA5	Measurement & Verification			Assume Government will not provide post-occupancy activities unless indicated otherwise.
EA6	Green Power		X	See paragraph LEED CREDITS COORDINATION.

MATERIALS AND RESOURCES				
MRPR1	Storage & Collection of Recyclables (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met. Coordinate with Installation during design development on collection service and receptacles.
MR1	Building Reuse			
MR2.1	Construction Waste Management: Divert 50% From Disposal	Pref		See paragraph CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.
MR2.2	Construction Waste Management: Divert 75% From Disposal	Pref		
MR3	Materials Reuse			
MR4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	Pref		See paragraph RECYCLED CONTENT.
MR4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	Pref		
MR5.1	Regional Materials:10% Extracted, Processed & Manufactured Regionally			
MR5.2	Regional Materials:20% Extracted, Processed & Manufactured Regionally			

MR6	Rapidly Renewable Materials	Pref		See paragraph BIOBASED AND ENVIRONMENTALLY PREFERABLE MATERIALS and paragraph FEDERAL BIOBASED PRODUCTS PREFERRED PROCUREMENT PROGRAM.
MR7	Certified Wood	Pref		See paragraph BIOBASED AND ENVIRONMENTALLY PREFERABLE MATERIALS.
INDOOR ENVIRONMENTAL QUALITY				
EQPR1	Minimum IAQ Performance (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met.
EQPR2	Environmental Tobacco Smoke (ETS) Control (PREREQUISITE)	Rqd	Rqd	All LEED prerequisites are required to be met. Assume all buildings are smoke free unless indicated otherwise (family housing, barracks and other lodging are facility types where smoking may be permitted in some cases).
EQ1	Outdoor Air Delivery Monitoring			
EQ2	Increased Ventilation			
EQ3.1	Construction IAQ Management Plan: During Construction	Pref		See paragraph CONSTRUCTION IAQ MANAGEMENT.
EQ3.2	Construction IAQ Management Plan: Before Occupancy	Pref		See paragraph CONSTRUCTION IAQ MANAGEMENT.
EQ4.1	Low Emitting Materials: Adhesives & Sealants	Pref		See paragraph LOW-EMITTING MATERIALS.
EQ4.2	Low Emitting Materials: Paints & Coatings	Pref		See paragraph LOW-EMITTING MATERIALS.
EQ4.3	Low Emitting Materials: Carpet/Flooring Systems	Pref		See paragraph LOW-EMITTING MATERIALS.

EQ4.4	Low Emitting Materials: Composite Wood & Agrifiber Products	Pref		See paragraph LOW-EMITTING MATERIALS.
EQ5	Indoor Chemical & Pollutant Source Control	Pref		System requiring weekly cleaning to earn this credit is not a permitted option unless indicated otherwise.
EQ6.1	Controllability of Systems: Lighting			
EQ6.2	Controllability of Systems: Thermal Comfort			
EQ7.1	Thermal Comfort: Design	Rqd		See paragraph HEATING, VENTILATING AND AIR CONDITIONING.
EQ7.2	Thermal Comfort: Verification			Project must earn credit EQ7.1 to be eligible for this credit. Assume Government will not provide post-occupancy activities unless indicated otherwise.
EQ8.1	Daylight & Views: Daylight 75% of Spaces	Pref		See paragraph DAYLIGHTING.
EQ8.2	Daylight & Views: Views for 90% of Spaces	Pref		
INNOVATION & DESIGN PROCESS				
IDc1.1	Innovation in Design			See paragraph INNOVATION AND DESIGN CREDITS. Assume Government will not provide any activities associated with ID credits.
IDc1.2	Innovation in Design			
IDc1.3	Innovation in Design			
IDc1.4	Innovation in Design			
IDc2	LEED Accredited Professional	Rqd	Rqd	LEED AP during design and construction is required.
REGIONAL PRIORITY CREDITS (Version 3 only)				See paragraph LEED CREDITS COORDINATION.

LEED 2009 for New Construction and Major Renovation

Project Checklist

Fort Leonard Wood BCT III South, Phase 1

Dec. 2009

Sustainable Sites — Possible Points: 26

Y	N	?			Points
8	10	6		**Sustainable Sites**	26
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
		5	Credit 2	Development Density and Community Connectivity	5
	1		Credit 3	Brownfield Redevelopment	1
	6		Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
1			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
	2		Credit 4.4	Alternative Transportation—Parking Capacity	2
	1		Credit 5.1	Site Development—Protect or Restore Habitat	1
1			Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
1			Credit 6.2	Stormwater Design—Quality Control	1
1			Credit 7.1	Heat Island Effect—Non-roof	1
		1	Credit 7.2	Heat Island Effect—Roof	1
1			Credit 8	Light Pollution Reduction	1

Water Efficiency — Possible Points: 10

Y	N	?			Points
7		3		**Water Efficiency**	10
Y			Prereq 1	Water Use Reduction—20% Reduction	
4			Credit 1	Water Efficient Landscaping	2 to 4
		2	Credit 2	Innovative Wastewater Technologies	2
3		1	Credit 3	Water Use Reduction	2 to 4

Energy and Atmosphere — Possible Points: 35

Y	N	?			Points
18	9	3		**Energy and Atmosphere**	35
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
11		3	Credit 1	Optimize Energy Performance	1 to 19
	7		Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
2			Credit 4	Enhanced Refrigerant Management	2
3			Credit 5	Measurement and Verification	3
	2		Credit 6	Green Power	2

Materials and Resources — Possible Points: 14

Y	N	?			Points
3	7	4		**Materials and Resources**	14
Y			Prereq 1	Storage and Collection of Recyclables	
	3		Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
	1		Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
1		1	Credit 2	Construction Waste Management	1 to 2
	2		Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	N	?			Points
1		1	Credit 4	Recycled Content	1 to 2
1		1	Credit 5	Regional Materials	1 to 2
	1		Credit 6	Rapidly Renewable Materials	1
		1	Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 15

Y	N	?			Points
11	3	1		**Indoor Environmental Quality**	15
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
		1	Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
1			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
1			Credit 5	Indoor Chemical and Pollutant Source Control	1
1			Credit 6.1	Controllability of Systems—Lighting	1
	1		Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7.1	Thermal Comfort—Design	1
1			Credit 7.2	Thermal Comfort—Verification	1
	1		Credit 8.1	Daylight and Views—Daylight	1
	1		Credit 8.2	Daylight and Views—Views	1

Innovation and Design Process — Possible Points: 6

Y	N	?			Points
1	5			**Innovation and Design Process**	6
	1		Credit 1.1	Innovation in Design: Specific Title	1
	1		Credit 1.2	Innovation in Design: Specific Title	1
	1		Credit 1.3	Innovation in Design: Specific Title	1
	1		Credit 1.4	Innovation in Design: Specific Title	1
	1		Credit 1.5	Innovation in Design: Specific Title	1
1			Credit 2	LEED Accredited Professional	1

Regional Priority Credits — Possible Points: 4

Y	N	?			Points
4				**Regional Priority Credits**	4
1			Credit 1.1	Regional Priority: SS 1	1
1			Credit 1.2	Regional Priority: SS 6.2	1
1			Credit 1.3	Regional Priority: MR 2	1
1			Credit 1.4	Regional Priority: MR 5	1

Total — Possible Points: 110

Y	N	?		Points
52	34	17	**Total**	110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80

Appendix M

Owner's Project Requirements Document for LEED Fundamental Commissioning

Project: Army Standard Design, Basic Training Complex

Approved:

Name	Owner's Representative	Date
Name	Design Agent's Representative	Date

Overview and Instructions

The purpose of this document is to provide clear and concise documentation of the Owner's goals, expectations and requirements for commissioned systems, and shall be utilized throughout the project delivery and commissioning process to provide an informed baseline and focus for design development and for validating systems' energy and environmental performance.

The Owner's Project Requirements Document is a required document for LEED-NC EA Prerequisite Fundamental Commissioning of the Building Energy Systems. It shall be completed by the Corps District/Design Agent based on coordination with the Installation/User/Proponent and shall be approved by the Installation/User/Proponent representative.

The intent of the Owner's Project Requirements Document is to detail the functional requirements of a project and the expectations of the building's use and operation as it relates to commissioned systems. This template contains the basic recommended components indicated in the LEED Reference Guide. It should be adapted as needed to suit the project, remaining reflective of the LEED intent.

The Owner's Project Requirements Document should ideally be completed before the start of design and furnished to the design team. It must be completed prior to the approval of Contractor submittals of any commissioned equipment or systems to meet LEED requirements.

Updates to the Owner's Project Requirements Document throughout the course of project delivery shall be made by the Corps District/Design Agent based on decisions and agreements coordinated with and agreed to by the Installation/User/Proponent.

The Owner's Project Requirements Document shall be included in the project's LEED documentation file under EA PR1, Fundamental Commissioning of the Building Energy Systems.

Owner's Project Requirements Document for LEED Fundamental Commissioning

Table of Contents

1. *Owner and User Requirements*

What is the primary purpose, program and use of this project? (example: office building with data center)

Describe pertinent project history. (example: standard design development)

Broad Goals

What are the broad goals relative to program needs?

What are the broad goals relative to future expansion?

What are the broad goals relative to flexibility?

What are the broad goals relative to quality of materials?

What are the broad goals relative to construction costs?

What are the broad goals relative to operational costs?

Other broad goals: *(Insert as applicable)*

2. *Environmental and Sustainability Goals*

What are the project goals relative to sustainability and environmental issues? (example: LEED Silver rating)

What are the project goals relative to energy efficiency? (example: Meet EPACT)

What are the project goals and requirements for building siting that will impact energy use?

What are the project goals and requirements for building facade that will impact energy use?

What are the project goals and requirements for building fenestration that will impact energy use?

What are the project goals and requirements for building envelope that will impact energy use?

What are the project goals and requirements for building roof that will impact energy use?

Other: *(Insert as applicable)*

3. Indoor Environmental Quality Requirements

What is the intended use for all spaces? For all spaces that have an intended use that is not readily apparent from the space name, provide this information in Table 1.

____
____
____

What is the anticipated occupancy schedule (numbers of occupants and time frames) for all occupied spaces? Indicate the default occupancy schedule below and for all spaces that have an occupancy schedule that differs from the default, provide this information in Table 1.

____
____
____

What accommodations for after-hours use are required? (example: access control, lighting controls, HVAC controls) Indicate general accommodations required below and for all spaces that have special requirements, provide this information in Table 1.

____
____
____

What are the lighting, temperature, humidity, air quality, ventilation and filtration requirements for all spaces? Indicate the default requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1.

Lighting: ____
Temperature: ____

Humidity: ____
Air Quality: ____

Ventilation: ____

Filtration: ____

What are the acoustical requirements for all spaces? Indicate the default acoustical requirements below and for all spaces that have a requirement that differs from the default, provide this information in Table 1.

____
____
____

What is the desired level of occupant ability to adjust systems controls? Indicate the default desired levels below and for all spaces that have a desired level that differs from the default, provide this information in Table 1.

Lighting: ____

Temperature: ______________________________

Humidity: ______________________________

Air Quality: ______________________________

Ventilation: ______________________________

What, if any, specific types of lighting are desired? (example: fluorescent in 2x2 grid, accent lighting, particular lamps)

____

____

____

4. Equipment and System Expectations

(Complete for each category as applicable or indicate "none identified" or "N/A". Add desired features information for other anticipated commissioned systems as applicable)

Indicate desired features for the following commissioned system: Space Heating

Desired Type: ______________________________

Quality: ______________________________

Preferred Manufacturer: ______________________________

Reliability: ______________________________

Automation: ______________________________

Flexibility: ______________________________

Maintenance Requirements: ______________________________

Efficiency Target: ______________________________

Desired Technologies: ______________________________

Indicate desired features for the following commissioned system: Ventilation

Desired Type: ______________________________

Quality: ______________________________

Preferred Manufacturer: ______________________________

Reliability: ______________________________

Automation: ______________________________

Flexibility: ______________________________

Maintenance Requirements: ______________________________

Efficiency Target: ______________________________

Desired Technologies: ______________________________

Indicate desired features for the following commissioned system: Air Conditioning

Desired Type: ____

Quality: ____

Preferred Manufacturer: ____
Reliability: ____
Automation: ____

Flexibility:____
Maintenance Requirements: ____
Efficiency Target: ____

Desired Technologies: ____

Indicate desired features for the following commissioned system: Refrigeration

Desired Type: ____

Quality: ____

Preferred Manufacturer: ____
Reliability: ____
Automation: ____

Flexibility:____
Maintenance Requirements: ____
Efficiency Target: ____

Desired Technologies:

Indicate desired features for the following commissioned system: HVAC Controls

Desired Type: ____

Quality: ____

Preferred Manufacturer: ____
Reliability: ____
Automation: ____

Flexibility:____
Maintenance Requirements: ____
Efficiency Target: ____

Desired Technologies: ____

Indicate desired features for the following commissioned system: Domestic Hot Water

Desired Type: ____

Quality: ____

Preferred Manufacturer: ____
Reliability: ____
Automation: ____

Flexibility:____
Maintenance Requirements: ________________________________
Efficiency Target: _____________________________________

Desired Technologies: __________________________________

Indicate desired features for the following commissioned system: Lighting Controls

Desired Type: _______________________________________

Quality: ____

Preferred Manufacturer: _________________________________
Reliability: ____
Automation: _______________________________________

Flexibility:____
Maintenance Requirements: ________________________________
Efficiency Target: _____________________________________

Desired Technologies: __________________________________

Indicate desired features for the following commissioned system: Daylighting Controls

Desired Type: _______________________________________

Quality: ____

Preferred Manufacturer: _________________________________
Reliability: ____
Automation: _______________________________________

Flexibility:____
Maintenance Requirements: ________________________________
Efficiency Target: _____________________________________

Desired Technologies: __________________________________

Indicate desired features for the following commissioned system: Emergency Power

Desired Type: _______________________________________

Quality: ____

Preferred Manufacturer: _________________________________
Reliability: ____
Automation: _______________________________________

Flexibility:____
Maintenance Requirements: ________________________________
Efficiency Target: _____________________________________

Desired Technologies: __________________________________

Indicate desired features for the following commissioned system: Other - ____________________

Desired Type: ____

Quality: ____

Preferred Manufacturer: ____
Reliability: ____
Automation: ____

Flexibility:____
Maintenance Requirements: ____
Efficiency Target: ____

Desired Technologies: ____

5. Building Occupant and O&M Personnel Requirements

How will the facility be operated? Who will operate the facility?

____
____
____

Will the facility be connected to an EMCS? If so, what are the interface requirements? (example: monitoring points, control points, scheduling)

____
____
____

What is the desired level of training and orientation for building occupants to understand and use the building systems?

____
____
____

What is the desired level of training and orientation for O&M staff to understand and maintain the building systems?

____
____
____

Table 1

Space	Use / Activity	Num of Occs	Special Occupancy Schedule	After Hours Use Reqmt.	Special Cooling Reqmt.	Special Heating Reqmt.	Special Humidity Reqmt.	Special Ventil./Filtration Reqmt.	Special Acoustic Reqmt.	Special Lighting Reqmt.	Special Occup Adjustability Reqmt.

APPENDIX N

LEED Requirements for Multiple Contractor Combined Projects

LEED Credit Paragraph	LEED 3.0 Multiple Contractor Responsibilities Table	Building CTR Substitution Permitted	Site CTR Substitution Permitted	**Required Points Strategy**	
BUILDING: Basic Training (BT) BARRACKS					
PAR	**FEATURE**				**REMARKS**
CATEGORY 1 – SUSTAINABLE SITES					
SSPR1	Construction Activity Pollution Prevention (PREREQUISITE)	NIC	NO	R	Building D/B Ctr is primary permittee
SS1	Site Selection	NIC	NO	1	Reference Section 01 10 00, par. 6.14.5 LEED Credits Coordination.
SS2	Development Density & Community Connectivity	NIC	NO		Not Targeted
SS3	Brownfield Redevelopment	NIC	NO		Not Targeted
SS4.1	Alternative Transportation: Public Transportation Access	NIC	NO		
SS4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	NO	NO	1	D/B CTR responsible.
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 1	NIC	YES		Not Targeted
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 2	NIC	YES		Not Targeted
SS4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles - OPTION 3	NO	NO		Not Targeted
SS4.4	Alternative Transportation: Parking Capacity	NO	NO	2	Site CTR responsible.
SS5.1	Site Development: Protect or Restore Habitat	NIC	YES	1	Site CTR responsible.
SS5.2	Site Development: Maximize Open Space	NIC	YES	1	Site CTR responsible.
SS6.1	Stormwater Design: Quantity Control	NIC	YES	1	Site CTR responsible.
SS6.2	Stormwater Design: Quality Control	NIC	YES		
SS7.1	Heat Island Effect: Non-Roof	NIC	YES	1	Building CTR responsible.
SS7.2	Heat Island Effect: Roof	YES	NIC	1	Building CTR responsible.
SS8	Light Pollution Reduction	NO	NO	1	Combined Bldg/Site credit. Building CTR responsible for building lighting rqmts. Site CTR responsible for site lighting rqmts.
CATEGORY 2 – WATER EFFICIENCY					
WEPR1	Water Use Reduction: Reduce by 20% (PREREQUISITE)	NO	NO	R	
WE1.1	Water Efficient Landscaping: Reduce by 50%	NIC	YES	2	Site CTR responsible.

LEED Credit Paragraph	LEED 3.0 Multiple Contractor Responsibilities Table	Building CTR Substitution Permitted	Site CTR Substitution Permitted	**Required Points Strategy**	
BUILDING: Basic Training (BT) BARRACKS					
PAR	**FEATURE**				**REMARKS**
WE1.2	Water Efficient Landscaping: No Potable Water Use or No Irrigation	NIC	YES	2	Site CTR responsible.
WE2	Innovative Wastewater Technologies - OPTION 1	NO	NO		Not Targeted
WE2	Innovative Wastewater Technologies - OPTION 2	NIC	YES		Not Targeted
WE3.1	Water Use Reduction: 30% Reduction	YES	NIC	2	Building CTR responsible.
WE3.2	Water Use Reduction: 35-40% Reduction	YES	NIC		
CATEGORY 3 – ENERGY AND ATMOSPHERE					
EAPR1	Fundamental Commissioning of the Building Energy Systems (PREREQUISITE)	NO	NO	R	Building CTR responsible for commissioning of building systems. D/B CTR responsible for commissioning of site systems.
EAPR2	Minimum Energy Performance (PREREQUISITE)	NO	NIC	R	Building CTR responsible.
EAPR3	Fundamental Refrigerant Management (PREREQUISITE)	NO	NIC	R	Building CTR responsible.
EA1	Optimize Energy Performance	YES	NIC	10	Building CTR responsible. Must comply with EPACT 2005 minimum energy performance.
EA2	On-Site Renewable Energy	YES	NO		Not Targeted
EA3	Enhanced Commissioning	NO	NO	2	Building CTR responsible.
EA4	Enhanced Refrigerant Management	YES	NIC		Building CTR responsible. Evaluate during design
EA5	Measurement & Verification	YES	NIC	3	Achievable
EA6	Green Power	NO	NIC		Not Targeted
CATEGORY 4 – MATERIALS AND RESOURCES					
MRPR1	Storage & Collection of Recyclables (PREREQUISITE)	NIC	NO	R	Combined Bldg/Site credit. Building CTR provides collection area in Building. Site CTR provides enlarged dumpster area(s) to accommodate recycling receptacles as well as dumpsters.
MR1.1	Building Reuse- Structure: Maintain Existing Walls, Floors & Roof	YES	NO		Not Targeted
MR1.2	Building Reuse- Interior: Maintain 50% of Non-Structural Elements	YES	No		Not Targeted

LEED Credit Paragraph	LEED 3.0 Multiple Contractor Responsibilities Table	Building CTR Substitution Permitted	Site CTR Substitution Permitted	**Required Points Strategy**	
BUILDING: Basic Training (BT) BARRACKS					
PAR	**FEATURE**				**REMARKS**
MR2.1	Construction Waste Management: Divert 50% From Disposal	NO	NO	1	Combined Aggregate credit. Building CTR responsible for diversion of minimum 50% of waste generated. Site CTR responsible for diversion of minimum 50% of waste generated. No on-post recycling facility available for GC use.
MR2.2	Construction Waste Management: Divert 75% From Disposal	NO	NO		Combined Aggregate credit. Building CTR responsible for diversion of minimum 75% of waste generated. Site CTR responsible for diversion of minimum 75% of waste generated.
MR3.1	Materials Reuse: 5%	NO	NO		Not Targeted
MR3.2	Materials Reuse: 10%	NO	NO		Not Targeted
MR4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	NO	NO	1	Combined Cumulative credit. Building CTR responsible for minimum 15% recycled materials. D/B CTR responsible for minimum 1% recycled materials. (Target steel, metals, finishes)
MR4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	NO	NO		Combined Cumulative credit. Building CTR responsible for minimum 30% recycled materials. D/B CTR responsible for minimum 1% recycled materials.
MR5.1	Regional Materials:10% Extracted, Processed & Manufactured Regionally	NO	NO	1	Combined Cumulative credit. Building CTR responsible for minimum 3% regional materials. D/B CTR responsible for minimum 30% regional materials. (Target masonry, CMU, concrete, asphalt)
MR5.2	Regional Materials:20% Extracted, Processed & Manufactured Regionally	NO	NO		Combined Cumulative credit. Building CTR responsible for minimum 6% regional materials. D/B CTR responsible for minimum 60% regional materials. (include landscaping, interior finishes)
MR6	Rapidly Renewable Materials	YES	NIC		Not Targeted
MR7	Certified Wood	YES	NIC		Building CTR responsible. Evaluate during design
CATEGORY 5 – INDOOR ENVIRONMENTAL QUALITY					
EQPR1	Minimum IAQ Performance (PREREQUISITE)	NO	NIC	R	Building CTR responsible.
EQPR2	Environmental Tobacco Smoke (ETS) Control (PREREQUISITE)	NO	NO	R	Smoking is prohibited in non-residential federal facilities. Building CTR responsible for building ETS control features. D/B CTR responsible for site ETS features.
EQ1	Outdoor Air Delivery Monitoring	YES	NIC	1	Building CTR responsible.
EQ2	Increased Ventilation	YES	NIC		Building CTR responsible. Evaluate during design
EQ3.1	Construction IAQ Management Plan: During Construction	YES	NIC	1	Building CTR responsible.
EQ3.2	Construction IAQ Management Plan: Before Occupancy	YES	NIC	1	Building CTR responsible.
EQ4.1	Low Emitting Materials: Adhesives & Sealants	YES	NIC	1	Building CTR responsible.
EQ4.2	Low Emitting Materials: Paints & Coatings	YES	NIC	1	Building CTR responsible.

LEED Credit Paragraph	LEED 3.0 Multiple Contractor Responsibilities Table	Building CTR Substitution Permitted	Site CTR Substitution Permitted	**Required Points Strategy**	
BUILDING: Basic Training (BT) BARRACKS					
PAR	**FEATURE**				**REMARKS**
EQ4.3	Low Emitting Materials: Flooring Systems	YES	NIC	1	Building CTR responsible.
EQ4.4	Low Emitting Materials: Composite Wood & Agrifiber Products	YES	NIC	1	Building CTR responsible.
EQ5	Indoor Chemical & Pollutant Source Control	YES	NIC	1	Building CTR responsible. Fax/Copy and Janitor
EQ6.1	Controllability of Systems: Lighting	YES	NIC	1	Building CTR responsible. Task Lighting
EQ6.2	Controllability of Systems: Thermal Comfort	YES	NIC		Building CTR responsible. Possible with UFAD.
EQ7.1	Thermal Comfort: Design	YES	NIC	1	Building CTR responsible.
EQ7.2	Thermal Comfort: Verification	YES	NIC	1	Building CTR responsible.
EQ8.1	Daylight & Views: Daylight 75% of Spaces	YES	NIC		Not Targeted
EQ8.2	Daylight & Views: Views for 90% of Spaces	YES	NIC		Not Targeted
CATEGORY 6 – INNOVATION & DESIGN PROCESS					
IDc1.1	Innovation in Design	YES	YES	1	
IDc1.2	Innovation in Design	YES	YES	1	
IDc1.3	Innovation in Design	YES	YES	1	
IDc1.4	Innovation in Design	YES	YES	1	
IDc1.5	Innovation in Design	YES	YES	1	
IDc2	LEED Accredited Professional	NO	NO	1	
CATEGORY 7 – REGIONAL PRIORITY CREDITS					
SSc4.1	Alternative Transportation, Public Transportation Access	NIC	NO		
SSc6.1	Stormwater Design, Quality Control	NIC	YES	1	
WEc3	Water Use Reduction for 40%	YES	NIC	1	
EAc1	Optimize Energy Performance for 28%	YES	NIC	1	
EAc2.1	On-Site Renewable Energy	YES	NO		
IEQc7.1	Thermal Comfort, Design	YES	NIC	1	
	TOTAL			**55**	

LEED Credit Paragraph	LEED 3.0 Multiple Contractor Responsibilities Table	Building CTR Substitution Permitted	Site CTR Substitution Permitted	**Required Points Strategy**	
BUILDING: Basic Training (BT) BARRACKS					
PAR	**FEATURE**				**REMARKS**

APPENDIX O
LEED Strategy Tables

Not Used

Section: APPENDIX P

APPENDIX P
USGBC Registration of Army Projects

Typical Registration Procedure

1. Complete the online registration form (see guidance below) at the USGBC website **http://www.leedonline.com.**
2. Pay the registration Fee.
3. The USGBC will follow up final invoice, the LEED-online passwords and template information.

Completing the Registration Form

BEFORE YOU BEGIN:

Create a personal account with USGBC if you do not have one.
You will need the following information:
Project name as it appears in P2 (obtain through USACE Project Manager)
Building number/physical address of project.
Zip code for Installation/project location
Total gross area of buildings in project
Total Construction cost for buildings only (see Project Details Section instructions below)

ACCOUNT/LOGIN INFORMATION SECTION

1. The person registering the project **must have an account with USGBS** (login and password) to complete the form. If you have an account, select "I already have a USGBC Web site account" and enter email and password (twice). If you do not have an account, you may select "Create a new USBGC website account" and follow the instructions. It is recommended that you create an account separately on the USGBC website before you start the form. IMPORTANT: USACE team members are members of USGBC and are eligible for Members price. USACE team members registering projects should be sure to include USACE Corporate Access ID on the form (if you do not have it contact **richard.l.schneider@usace.army.mil** or **judith.f.milton@usace.army.mil** for the number).
2. The Account/Login Information is filled out by the person registering the project. It may be a Contractor or a USACE staff member.

PROJECT TYPE SECTION

Self-explanatory.

GENERAL PROJECT INFORMATION SECTION

Project Title: Match the project name used in P2. Contact the USACE Project Manager for this information.
Is project confidential: Indicate NO except if the project has security sensitivity (elements that are FOUO are higher security) indicate YES.
Project Address 1 and 2: This is the physical location of the project. Provide building number, street address, or what ever is known to best describe the location of the project on the installation.

Project City: Installation Name
State, Country, Zip Code: Self-explanatory
How Did You Heat About LEED: USACE Requirement

Primary Contact Information

The Primary Contact may be a Contractor or a USACE staff member. USBGC considers this individual to be the primary contact for all aspects of the project.

PROJECT DETAILS

Project Owner, First Name, Last Name, email: The Project Owner is the USACE Project Manager.
Organization Name: U.S. Army Corps of Engineers. This field MUST be completed this way because it will be used as a search field for higher HQ to find all USACE registered projects.

PROJECT DETAILS

Owner Type: Military Base
Project Scope: Provide brief description (example: barracks complex)
Site Conditions: Provide brief description (example, wooded with steep grades)
Occupant Type: Provide brief description (example, military and civilian employees)
Owner Occupied: No
Gross Square Footage: Provide total area all buildings in project.
Project Budget: Do not include the cost for design, site work, demolition, abatement or other work,- do not include Government contingency or supervision cost. For design-build and construction projects registered after award, use the awarded contract cost for construction of buildings only. For projects prior to award of design-build or construction contract, use the total Primary Facility cost from the DD1391 or updated Primary Facility cost based on design development if available.
Current Project Phase: Identify phase at time of registration (example: design start, construction start)
Project Type: Self-explanatory

PAYMENT INFORMATION

Self-explanatory

APPENDIX Q
REV 1.1 – 31 MAY 2009
AREA COMPUTATIONS

Computation of Areas: Compute the "gross area" and "net area" of facilities (excluding family housing) in accordance with the following subparagraphs:

(1) Enclosed Spaces: The "gross area" is the sum of all floor spaces with an average clear height ≥6′-11″ (as measured to the underside of the structural system) and having perimeter walls which are ≥4′-11″. The area is calculated by measuring to the exterior dimensions of surfaces and walls.

(2) Half-Scope Spaces: Areas of the following spaces shall count as one-half scope when calculating "gross area":

- Balconies
- Porches
- Covered exterior loading platforms or facilities
- Covered but not enclosed passageways and walks
- Open stairways (both covered and uncovered)
- Covered ramps
- Interior corridors (Unaccompanied Enlisted Personnel Housing Only)

(3) Excluded Spaces: The following spaces shall be excluded from the "gross area" calculation:

- Crawl spaces
- Uncovered exterior loading platforms or facilities
- Exterior insulation applied to existing buildings
- Open courtyards
- Open paved terraces
- Uncovered ramps
- Uncovered stoops
- Utility tunnels and raceways
- Roof overhangs and soffits measuring less than 3′-0″ from the exterior face of the building to the fascia

(4) Net Floor Area: Where required, "net area" is calculated by measuring the inside clear dimensions from the finish surfaces of walls. If required, overall "assignable net area" is determined by subtracting the following spaces from the "gross area":

- Basements not suited as office, special mechanical, or storage space
- Elevator shafts and machinery space
- Exterior walls
- Interior partitions
- Mechanical equipment and water supply equipment space
- Permanent corridors and hallways
- Stairs and stair towers
- Janitor closets
- Electrical equipment space
- Electronic/communications equipment space

RMS SUBMITTAL REGISTER INPUT FORM

CONTRACT NUMBER

DELIVERY ORDER

TITLE AND LOCATION

Button	<-----Right click for Instructions		TYPE OF SUBMITTAL											CLASSIFICATION						REVIEWING OFFICE					
SECTION	PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	01 - PRECON SUBMITTALS	02 - SHOP DRAWINGS	03 - PRODUCT DATA	04 - SAMPLES	05 - DESIGN DATA	06 - TEST REPORTS	07 - CERTIFICATES	08 - MFRS INSTRUCTIONS	09 - MFRS FIELD REPORT	10 - O&M DATA	11 - CLOSEOUT SUBMITTALS	FIO - FOR INFORMATION ONLY	GA - GOVERNMENT APPROVED	DA - DESIGNER OF RECORD APPROVAL	CR - CONFORMANCE REVIEW	DA / CR	DA / GA	DO - DISTRICT OFFICE	AO - AREA OFFICE	RO - RESIDENT OFFICE	PO - PROJECT OFFICE	DR - DESIGNER OF RECORD	AE - ARCHITECT / ENGINEER
00 72 00	52.236-13	Accident Prevention Plan	X														X				X				
00 73 00	1.11	Dev. From Accept. Design. No Deviation from Contract					X											X			X			X	
00 73 00	1.11	Dev. From Accepted Design - Deviates from Contract					X												X		X			X	
00 73 00	1.17	Supplemental Price Breakdown	X											X							X				
00 73 00	1.18	SSHO Qualifications	X												X						X				
01 10 00	5.2.3.1	(if concrete pavement) Joint Layout Plan with design drawings					X										X								
01 10 00	5.5.2	Building Envelope Sealing Performance Testing						X						X							X				
01 10 10	***	Tests as Req by Codes - DOR Develops Test Program						X						X							X			X	
01 10 00	5.8.3	BAS Review Information		X														X		X	X			X	
01 10 00	5.8.3	BAS Performance Verification Test						X						X							X			X	
01 10 00	5.8.4	Testing Adjusting and Balancing						X						X							X			X	
01 10 00	5.8.5	Commissioning						X						X							X			X	
01 10 00	6.15	Environmental As Required for Site Specific					X										X				X			X	
01 10 00	6.16	Permits as required for Site specific					X										X				X			X	
01 10 00	5.10.2	Fire Protection Tests						X	X					X							X			X	
01 32 01.00 10	3.4.1	Preliminary Project Schedule	X												X						X				
01 32 01.00 10	3.4.2	Initial Project Schedule	X												X						X				
01 32 01.00 10	3.4.3	Design Package Schedule	X												X						X				
01 32 01.00 10	3.6.1	Periodic schedule updates from the Contractor	X												X						X				
01 32 01.00 10	3.7	Time Extension Request (Schedule)	X												X						X				
01 33 00	1.8	Submittal Register - DOR Input Required	X												X						X			X	
01 33 00	1.8	Submittal Register Updates (Design Packages, etc.)	X												X						X			X	
01 33 00	1.3.1	Substitution of Manuf or Model Named in Proposal		X	X													X			X			X	
01 33 16	1.2	Identify Designer(s) of Record	X												X						X				
01 33 16	1.1.2 / 3.2.4	Fast Track Design Package(s)					X										X			X	X				
01 33 16	1.2	Identification of all Designers of Record	X														X				X				
01 33 16	3.2.1	Site and Utility Des Package, incl. Substantiation					X										X			X	X				
01 33 16	3.2.2/3.5	Interim Des Subm Package(s), incl. Substantiation					X										X			X	X				
01 33 16	3.5.1	Drawings					X										X			X	X				
01 33 16	3.5.2.2	Sitework Design Analyses					X										X			X	X				
01 33 16	3.5.2.3	Structural Design Analyses					X										X			X	X				
01 33 16	3.5.2.4	Security Design Analyses					X										X			X	X				
01 33 16	3.5.2.5	Architectural Design Analyses					X										X			X	X				
01 33 16	3.5.2.6	Mechanical Design Analyses					X										X			X	X				
01 33 16	3.5.2.7	Life Safety Design Analyses					X										X			X	X				
01 33 16	3.5.2.8	Plumbing Design Analyses					X										X			X	X				
01 33 16	3.5.2.9	Elevator Design Analyses (as Applicable)					X										X			X	X				
01 33 16	3.5.2.10	Electrical Design Analyses					X										X			X	X				
01 33 16	3.5.2.11	Telecommunications Design Analyses					X										X			X	X				
01 33 16	3.5.2.12	Cathodic Protection Design Analyses					X										X			X	X				
01 33 16	3.5.3	Geotechnical Investigations and Reports					X										X			X	X				
01 33 16	3.5.4	LEED Submittals					X										X			X	X				
01 33 16	3.5.5	Energy Conservation Documentation					X										X			X	X				
01 33 16	3.5.6	Specifications					X										X			X	X				
01 33 16	3.5.7	Building Rendering					X										X			X	X				
01 33 16	3.2.4/3.7	Final Des Submittal Package(s), incl. Substantiation					X										X			X	X				
01 33 16	3.7.5	DD Form 1354 (Transfer of Real Property)											X				X				X				
01 33 16	3.2.5/3.8	Design Complete Submittal Package(s)					X										X			X	X				
01 33 16	3.3.3	Design and Code Review Checklists					X										X			X	X				
01 33 16	A-2.0	SID - Interim and Final (as applicable)			X	X	X								X						X				
01 33 16	B-2.0	FFE (as Applicable)					X								X						X				
01 45 04.00 10	3.2	Design and Construction QC Plan	X														X				X				
01 57 20.00.10	1.2	Environmental Protection Plan	X														X				X				
01 78 02.00 10	1.2.1	Final as-Built Drawings											X		X						X				
01 78 02.00 10	1.2.3.11	Non-Hazardous Solid Waste Diversion Reports							X					X							X				
01 78 02.00 10	1.2.7	Provide final as-built CADD and BIM Model files											X		X						X				
01 78 02.00 10	1.2.9	Provide scans of all other docs in Adobe.pdf format											X		X						X				
01 78 02.00 10	1.3.1	Equip-in-Place list of all installed equip and cost											X		X						X				
01 78 02.00 10	1.3.2	Data on equip not addressed in O&M manuals											X		X						X				
01 78 02.00 10	1.3.3	Final as-built specs - electronic files											X		X						X				
01 78 02.00 10	1.4.2.1	Warranty management plan - FAR 52.246-21											X		X						X				
01 78 02.00 10	1.4.2.1	Certificates of Warranty for extended warranty items											X		X						X				
01 78 02.00 10	1.4.2.1	Contractor's POCs for implementing warranty process											X		X						X				
01 78 02.00 10	1.4.2.1	List of each warranted equip, item, feature or system											X		X						X				
01 78 02.00 10	1.5	See also Section 01 10 00 par. 5.8.4 and 5.8.5											X		X						X				
01 78 02.00 10	1.6.1.2	Equipment O&M Manuals - 1 electronic / 2 hard copies											X		X						X				
01 78 02.00 10	1.7	Field Training DVD Videos										X		X							X				
01 78 02.00 10	1.8	Pricing of CF/CI and GF/CI Property											X	X							X				
01 78 02.00 10	1.11	List of Completed Cleanup Items											X				X				X				

RMS INPUT FORM 4288A

Export to RMS in CSV(MS-DOS) (*.csv) Format

Note: Reviewing Office Optional

APPENDIX AA

Fort Leonard Wood Fire Department Required Information

DESIGN SPECIFICATION FOR CONSTRUCTION OF

FIRE DETECTION AND FIRE SUPPRESSION

4 May 2010 Update

FLW FIRE PROTECTION & PREVENTION DIVISION STAFF POC.

Kevin Curtis, Assist. Chief of Fire Prevention 573-596-0883 (Fire Dept)
573-512-1243

Ralph Mills, Fire Protection Specialist. 573-596-1379 (Office Direct Dial)
573-512-0834

Angela Yeager, Fire Protection Inspector 573-596-0883 (Fire Dept)
573-596-0131 Ext. 64874 (Office)

Introduction

The purpose of these specifications is to describe information, references and recommended practices relating to Life Safety, Fire Protection, and Mass Notification. It was developed to standardize the design and construction of fire protection and mass notification systems at facilities throughout the Fort Leonard Wood, Missouri. These guidelines are intended to convey the minimum standards to successfully provide reliable fire protection and mass notification systems. It is further intended that design engineers tailor this document with respect to specific project requirements at Fort Leonard Wood while maintaining a standardized system configuration as required by the latest edition of the UFC 3-600-01 Fire Protection Engineering for Facilities and UFC 4-021-01 Mass Notification Systems. UFC 3-600-01 is the primary fire protection reference for all DOD facilities, followed by the NFPA Codes and Standards. In the event of a conflict between any UFC and other criteria, the UFC shall govern.

Application

This document has been developed as a guideline; it is not the intent of this document to limit, restrict, or discourage anyone from enhancing the specifications to fit specific requirements in a given area or situation. However, the minimum standards shall not be compromised.

Scope of UFC3-600-01:

"This UFC establishes fire protection engineering policy and criteria for all DOD components. The provisions of this UFC are applicable to all new and existing DOD facilities located on or outside of the DOD installations, whether acquired or leased, by appropriated or non-appropriated funds, or third party financed and constructed. Facilities covered by this document include all types of buildings and their contents, structures, whether considered temporary or permanent, mobile and stationary equipment, waterfront facilities, outside storage and shore protection for ships and aircraft."

Orientation/Pre-design Meeting

The A/E orientation and/or pre-design meetings are crucial to any part of a project to ensure a full understanding of the fire protection and mass notification goals and expectations. The Fire Protection Engineer shall play an integral part of the design team, and shall be involved in every aspect of the design as it relates to fire protection. During orientation/pre-design, the project scope should be secured and a design strategy established. Expectations unique to the facility will be conveyed by the Fire Prevention Plan Review Staff.

Design Analysis

A fire protection design analysis is required for all designs and shall address the fire protection and mass notification requirements of the project as required by UFC 3-600-01 Sec 1-4 and UFC 4-021-01. The name and qualification of the fire protection engineer who supervised/prepared the design analysis shall be provided IAW UFC 3-600-01 Section 1-5 for services and qualifications.

The contractor shall verify and confirm in writing at shop drawing submittal that fire alarm and mass notification systems will meet intelligibility requirements per UFC 4-021-01. A test of intelligibility will be performed per the UFC.)

Code Analysis

Utilize the latest version of applicable codes and standards. Unified Facilities Criteria (UFC) UFC 3-600-01 Fire Protection Engineering, UFC 4-021-01 Mass Notification, the National Fire Protection Association Codes (NFPA) and the International Building Code (IBC) are the principal codes used. UFC 3-600-01, and UFC 4-021-01, Mass Notification Systems, provide detailed guidance for incorporating fire protection and mass notification engineering measures in the design and construction of Department of Defense (DOD) facilities. NFPA 101 , Life Safety Code is the primary code pertaining to all life safety issues. The IBC should be used primarily to determine allowable building construction sizes for the specific occupancy and construction type. The IBC should also be used to address other building code criteria not covered by UFC 3-600-01 or NFPA standards (i.e. building separation requirements, minimum construction standards, etc.). Other applicable codes and standards include, but are not limited to, ADA requirements. All equipment and material shall comply with the applicable provisions of NEMA, FM, UL, and CSA. ***NOTE:*** *In the event of a conflict between any Unified Facilities Criteria's (UFC) and other criteria, the UFC shall govern.*

Fire Alarm Reporting Systems

The FLW Fire Alarm Central Station Radio Receiving System is a Monaco D-21 system that operates using VHF bandwidth (138.925Mhz) and FSK protocol. The fire alarm central system is located off the Installation at the Pulaski County (PC) E-911 Center and Bldg 580, Fire Station 1 on FLW.

All buildings shall be equipped with Monaco BT-XF transceiver and shall have at least 60 zones reporting, unless there are less than 56 devices in the building. If less than 56 devices, one zone shall report for each device plus 4 spare zones. Each zone is a relay in the fire alarm control panel with a pair of wires rerouted to the BT-XF. Sixty zones will have sixty sets of wires routed between the FACP and BT-XF, and 60 relay contactors in the FACP. Each FACP initiating device, supervisory device and a system trouble shall be zoned. The contractor shall provide the wiring location contact points between the FACP and BT-XF with the fire alarm submittals for review and for FLW Fire Department use in programming of the Monaco D-21 System.

MASS NOTIFICATION (MNS)

The FLW Wide-Area Mass Notification Central Control Station is a Wheelock / ATI CCSWH system that operates using UHF bandwidth (407.870MHz) and FSK protocol. The mass notification central system is located at building 3200 on the Installation within the Emergency Operations Center (EOC). EOC uses a React-4000 computer system for local MNS. The switch over between the mass notification (MNS) and fire alarm system (FAS) shall be automatic. The systems must be user friendly and shall not require resetting by the user in the buildings. ***Note:*** *Separate wireless transmitters/receivers (transceivers) are required for the fire alarm and mass notification central systems. When local MNS micro-phone is required, a remote secured panel or keyed micro-phone lock-out shall be required next to the annunciator panel unless location is specified.*

Programming EOC Mass Notification Computer: The programming is a contractual agreement. Call the EOC at 573-563-5157 for details. Coordination with Fire Alarm /Mass Notification Acceptance Testing by the FLW Fire Protection & Prevention Division is required.

FIRE ALARM SYSTEMS (FAS)

Fire Alarm Control Panel shall be an intelligent addressable panel. The system shall be activated into alarm mode by the actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset through the fire alarm control panel manually restored or through a supervised automated reciever to the normal operating mode. Main fire alarm control panel and auxiliary panels shall be colored red and marked for the fire alarm system. Each building shall be required a fire alarm control panel (FACP). Multiple buildings may share a BT-XF. Lesson Learned : Multiple buildings sharing the same FACP has created maintenance issues, lost of systems and repairs from ground faults, improper wiring methods and lightning from weather. Power surges from lightning can transverse the ground causing electrical shorting of system. *Note: The fire department would prefer intelligent addressable panel with a integral radio alarm transceiver compatible with the base fire alarm receiving system when applicable for space savings, training of fire alarm repair technician,standardization of alarm maintenance, and reduce overall cost.*

Fire Reporting System Programming. The fire alarm designer shall provide the Fire Prevention Plan Review Staff upon submittal of plans; specifications and the addressing data of the point of contact for the fire alarm control panel to determine the number of zone-id's that will be required for programming the BT-XF and the installation fire reporting system.

Fire Alarm System Performance and Integrity:

(1) **Notification Appliance Circuits:** The notification appliance circuits (NACs) shall be Class A per NFPA 72 Chapter 6.4 and perform per NFPA 72 Chapter 6.7. The fire alarm system amplifiers, circuits, wiring shall not be more than 75% loaded. If a mass notification system fails the intelligibility test, then it easy for a contractor to add more speakers provided the circuit is not fully loaded. Many speakers each at low power increases intelligibility. Few speakers each at high power results in less intelligibility. Contractors should be advised to put a speaker in every occupied room. If not, then he must be ready to add speakers if the intelligibility test fails.

(2) **Initiating Device Circuit:** The initiating device circuits (IDCs) shall be Class A per NFPA 72 Chapter 6.4 and perform per NFPA 72 Chapter 6.5. All addressable initiating devices shall be of the intelligent bi-directional type and listed for use with applicable control panels. Conventional initiating devices are to be used only in conjunction with addressable interface modules where environmental condition al prevent intelligent devices to be installed.

(3) **Signal Line Circuits:** The signal line circuits (SLCs) shall be a class A Style 7 per NFPA 72 Chapter 6.4 and perform per NFPA 72 Chapter 6.6.

Wiring Method of Fire Alarm System: The wiring method used shall comply with applicable codes i.e. NFPA 70, 72, 101 be approved by the local FLW AHJ prior to installation. All terminal and junction locations used for fire alarm circuits shall be labeled and provided with specific identifying characteristics (i.e. painted red) and the fire alarm circuit identification shall be accomplished in accordance with NFPA 70 Art 760.30. Wiring method used shall be installed in such fashion that outgoing and return conductors, exiting and returning to control units, respectively, are separately routed and encased (both wire sets shall be enclosed in separate conduit lines where each conduit line is also geographically separate). The outgoing and return (redundant) circuit conductors shall not run in the same cable assembly, enclosure or raceway per NFPA 72 Chapter 6.

Fire Alarm System Remote Display (Graphic Annunciator) located in the lobby/vestibule shall be used in large buildings, multi-story buildings, and secured buildings. Graphic annunciator shall have a plan view of the building. Indicator lamps shall be shown on the plans. LEDs shall be red for alarm condition, amber for supervisory malfunction condition, and yellow for trouble condition. Plan views shall be approximately to scale and in no case smaller than 15 inches in length or width. Annunciator shall have a door with piano hinge and two point cylinder lock or two cylinder locks. Lock shall be operable using the same key as the FACP to lock out switches. Annunciator shall contain a LED test switch, audible trouble signal and a trouble switch to silence the audible alarm, but not extinguish the trouble LED. Annunciator shall be surface mounted.

For other buildings a remote annunciator panel will be required in the lobby/vestibule shall have a minimum of a reset switch, trouble switch, silence switch, and LED test switch with indicating lights and addressable visual monitor. Lock shall be operable using the same key as the FACP to lockout switches.

Notification Appliances Device Specification. Strobes with clear lens & red housing shall be used for building equipped with Fire Alarm System. Strobes for MNS shall be Amber lens with white housing. The MNS strobes shall be synchronized with the fire alarm strobes. Strobes will be located as required by ADAAG and NFPA 72. Strobes will be provided in common areas, restrooms, meeting areas, and other spaces required by the ADAAG. Provide plans with ceiling mounted appliances. This is expected for an Army facility and clearly allowed by ADA. Wall mounted appliances are not desired and any shown shall be required on wall elevations with all the interior elevations including systems furniture, screens, etc. See attached standard design direction for FLW. File FLW_6-13. *Note: One piece notification device with red housing is permitted for FAS/MNS.*

Initiating Devices Specification: Initiating Devices shall be analog addressable unless environmental conditions warrant otherwise the initiating devices shall be in according to their specific application for protection and as required by applicable codes and references.

> **(1). Manual Pull Stations.** Dual action manual pull stations shall be installed in gymnasiums, schools and similar areas where they may be subject to false activation or mechanical jarring. Single action pull stations should be used in other areas as required. Do not use manual pull stations with break-glass rods. All pull stations will be key accessible.
>
> **(2). Photo Electric Smoke Detector** shall be used when such detectors are required. Under floor detectors shall be indicated on the graphic annunciator panel showing the detector location in respect to the floor plan. Detectors shall be application specific to the facilities and equipment being protected.
>
> **(3). Heat Detectors** when required shall be combination rate of rise heat detectors for wide temperature range changes are expected (i.e. over ovens, fuel-fired equipment, attic areas, etc.). Fixed temperature heat detectors shall be installed where wide temperature range changes are not expected. The temperature rating of fixed temperature detectors shall be based on the maximum ambient temperature expected in the facility in conjunction with manufacturer's recommendations. Heat detectors shall be resettable from FACP. NFPA 72 will be followed.
>
> **(4). Duct Detectors** and spot type smoke detectors shall be installed on separate zones. Duct detection will not be used to replace open area detectors. Each duct smoke detector shall have a remote indicator/or test station located in an accessible space.

(5). Beam Detectors may be utilized in areas susceptible to false alarms and other areas where conventional detection is not feasible i.e. industrial operations, high ceilings, etc. and shall have a remote indicator/or test station located in an accessible space.

Acceptance Testing. Fire detection and suppression systems shall be tested in accordance with applicable NFPA codes and manufacture requirements. Prior to starting operational testing of a fire alarm system, notify the Contracting Officer and Fire Prevention Plan Review Staff at least five days in advance for scheduling this event. A Fire Prevention representative must be present during all test phases and procedures. Use applicable NFPA and manufactures checklists to accomplish testing of these systems. Upon full acceptance of testing on a fire detection/suppression systems, the installing contractor shall provide a written record of test completion verifying that NFPA and manufacture's requirements have been met. Voice intelligibility (CIS readings) for mass notification per the UFC 4-021-01 shall be required as part of acceptance testing. Provide all documentation for testing, to include manufacture data and installed equipment sheets.

Fire Alarm Control & Mass Notification Panels and Sprinkler Riser Location

All panels and sprinkler risers shall be located in electrical rooms and/or mechanical room near the outside mechanical room door. User not permitted access to these rooms. All equipment shall have a minimum 36 inches separation from other mechanical room equipment. Spacing required for firefighter access.

<u>Contractor Training</u>

The Contractor shall provide Government maintenance personnel the capability to operate, maintain, test, repair, and expand the system, to include as a minimum, the following.

(1) Contractor shall provide all software: database with complete identification and addresses for all programmable system equipment and devices, and all other systems programming data on all modes of the system: connecting cables; and proprietary equipment necessary for the operation, maintenance, testing, repair, and reprogramming, etc. of the system, to include that which may be required for implementation of future changes to the fire alarm system (additional and/or relocated initiating devices, notification devices, etc).
(2) Contractor shall provide all system and equipment technical data and computer software with the requisite tights to use by the government.
(3) Contractor shall provide fire department personnel two basic training sessions on the operation of the fire alarm and mass notification.

<u>TEMPORARY BUILDING NUMBERS</u>

The contractor shall be required to obtain the assigned Building Number from DPW. A temporary building sign will be required at each entrance to the building and shall be Brown background with white letters. The sign shall be vi sible from the road. This is required for EM S & Fire response.

HOT WORK PERMITS

FLW Fire Protection & Preven tion Division Prevention Unit issue s the "HOT W ORK PERMIT". A permit will be issued for each building under construction or renovation. It shall be the responsible of the contractor to provide copies furnished to each sub-contractor and check the site after hot work activity. Th e contractor shall pr ovide an electronic copy of all hot work permits issues at the end of each month to the Fire Department Fire Prevention Unit.

FIRE HYDRANTS

The FLW Fire Protectio n & Preven tion Division recomm ends the use of Mueller Centurion as per the Installation Design Guild (IDG), or a Clow Medallion, when fire hydrants are part of the project. If existing fire hydrants are to provide coverage for a new project or m ajor renovation, that the existing fire hydrants that provide pr otection to that buildin g shall be replaced. The contractor shall paint th e fire hydrants Nutm eg Brown in colo r as per the IDG. The fire hydrant shall be color coded per UFC 3-600-01 section 3- 7.3.1 Fire Flow and M arking of Hydrants shall be accom plished by m arine typ e reflectiv e tap e around the brim of the bonnet. The contracto r shall p rovide f low test results to th e f ire de partment for updating DPW and Fire Departm ent records.

SPRINKLER SYSTEMS

If required shall be installed in accordance to UFC 3-600-01 and NFPA 13.

(1) Post Ind icator Value s hall b e req uired on Sprinkler sy stems. Tam per switch is required.
(2) Fire hydrants shall be required within 150 feet of the fire department pre-connection.
(3) Fire Departm ent connections b ecause of force protection 2 5 m eter req uirements and fire department acc essibility sha ll be three to e ight feet cu rb/sidewalk s ide of stree ts and park ing lots where app licable. U<u>FC 3 -600-01 Sec 1-3.9 "Antiterrorism requirements (i.e. Force Protection) m ust not preclude a ny fire protection requirements."</u>
(4) Hydrostatic Testing and Acceptance Testing shall be witnessed by the Fire Prevention Unit Staff.
(5) FLW Installation in so me areas has a spik ing problem with the wate r system . So a pressure reducer maybe required on the sprinkler system.
(6) Backflow preventers are required on the sprinkler systems and jockey pumps.
(7) Strainers shall be required IAW NFPA 13.

STANDPIPES

Wet or Dry Standpipes shall be required on projects as needed in relation to Force Protection and fire department access. UFC 3-600-01 Section 4-5.1. Contractor shall contact the Fire Prevention Unit Plan Review Staff for determination.

REMOTE FIRE DEPARTMENT CONNECTIONS

Remote Fire Department Connections (FDC's) shall be required on all buildings with sprinkler systems and standpipes when force protection and fire department access is limited. Fire Department connections shall three to eight feet curb/sidewalk side of streets and parking lots where applicable.

PENETRATION

Fire Wall penetrations shall be sealed as per application and code. Fire wall penetration for DOIM cable trays and wiring, Cable TV, and Phone Service shall use an EZ-PATH type system that permits installers to install wiring under normal conditions, but will seal in case of fire.

FLOW TESTING

FLW Fire Protection & Prevention Division shall provide flow testing results of water supply for projects requiring sprinkler systems upon written request or Email request. It will be responsibility of the Fire Protection Engineer to determine if the flow test shall be a witness test.

FIRE DEPARTMENT ACCESS.

Knox Box is required on all permanent buildings. The type of Knox Box (recess or surface mount) and color will be determined during the design review. The Knox Box must be keyed to the FLW Fire Protection & Prevention Division account. An approved application will be furnished to contractor upon request. Note: When contractor receives the Knox Box, Fire Prevention Staff will need to verify the keying of the lock before installation.

The Knox Box will be installed at the nearest exit to the annunciator panel or at an approved fire department location. The Knox box will have tamper switches connected to the supervisory side of the fire alarm system that transmits a supervisory (Fire Auxiliary) signal to the E-911 center if the Knox Box is tampered with. Generally, on building with brick exterior finish, a recess mounted Knox Box will be required. Knox Box #3275 Dark Bronze with tamper switches and #3290 recessed mounting kits will be required. For building that need surface mounting, Knox Box #3266 Dark Bronze with tamper switches will be required.

GATED/FENCED FACILITIES

(1) Knox Key Switch override keyed to the FLW Fire Protection & Prevention Division Knox Box account shall be required on all electric control gates.
(2) For non-electric gates and force protection requirements a residential Knox Box keyed to the Fire Department Knox Box account shall be required on the gate post or bollards at each entrance.
(3) FLW Fire Protection & Prevention Division may furnish to contractors a lock box for the contractor keys when the building is enclosed for emergency access.

CONTRACTORS SITE OFFICE AND STORAGE TRAILERS.

(1) Construction Site Offices will be installed to ACOE standards. At least one 5 lb ABC Dry Powder Fire Extinguisher will be visible and accessible in each trailer.
(2) Separation between office trailers and storage trailer will be 10 feet. Storage trailer/Conex may sit next to each other.
(3) A 20 LB ABC Fire Extinguisher shall be accessible in the storage trailer/Conex area.
(4) 20 Lb ABC Fire Extinguishers shall be required within 75 feet travel distance on all levels of building construction and renovation.

FIRE EXTINGUISHERS

Fire Extinguisher is considered real property by FLW with the required fire extinguisher cabinet IAW UFC 3-600-01.. The size and location shall be determined during design analysis; 20 lb extinguishers are not appropriate for business type occupancies (NOT USER FRIENDLY) and should only be placed in higher hazard areas. Fire extinguishers shall be installed in accordance IAW NFPA 10, except where modified by UFC 3-600-01. *Note: Issues have arisen in the past where the fire extinguisher cabinets are the wrong size for the fire extinguishers used.*

HOOD & DUCT SYSTEMS

Hood and duct systems for commercial cooking equipment that produces smoke or grease-laden vapors must comply with IAW NFPA 96. System will be a Class K wet extinguishing system and will also include a class K portable fire extinguisher located per IAW NFPA 96. Openings in duct shall be provided at the sides or the top of the duct whichever is more accessible, and at changes in direction. Horizontal ducts require access every 12 feet; vertical ducts require access at each floor and at every change of direction.

O & M and As-Built Drawings.

COE Projects: Provide through the COE to the Fire Protection & Prevention Division in Micro Station CADD format and PDF one copy of CD's As-builds' and one copy of O & M and ½ size prints of plans for the Fire Alarm, and Mass Notification System. This is need for fire preplanning, programming the Fire Reporting System and fire alarm/mass notification repairs.

Other Projects: Provide through the Contracting Officer to the Fire Protection & Prevention Division in Micro Station CADD format and PDF two copies of CD's As-builts and one copy of O & M and ½ size prints of plans for the Fire Alarm, and Mass Notification System. This is need for fire preplanning, programming the Fire Reporting System and fire alarm/mass notification repairs.

Appendix BB

KCD CADD Standards

KCD CADD STANDARD 3.0
FOR
MILITARY AND CIVIL WORKS PROJECTS

1. APPLICABILITY. For military and Civil projects, KCD and it's A/E contractors will use, as a guide, the sheet numbering and CADD file naming system as shown in the latest version of the A/E/C CADD Standard as published by The CADD/GIS Technology Center. This document will provide specific guidance as to the implementation of the standard as used in the Kansas City District. Any issue covered in this document is developed within guidelines of the AEC CADD Standard and supersedes that document It also addresses some of the items not delineated in the CADD standards, which are required to provide uniformity among disciplines and consistency with current and future projects.

2. REFERENCE: BQP 5.6.07, Management of Electronic Files **,** Project File Structure**,** A/E/C CADD Standard (Release 2.0)

3. DRAWING FILE CREATION. The following steps are required in order to create a new drawing file:

STEP 1: Determine CADD file type.

STEP 2: Determine and assign a file name.

STEP 3: Determine drawing working units.

STEP 4: Select and attach seed file.

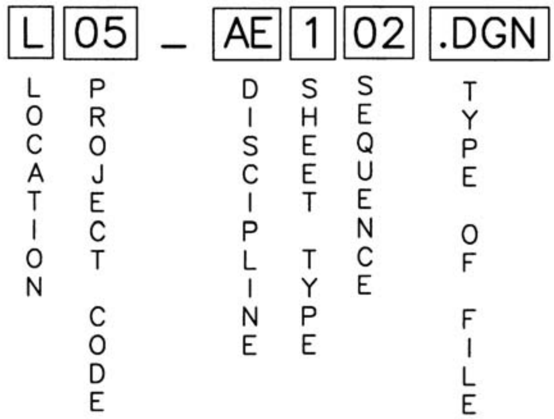
STEP 5: Attach border (reference) file.

STEP 1: Determine CADD file type. All drawing files are either "sheet" files or "model" files. The use of Model Files is mandatory for any drawing that may be used as a reference file by another discipline. In vertical construction all floor plans and elevations (architectural, structural, mechanical, electrical etc) shall be drawn in model files. Each floor of a building shall be in a separate model file. All model files shall be registered one directly above another. The border file shall be considered a model file. Elevations may be located in a single model file or as separate model files for each elevation view, as determined by the Project Development Team (PDT). For Model File application, see Option 2(Use of Design Model Only), and Figure 2-3, pgs.10 & 11, Ch.2 A/E/C CADD Standard 3.0. File naming convention is different for model files and sheet files (*See Step 2 below*).

STEP 2: Determine and assign a file name.

A. Standard Sheet File Naming (*for one building, one volume drawing set*):

Each CADD sheet file will be given a unique file name that is derived from the project location, project code, discipline, sheet type, and the sequential number of sheets within the type. Drawing names will contain 9 characters with a three (3) character extension. *(See paragraph 5 for file and sheet naming conventions regarding multiple building/multiple volume drawing sets)*. An example format for a standard sheet file is a follows: **L05_AE102.DGN**



LOCATION.

Military Location codes are as follows:

G	GRAND FORKS AFB, NORTH DAKOTA
K	LAKE CITY ARMY AMMUNITION PLANT
L	FORT LEONARD WOOD, MISSOURI
M	MCCONNELL AFB, KANSAS
R	FORT RILEY, KANSAS
U	US Army Reserve
V	FORT LEAVENWORTH, KANSAS
W	WHITEMAN AFB, KANSAS

Civil Works Location codes are as follows:

BC	BRUSH CREEK
BR	BLUE RIVER
BS	BLUE SPRINGS
CL	CLINTON LAKE
DC	DAVID CITY
HA	HARLAN COUNTY
HL	HILLSDALE LAKE
HT	HARRY S. TRUMAN
KA	KANOPOLIS
KC	KANSAS CITY
KR	KANSAS RIVER
LT	LITTLE BLUE
LB	LONGBRANCH
LV	LONGVIEW LAKE
ME	MELVERN LAKE
MI	MILFORD LAKE
MK	MILL CREEK
MO	MISSOURI RIVER
OS	OSAGE
PA	PAOLA
PE	PERRY LAKE

PO	POMONA LAKE
RA	RATHBURN
SM	SMITHVILLE LAKE
ST	STOCKTON LAKE
TK	TURKEY CREEK
TT	TUTTLE CREEK
WA	WAYNESVILLE
WE	WELDON SPRINGS
WI	WILSON LAKE

PROJECT CODE. Project codes are assigned by IM to the Project Manager (PM), who will distribute this project code to all team members at the time of Project creation on the server. The code is sequential as projects are created. The subdirectory created for a project will consist of the project location and code and the name of the project. In the past, project folders on the server (E drive) were identified with only 3 digits (i.e., R27, L06, etc.) It is now common to see project folders with additional descriptive letters as shown in the examples below. Although the project folder (directory name) is permitted to have a longer name, CADD file names within a directory will use only the first 3 digits (i.e., R27). Examples :

CIVIL WORKS:
BC05 (*PROSPECT BRIDGE on Brush Creek*)

MILITARY:
R16_CDC (*CHILD DEVELOPMENT CENTER, Fort Riley*)
L36_FY08BARRACKS (FY08 Barracks, Fort Leonard Wood)

DISCIPLINE. Disciplines (general) are designated by the following codes:

AE	ARCHITECTURAL
B-	GEOTECHNICAL
C-	CIVIL
E-	ELECTRICAL
G-	TITLE, LEGEND, AND BORDERS
IN	INTERIOR DESIGN
S-	STRUCTURAL
M-	MECHANCAL
P-	PLUMBING
V-	SURVEY

Each discipline requires 2 characters. Therefore designators using only one letter, such as “E” must be followed by a dash (“-“) so the completed discipline code is “E-“. The designer or sheet originator shall determine the correct discipline designator for each sheet based on drawing content. See the following appendices for each discipline’s designators:

Site (Survey, Civil, Landscaping)
Structural
Architectural
Interiors
Fire Protection
Mechanical (Plumbing and HVAC)
Electrical (Lightning Protection/Grounding, Lighting, Power, Telecommunications, and Special Systems)

SHEET TYPE. See KCD CADD Standards spreadsheets, that follow, for sheet type descriptions and designators used in this district.

SEQUENCE. The drawing sequence number within the discipline and sheet type: Sequences less than 10 are padded with zeroes in the file name.

CADD SYSTEM FILE TYPE. CADD system file types are as follows:

DGN MICROSTATION DESIGN FILES
DWG AUTOCAD DESIGN FILES

The CADD file type designator is provided only in the CADD directory file name and on the project index sheet. It is not required in the file name block on the border sheet.

Page 6: B. Model File Naming:

Model files contain the design elements for numerous sheet files. Model file naming conventions are very similar to sheet file conventions with some exceptions. The word “MODEL_” must be inserted immediately after the project code to indicate model files. Sheet type codes are different from regular sheet files and are provided in the A/E/C CADD Standard in Chapter 2, Table 4. An example file name format for a model file is a follows: **L05MODEL_A-FP102.DGN** *(architectural floor plan model file.)*

L	**05**	**V1**	**MODEL**	**-A**	_	**A-**	**FP**	**01**	**.DGN**
LOCATION	PROJECT CODE	VOLUME		BUILDING		DISCIPLINE	SHEET TYPE	SEQUENCE	FILE TYPE

Location column and project code column are assigned by the Project Manager.
This is the project directory.

Volume is only used with projects using multiple volumes to separate large quantities of sheets. i.e. Large Site package with large building having 200-300 sheets can be subdivided into manageable volumes (bound sets) of drawings.

Building column is only used with multiple buildings being submitted. i.e. Range projects have a GIB and Control Tower. One would be building A and the other building B.

Discipline is as indicated in the matrices submitted or AEC 3.0 Cadd Standards

Sheet type is based on common terms. FP is Floor Plan, RP is roof plan, PP is power plan, LP is lighting Plan, GP is grounding plan, etc.

Sequence number is based on the sheet files. i.e. if multiple sheet files use the floor plan then use the root numbers of that group. A model file for sheets 101,102,103 and 104 would be 100. If

3 digit sheet files are used then 2 digit model files are possible. i.e. Sheet 101 with model fie 01 is OK since the first “1” is designating “plan” sheet.

Enter file name here

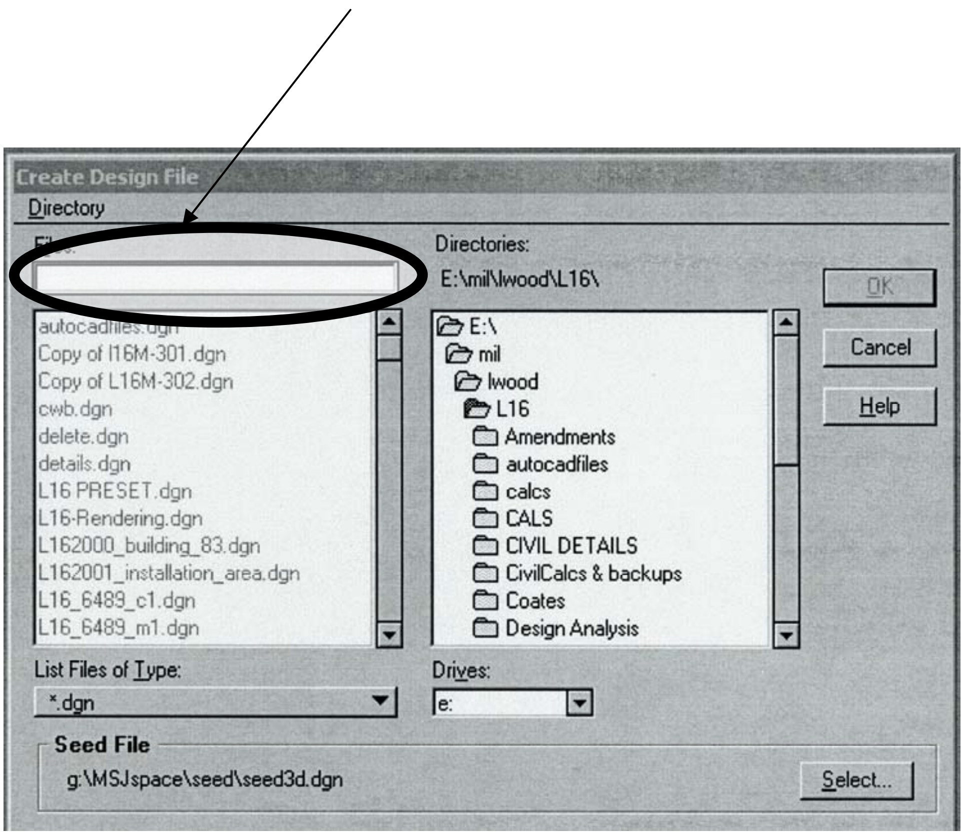


Figure 1.1

STEP 3: Determine drawing working units.

Vertical Construction projects may be designed in either English (inch-pound) or metric units. Project unit of measure will be determined by the PM (project manager) in concert with the PDT before design process begins, based on customer preference and the unit of measure most advantageous to the government.

Remodel and rehabilitation work, including vertical construction, levee’s, channels, etc. may be done in English units, if the original construction and as-built drawings are in English units.

Working Units for MicroStation:

	MU	SU	PU
English AEC	1ft	12 inch	8000
English Civil	1ft	100	10
Metric AEC	1mm	1	100
Metric Civil	1M	1000	1

AEC working units are used primarily for vertical construction or design features requiring a high level of CADD precision. Civil working units are primarily used by civil disciplines for site, survey, and mapping files. It is typical to have both AEC and Civil working unit files in the same project, however, the PDT should develop a plan to determine which working units will be used to maintain compatibility.

STEP 4: Select and attach seed file.

SEED FILES: Seed files automatically set sheet file defaults for dimensioning, color table, view attributes, locks, AEC global positioning, display depth, active depth, etc. in accordance with the A/E/C CADD Standard and KCD standards. Although these defaults can be changed by the designer/engineer, it is highly recommended that the defaults remain in place to provide consistency from drawing sheet to drawing sheet. This is especially important with regard to referencing of files from one sheet to another. Seed files are available in both 2d and 3d files. Select seed file based on 2d vs. 3d and required working units. Design files should typically be selected as 3d. 3d files ensure compatibility with other CADD features and programs such as INROADS, 3D rendering, and fly-throughs. 2d files should be limited to schedules and text-type files.

Available AEC seed files are:

Arch_2d_E.dgn	AEC 2 dimension foot-pound (English)
Arch_3d_E.dgn	AEC 3 dimension foot-pound (English)
Arch_2d_M10.dgn	AEC 2 dimension metric 10pu
Arch_3d_M10.dgn	AEC 3 dimension metric 10pu
Arch_2d_M100.dgn	AEC 2 dimension metric 100pu
Arch_3d_M100.dgn	AEC 3 dimension metric 100pu

Civil seed files: are based on the survey file.

Seed files are selected by “hitting” the SELECT button in the CREATE DESIGN FILE dialog box *(See Figure 1.2)*

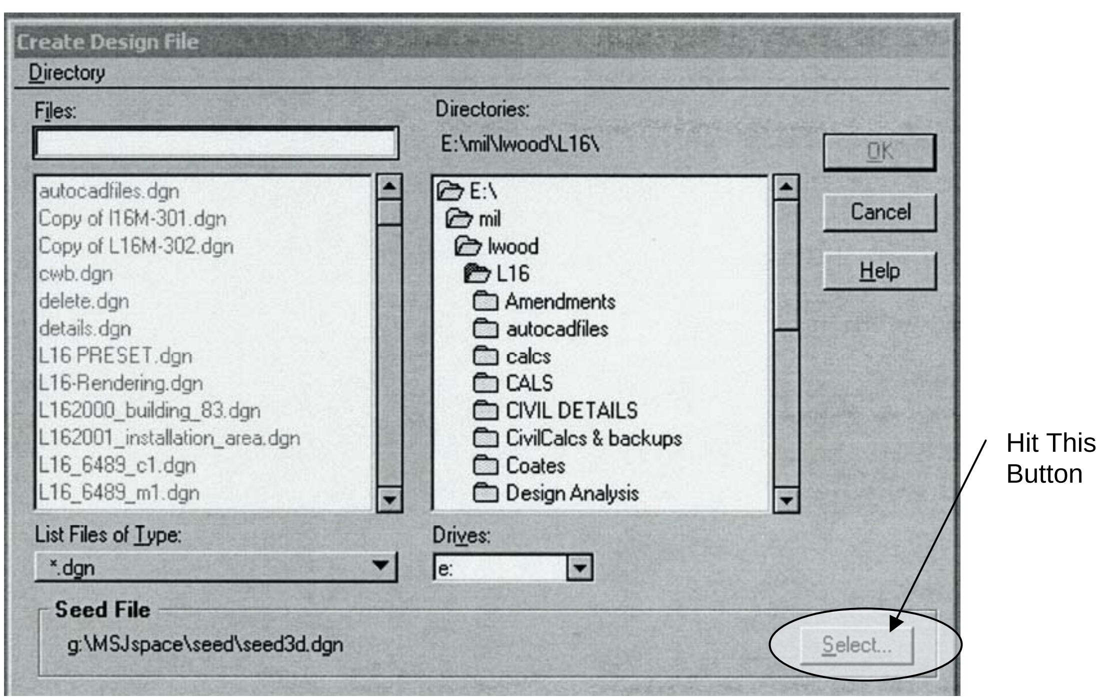


Figure 1.2

STEP 5: Attach border (reference) file.

The Border file shall be created as a 2 dimensional (2d) model file and placed in the project directory. This allows it to be attached as a reference file to both 2d and 3d project sheet files. The border shall be placed in the file life size, English (2'-0"x 3'-0"), Metric (609.6mm x 914.4mm). Generic project border files for both English and metric units of measure and for both AEC and civil drawings have already been created as cells and are currently located in the following cell library:

G:\MSJspace\cell\MilCon\Borders.cel

IMPORTANT NOTE: It is recommended that at the beginning of the project design phase, a single team member be assigned to create the required project border file by abstracting the correct border file cell from the cell library and creating a project border model file. With input from the PM, the border sheet originator shall make the necessary changes in the title block information (project name, number, date, drawing code, etc.) that will be common to all drawing sheets. Example of a border sheet file name:

R13MODEL_G-BS01.DGN

There should never be more than one border model file per volume per project.

4. SHEET NUMBERING CONVENTION. (Sheet Identifiers) In accordance with the A/E/C CADD Standard, each drawing sheet in a contract set shall be numbered according to the discipline, subject, and sequence within that subject, according to the following syntax examples:

AE502 where "AE" is the discipline designator (Architectural elements), "5" is the sheet type designator (Details), and the "02" is the sequence number.

M-403 where "M-" is the discipline designator (Mechanical elements), "4" is the sheet type designator (Large Scale Views), and the "03" is the sequence number.

This is the correct format for the sheet number entry of drawing title blocks. Note that only the sequence numbers are padded with zeroes when they are less than 10. Specific designators for disciplines and sheet types for KCD drawing files provided are based on those shown in the A/E/C CADD Standard.

5. SPECIAL RULES FOR PROJECTS WITH MULTIPLE BUILDINGS.

Often, a contract will include the design of multiple buildings or features which are to be packaged together as a single project under a single contract. Examples are the UEPH and Barracks projects, which included barracks buildings, soldier community buildings, dining facilities and COFs within a single project. Under these circumstances, it is desirable to number the drawing sheets and name the CADD files in a manner which identifies the building or feature to which each drawing applies.

5.1 File Naming. There are two ways to handle file naming for this type of project. The project could be published with one volume and multiple features/buildings within that volume. It is also permissible to publish multiple volumes with buildings in each volume. The PDT should develop a strategy at the beginning of the project to determine how the project design should be packaged. The PDT should also determine volume contents and letters designated to each building and feature.

.

Example: Project L05 –MODEL FILE NAMING

L	05	V1	-A	_	A-	101	.DGN
LOCATION	PROJECT CODE	VOLLUME	BUILDING		DISCIPLINE	SEQUENCE	FILE TYPE

Location column and project code column are assigned by the Project Manager.
This is the project directory.

Volume is only used with projects using multiple volumes to separate large quantities of sheets. i.e. Large Site package with large building having 200-300 sheets can be subdivided into manageable volumes (bound sets) of drawings.

Building column is only used with multiple buildings being submitted. i.e. Range projects have a GIB and Control Tower. One would be building A and the other building B.

Discipline is as indicated in the matrices submitted or AEC 3.0 Cadd Standards

Sequence number is based on the matrices or AEC 3.0 Cadd Standards. Always start with a sheet number ending in 1 unless sheet is an overall sheet with areas identified by a key plan. i.e AE100 that keys sheets AE101,AE102, etc. As long as the Architectural (for building) and Civil (for Site) utilize these overall sheets, the sub-disciplines do not need to provide an overall sheet. i.e. AE100 does not need to have a matching EP100 sheet. EP can start with EP101. Key plans are required for these types of plans.
.

5.2 Sheet Naming & Project Directory Naming. For multi-building projects, a building prefix will be added to the sheet number. Each drawing sheet in a contract set will be numbered according to the building, discipline, subject, and sequence within that subject, according to the following syntax:

B_AE101

where B is the building identifier, and all other characters are the same as described in paragraph 4. Building identifiers should be identified and assigned by the PM and PDT prior to commencement of design work.

All files in a project will reside in the same drawing directory. Subdirectories for different buildings under the same volume will not be used.

Comprehensive examples of file naming conventions for single building, multiple building, multiple volume, and multiple building/multiple volume are located in Appendix G.

6. ENTERING TITLE BLOCK INFORMATION.

Upon completion of referencing in the border sheet for a new sheet file, the title block should be filled in as completely as possible. Examples of the correct text font ands attributes for each block are provided as part of the border sheet file just outside the border. These examples should be copied in and edited.

IMPORTANT NOTE: Do not change the text font or attributes without consulting with the project PDT team for concurrence.

Input the following:

Sheet Reference Number. Use naming convention as described in paragraph 4. Use the same text size for both projects having one building (See Figure 1.3) and those projects having multiple buildings (See Figure 1.4).

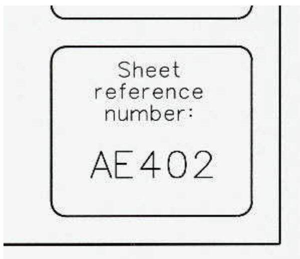


Figure 1.3

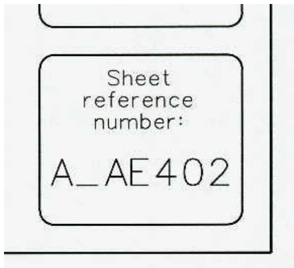


Figure 1.4

Sheet Title *(See Figure 1.5).* Provide a brief title that describes the sheet content.

IMPORTANT NOTE: The title provided in the title block must match, exactly, the title listed on the project index sheets. Any abbreviations used in one location must be used in the other. KCD uses third-party software to create CD's and the title information must match at both locations.

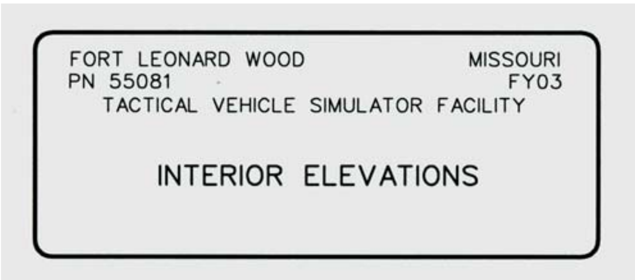


Figure 1.5

Designed By *(See Figure 1.6).* Provide designer/engineer's first initial /last name that developed the information shown on the sheet.

Date *(See Figure 1.6).* Information is to show up in All Border Sheets. The date will be provided and inputted by the border sheet originator and will appear as part of the border reference file sheet. Format is Month and Year.

Drawn By *(See Figure 1.6).* Provide first initial /last name of person who did the actual CADD work on the drawing. This may be the designer/engineer.

File No. *(See Figure 1.6).* Information is to show up in All Border Sheets. The drawing file number will be provided and inputted by the border sheet originator and will appear as part of the border reference file sheet. It can be found in the 1391 next to the Project number. The PM will provide this information to the Design Team.

Checked By *(See Figure 1.6).* Provide first initial /last name of the individual who performed the peer review for the drawing. Initials should be entered only after peer review is completed. For A/E's this is your Quality Control Reviewer.

Plot Scale *(See Figure 1.6).* Provide the plot scale selected for the drawing. Example: 1/8" = 1'-0" equals a plot scale of 8:1.

Submitted By *(See Figure 1.6).* In House Provide first initial /last name of the designer's supervisor. A/E's to provide initials of Professional of Record here.

CADD File Name *(See Figure 1.6).* Provide the file name developed as per naming conventions provided in paragraphs 3 & 5. Do not include the CADD type extension ".dgn" or ".dwg".

Figure 1.6

7. AMENDMENTS & MODIFICATIONS TO DRAWING SHEETS.

Changes to drawings as a result of amendments or modifications shall be clearly indicated and highlighted on the drawings. All symbols and text used to indicate modifications and amendments shall appear on the sheet file (not the model file). Use the following standard conventions to indicate amendments and modifications:

A. Clouds. Each change on the drawing sheet shall be surrounded by a "cloud" symbol. This symbol can be generated using an MDL command in Microstation by typing in "MDL L CLOUD". The correct color, line weight and level shall be indicated by an example shown on the right side of the border sheet.

B. Numbered Triangles. Each cloud shall include a corresponding small triangle with a number such as "1" within the triangle. An example, which can be copied into the drawing, is shown on the right hand side of the border sheet in the proper size, level and color. The triangle should be placed close to the appropriate cloud or attached to the cloud with a line (same weight, color and level as the cloud). *The numbering system is provided in paragraph 7.1.*

C. Text Description (Optional). Provide a brief text description of the change if it is not obvious. Use standard (note) text size, color, and line weight. Level shall be the same as the triangle.

D. Revision Block Entries (*See Figure 1.7*). Amendments and modifications shall also be indicated in the revision block, in the upper right-hand corner of the border sheet. Sample text and triangles, in the required color, line weight, and level, shall be provided to the right hand of the border sheet and should be copied into the active drawing file and edited. Note that all entries in the revision block shall be on Level 5 and shall always be shown (turned on). Entries in the revision block should be made starting at the top of the block and working downwards with successive entries. Entries in the columns shall be as follows:

Symbol Entry: Triangle with corresponding number of modification or amendment. Number should match the triangle number used on the clouded areas (changes) that correspond to the amendment or modification.

Description Entry: Indicate whether it is an amendment or modification provided by a general description of changes if applicable. DO NOT enter any amendment or modification number unless so directed by the project manager. The description must be general but specific enough to provide some information regarding the changes. Examples of good and bad descriptions are as follows:

Bad Examples: “Amended Sheet”
“Modifications as Shown”

Good Examples: “Amendment – Change Note 4 & Add Notes 6-7”
“Modification – Delete Detail C & D”

Date Entry: Provide a date as agreed upon by the PDT and project manager.

5	MODIFICATION - REVISE FLASHING ON DETAIL 3	2/7/04	
4	MODIFICATION - ADD INSULATION TO DETAIL 4	6/30/03	
3	MODIFICATION - DELETE GENERAL NOTES	6/14/03	
2	AMENDMENT - CHANGE DETAIL 5	1/20/03	
1	AMENDMENT - CHANGE TEXT NOTES	1/3/03	
Symbol	Description	Date	Appr.

Figure 1.7

7.1 Multiple Amendments and/or Modifications.

A. Most Current Amendment and/or Modification.

All elements of the most current change to include bubbles, leaders, triangles, and text associated with the change shall be placed on a level 63, with the exception of the revision block text and graphics (triangle) which shall always be placed on level 5 and shall always remain visible on the drawing.

B. Preceding (Previous) Amendments and Modifications.

Each time an amendment/modification is followed by a succeeding amendment/modification on a drawing sheet, the preceding amendment/modification identification graphics and text shall have the level changed or be deleted from the drawing so that only the most current amendment/modification identification graphics and text information are visible. It shall be the responsibility of the discipline's section chief or the individual designer of the drawing sheet to determine if the changes are to be retained on a separate level or deleted from the drawing.

Acceptable options are as follows:

Option 1: Retain all changes. Place most current change on Level 63. Place all previous changes on Level 62. Turning on both levels 62 and 63 would show all amendments and modifications. In summary:

Current Change	LV 63
Previous Changes	LV 62
Revision Block Information	LV 05

Option 2: Retain only most recent change (amendment or modification). Delete all references to previous changes except for the revision block. In summary:

Current Change:	LV 63
Previous Changes:	Delete All Changes
Revision Block Information	LV 05

C. Revision Block Entries.

As noted previously, all amendment and modification changes shall be entered in the revision block and these entries shall always be turned on (LV 05). Each succeeding amendment or modification made to a drawing sheet shall be given a new (the next consecutive) number (1, 2, 3, 4, etc.) within the corresponding triangle. This numbering is independent for each drawing sheet and has no corollary with other drawing sheets even though the amended change may be part of the same amendment or modification. In other words, a change as a part of Amendment XYZ could appear as a "1" on drawing sheet no. A-02 because it is the first amended change on that sheet, but a change that is part of Amendment XYZ on drawing sheet no. A-04 could be labeled as "2" because there was a previous change recorded on that sheet.

Succeeding amendments and/or modifications shall be entered in the revision block above the preceding entries using the same format so that they appear in the order in which the changes were made with the most current change appearing on top. (*See Figure 1.7*)

Upon notification that the project contract has been awarded, all amendment graphics and corresponding text information on the drawing shall be deleted from the drawings. Information regarding amendments in the revision block shall always remain.

8. Cell Library Names: Each discipline group is responsible for the maintenance of their individual cell libraries. Existing cell libraries can be found at G:\MSJspace\cell. Cell library “mst8000” is provided as a general library of symbols, etc. used buy multiple disciplines. Libraries should be named in the following manner:

Discipline_cell type_eng.cel
Discipline_cell type_met.cel

Example:

Arch_doors_eng.cel (This is an architectural cell library containing cells relating to doors and is in English units)

9. COMMENTS. **Comments should be directed to the Project Manager.** All comments or proposed changes shall be coordinated with the CADD standards committee members. Members are as follows:

Jim Turner, ED-D
Mike Coates, ED-DA
John Hunt, ED-DA
Dan Winkel, ED-DM
Hank Mildenberger, ED-GC

KCD CADD STANDARD 3.doc

Appendix CC

Mechanical Controls

SECTION TABLE OF CONTENTS
DIVISION 15 - MECHNICAL
FORT LEONARD WOOD, MISSOURI DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS Dated 09-18-2008

-- End of Section Table of Contents --

PART 1 GENERAL

1.1 REFERENCES

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

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 500-D (1998) Laboratory Methods of Testing Dampers for Rating

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASME B16.34 (1996) Valves - Flanged, Threaded, and Welding End

ANSI/ASME B16.15 (1994) Cast Bronze Threaded Fittings, Classes 125 and 250

ANSI C12.1 (1995) Code for Electricity Metering

ANSI C12.10 (1997) Electromechanical Watthour Meters

ANSI C12.20 (2002) Electricity Meter - 0.2 and 0.5 Accuracy Classes

ANSI/EIA 709.1B (2002) Control Network Protocol Specification

ANSI/EIA 709.3 (1998) Free-Topology Twisted-Pair Channel Specification

ANSI/FCI 70-2 (2003) Control Valve Seat Leakage
ANSI/EIA 852 (2001) Tunneling Component Network
Protocols Over Internet Protocol Channels
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)
ASHRAE Fundamentals Hdbk (2001) Fundamentals Handbook
AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM A 269 (1996) Seamless and Welded Austenitic
Stainless Steel Tubing for General Service
ASTM B 88 (1996) Seamless Copper Water Tube
ASTM B 88M (1996) Seamless Copper Water Tube (Metric)
ASTM D 1693 (1997a) Environmental Stress-Cracking of
Ethylene Plastics
ASTM D 635 (1997) Rate of Burning and/or Extent and Time of Burning of Self-Supporting
Plastics in a Horizontal Position
ASME INTERNATIONAL (ASME)
ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC VIII D1 (1998) Boiler and Pressure Vessel Code;
Section VIII, Pressure Vessels Division 1
-Basic CoverageFEDERAL COMMUNICATIONS COMMISSION (FCC)
FCC Part 15 (2002) FCC Rules and Regulations Part 15:
Radio Frequency Devices (Volume II)
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
IEEE C62.41 (1991; R 1995) Surge Voltages in
Low-Voltage AC Power Circuits
IEEE Std 142 (1991) IEEE Recommended Practice for
Grounding of Industrial and Commercial Power Systems
INSTRUMENT SOCIETY OF AMERICA (ISA)
ISA S7.0.01 (1996) Quality Standard for Instrument Air
LONMARK INTERNATIONAL (LonMark)
LonMark Interoperability Guide (2002) LonMark Application-Layer
Interoperability Guide; Version 3.3
LonMark SNVT Master List (2002) LonMark SNVT Master List; Version
11, Revision 2
LonMark XIF Guide (2001) LonMark External Interface File Reference Guide; Revision
4.0B
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
NEMA 250 (2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NFPA 70 (2002) National Electrical Code
NFPA 90A (1996) Installation of Air Conditioning and Ventilating Systems
UNDERWRITERS LABORATORIES (UL)
UL 1585 (2001) Class 2 and Class 3 Transformers
UL 555 (1995) Standard for Fire Dampers

UL 555S (1996; R2000) Leakage Rated Dampers for
Use in Smoke Control Systems
UL 94 (1996; Rev thru Jul 1998) Tests for
Flammability of Plastic Materials for
Parts in Devices and Appliances
UL 916 (2004) Energy Management Equipment

1.2 DEFINITIONS
The following list of definitions may contain terms not found elsewhere in the Section but are included here for completeness.

a. Application Specific Controller: A device that is furnished with a pre-established built in application that is configurable but not re-programmable. An ASC has a fixed factory-installed application program (i.e Program ID) with configurable settings.

b. Binary: A two-state system where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level. 'Digital' is sometimes used interchangeably with 'binary'.

c. Binding: The act of establishing communications between ANSI/EIA 709.1B devices by associating the output of a device to the input of another.

d. Building Control Network: The ANSI/EIA 709.1B control network installed under FORT LEONARD WOOD, MO. DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS consisting of a backbone and one or more local control busses.

e. Building Point of Connection (BPOC): The BPOC is the point of connection between the **Fort Leonard Wood LAN** network (an IP network) backbone and the building control network backbone. The hardware at this location, that provides the connection is referred to as the BPOC Hardware. In general, the term "BPOC Location" means the place where this connection occurs, and "BPOC Hardware" means the device that provides the connection .Sometimes the term "BPOC" is used to mean either and its actual meaning (i.e. location or hardware) is determined by the context in which it is used.

f. Channel: A portion of the control network consisting of one or more segments connected by repeaters. Channels are separated by routers. The device quantity limitation is dependent on the topology/media and device type. For example, a TP/FT-10 network with locally powered devices is limited to 128 devices per channel.

g. Configuration Parameter: Controller setting usually written to EEPROM. Also see 'Standard Configuration Parameter Type (SCPT)'

h. Control Logic Diagram: A graphical representation of control logic for multiple processes that make up a system.

i. Domain: A grouping of up to 32,385 nodes that can communicate directly with each other. (Devices in different domains cannot communicate directly with each other.) Part of the Node Addressing scheme.

j. Explicit Messaging: A method of communication between devices where each message contains a message code that identifies the type of message and the devices use these codes to determine the action to take when the message is received. These messages are non-standard and often vendor (application) dependent.

k. External Interface File (XIF): A file which documents a device's external interface, specifically the number and types of LonMark objects; the number, types, directions, and connection attributes of network variables; and the number of message tags.

l. Functional Profile: The description of one or more LonMark Objects used to classify and certify devices.

m. Gateway: A device that translates from one protocol to another. Gateways are also called Communications Bridges or Protocol Translators.

n. General Purpose Programmable Controller (GPPC): Unlike an ASC, a GPPC is not furnished with a fixed application program. A GPPC can be (re-)programmed, usually using vendor-supplied software.

o. LonMark Object: A collection of network variables, configuration parameters, and associated behavior defined by LonMark International and described by a Functional Profile. Defines how information is exchanged between devices on a network (inputs from and outputs to the network).

p. LNS Plug-in: Software which runs in an LNS compatible software tool. Device configuration plug-ins provide a 'user friendly' interface to configuration parameters.

q. LonMark: See LonMark International. Also, a certification issued by LonMark International to ANSI/EIA 709.1B devices.

r. LonMark International: Standards committee consisting of numerous independent product developers and systems integrators dedicated to determining and maintaining the interoperability guidelines for the LonWorks industry. Maintains guidelines for the interoperability of ANSI/EIA 709.1B devices and issues the LonMark Certification for ANSI/EIA 709.1B devices.

s. LonMark Interoperability Association: See 'LonMark International'.

t. LonWorks: The overall communications technology, developed by Echelon Corporation, for control systems. The term is often used to refer to the technology in general, and may include reference to any/all of the: protocol, network management, and interoperability guidelines where the technology is based on the ANSI/EIA 709.1B protocol and employs interoperable devices along with the capability to openly manage these devices (via multiple vendors) using a network configuration (or service) tool.

u. LonWorks Network Services (LNS): A network management and database standard for ANSI/EIA 709.1B devices.

v. Monitoring and Control (M&C) Software: Software which performs supervisory functions such as alarm handling, scheduling and data logging and provides a user interface for monitoring the system and configuring these functions. Can reside on the BPOC building level server or a remote IT server.

w. Network Variable: See 'Standard Network Variable Type (SNVT)'.

x. Network Configuration Tool: The software used to configure the control network and set device configuration properties. This software creates and modifies the control network database (LNS Database).

y. Node: A device that communicates using the ANSI/EIA 709.1B protocol and is connected to an ANSI/EIA 709.1B network.

z. Node Address: The logical address of a node on the network. Variations in node addressing are possible, but the 'Domain, Subnet, Node' format is the established standard for this specification.

aa. Node ID: A unique 48-bit identifier assigned (at the factory) to each ANSI/EIA 709.1B device. Sometimes called the Neuron ID.

bb. Program ID. An identifier (number) stored in the device (usually EEPROM) that identifies the node manufacturer, functionality of device (application & sequence), transceiver used, and the intended device usage.

cc. Repeater: A device that connects two control network segments and retransmits all information received on one side onto the other.

dd. Router: A device that connects two channels and controls traffic between the channels by retransmitting signals received from one subnet onto the other based on the signal destination. Routers are used to subdivide a control network and to control bandwidth usage.

ee. Segment: A 'single' section of a control network that contains no repeaters or routers. The device quantity limitation is dependent on the topology/media and device type. For example, a TP/FT-10 network with locally powered devices is limited to 64 devices per segment.

ff. Service Pin: A hardware push-button on a device which causes the device to broadcast a message (over the control network) containing its Node ID and Program ID. This broadcast can also be initiated via software.

gg. Standard Configuration Parameter Type (SCPT): Pronounced 'skip-it'. A standard format type (maintained by LonMark International) for Configuration Parameters.

hh. Standard Network Variable Type (SNVT): Pronounced 'snivet'. A standard format type (maintained by LonMark International) used to define data information transmitted and received by the individual nodes. The term SNVT is used in two ways. Technically it is the acronym for Standard Network Variable Type, and is sometimes used in this manner. However, it is often used to indicate the network variable itself (i.e. it can mean "a network variable of a standard network variable type"). In general, the intended meaning should be clear from the context.

ii. Subnet: Consists of a logical (not physical) grouping of up to 127 nodes, where the logical grouping is defined by node addressing. Part of the Node Addressing scheme.

jj. TP/FT-10: A Free Topology Twisted Pair network defined by ANSI/EIA 709.3. This is the most common media type for an ANSI-709.1 control network.

kk. UMCS Network: An IP network connecting multiple building level control networks.

ll. The existing Fort Leonard Wood UMCS is a solution that utilizes the Web services interface of the BPOC Internet Server to collect data to the Installation Microsoft SQL Server. Using Web Services, SOAP and XML the data from the BPOC Internet Server will be integrated into the SQL database.(4-02-08)

mm. User-defined Configuration Parameter Type (UCPT): Pronounced 'u-keep-it'. A Configuration Parameter format type that is defined by the device manufacturer.

nn. User-defined Network Variable Type (UNVT): A network variable format defined by the device manufacturer. Note that UNVTs create non-standard communications (other vendor's devices may not correctly interpret it) and may close the system and therefore are not permitted by this specification.

1.3 SYSTEM DESCRIPTION

The Direct Digital Control (DDC) system shall be a complete system suitable for supervisory control and monitoring using Lonworks Network Services and web client server software of the heating, ventilating and air conditioning (HVAC) and other building-level systems as specified and shown.

1.3.1 System Requirements

Systems installed under this guide specification shall have the following characteristics:

a. The Direct Digital Control system shall connect to BPOC hardware that has a built in web server that allows web access to all data points maintained by the building level DDC.(04/02/08)

b. The control system shall be an open implementation of LonWorks technology using ANSI/EIA 709.1B as the communications protocol and using LonMark Standard Network Variable Types as defined in LonMark SNVT Master List for communication over the network.

c. LonWorks Network Services (LNS) shall be used for all network management including addressing and binding of network variables. A copy of the LNS database shall be submitted to the project site as specified.
(1) Lonmark version 3.3 shall be used (Lonmaker Professional Turbo is the network management tool presently being used at FLW).(12/10/07)

d. All communication between the UMCS and building networks shall be via the ANSI/EIA 709.1B protocol over the IP network in accordance with ANSI/EIA 852. (12/12/07)

e. Integrate the control system to the installation's existing UMCS.
The existing UMCS is a solution that utilizes the Web services interface of Echelon's i.LON® 100 Internet Server(BPOC) to collect data to the Installation Microsoft SQL Server (check with DPW MES for current version). Using Web Services, SOAP and XML the data from the Echelon's i.LON® 100 Internet Server shall be integrated into the SQL database as required in the sections of the specifications detailing the data collection requirements. The system shall be configured using LonMaker with Echelon's LNS and DDE software (check with DPW MES for current LNS server configuration requirements).(4-02-08)

f. The hardware shall perform the control sequences as specified and shown.

g. The building level systems shall have a stand alone architecture where failure of a single controller shall not impact more than one system.

h. Control sequence logic shall reside in DDC hardware in the building. The building control network shall not be dependent upon connection to a Utility Monitoring and Control System (UMCS) for performance of control sequences in this specification. The hardware shall, to the greatest extent practical, perform the sequences without reliance on the building network.

i. The hardware shall be installed such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.

j. The hardware installed under this specification shall be readily available from the General Services Administration (GSA) supply schedule.

k. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software shall be licensed to U.S. Army with Fort Leonard Wood Directorate of Public Works Systems Manager as the agent and will otherwise remain with the Government such that the Government or their agents are able to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

l. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software shall be turned over directly to the DPW Management of Engineered Systems section @ building 2224 in the DPW compound.

m. The Contractor shall provide sufficient documentation and data, including rights to documentation and data, such that the Government or their agents can execute work to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

n. Hardware shall be installed and configured such that the Government or their agents are able to perform repair, replacement, and upgrades of individual hardware without further interaction with the Contractor.

o. Control hardware shall be installed and configured to provide all input and output Standard Network Variables (SNVTs) as shown and as needed to meet the requirements of this specification.

p. All DDC devices installed under this specification shall communicate via ANSI/EIA 709.1B. The control system shall be installed such that a SNVT output from any node on the network can be bound to any other node in the domain.

q. The M&C software installed under this specification shall allow for graphical navigation between systems, graphical representations of systems, access to real-time data for systems, ability to override points in a system, access to all monitoring and control functions as shown on the point schedule.

r. The DDC system shall incorporate a labeled HVAC ventilation shutdown switch located as shown.

s. DDC Contractor personnel loading, configuring and providing DDC software on government owned computers and network access shall comply with AR-25-2 IT network security requirements.

t. DDC contractor shall use government provided computers only after DDC hardware is installed in building.

u. DDC Contractor shall provide application specific controllers(ASC's) utilizing standard Lonmark Functional profiles and manufacture plug in software as specified for all terminal and zone unit hardware.(04/02/08)

v. DDC Contractor shall coordinate software installation with DPW MES 10 days in advance.(8-11-08)

1.3.2 *Job Requirments Building [ ]*
These requirments are in addition to requirments specified and shown.

1.3.3 Verification of Dimensions
After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.3.4 Drawings
The Government will not indicate all offsets, fittings, and accessories that may be required on the drawings. The Contractor shall carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall provide all work necessary to meet such conditions.

1.4 SUBMITTALS
The Following items shall be submitted for government approval.

a. DDC contractor design drawings shall be submitted in hardcopy(4 copies) completed as stated in section 3.3.2 of this specification..
b. Product specific data shall be submitted for each product provided under this specification.

c. Software: The most recent version unless otherwise stated, of all software provided under this specification shall be delivered as a technical data package to the DPW MES section. Software CD'S shall be clearly marked and labeled with a CD index and software index , type of software, software version, software company name and DPW building number(s) software covers. Software shall be in it's native format(No zip files)
d. Software CD's shall be provided for each building on multi-building projects.
e. Coordination is required for turnover of the technical data with DPW MES section.
f. Contractor shall provide a software list of all software used with name, type, model number and version. (03-05-08)
g. All passwords shall be provided. (03-05-08)

(1) Unless otherwise stated the most recent version of the Programming software for each type (manufacturer and model) of General Purpose Programmable Controller (GPPC) shall be submitted as a Technical Data Package and shall be licensed to the project site as shown. Software shall be submitted on CD-ROM and 5 hard copies of the software user manual shall be submitted for each piece of software provided. Programing software CD shall be clearly marked and labeled with product name, version and bldg. number. (03/05/08)

(2)GPPC Application Programs

All installed GPPC Application Programs shall be submitted on CD-ROM as a Technical Data Package. The CD-ROM shall include a list or table of contents clearly indicating which application program is associated with each device. 2 copies of the GPPC Application Program's CD-ROM shall be submitted. software CD shall be clearly and labeled.

(3)XIF files
External interface files (XIF files) shall be submitted as a technical data package for each model of DDC Hardware provided under this specification. XIF files shall be submitted on CD-ROM. XIF files and CD shall be clearly marked which device the file is associated with, labeled, indexed and building number. A copy shall be provided for each building on multi-building projects.

(4) LNS Database
Two copies of the LNS Database for the complete control network provided under this specification shall be submitted as a Technical Data Package. Each copy shall be on CD-ROM and shall be clearly marked identifying it as the LNS Database for the work covered under this specification and with the date of the most recent database modification. A copy shall be provided for each building on multi-building projects.

(5)LNS Plug-in
LNS Plug-ins for each Application Specific Controller shall be submitted as a Technical Data Package. LNS Plug-ins distributed under a license shall be licensed to the project site. Plug-ins shall be submitted on CD-ROM and clearly marked and identified with the device the software is associated with. Hard copy manuals, if available, shall be submitted for each plug-in provided.

(6) 2 copies of as built drawings in MICROSTATION format shall be provided on separate CD-ROM in the close out submittal package.

(7) BPOC Application and Graphic's Programs
All installed BPOC application and graphic's programs shall be submitted on dedicated CD-ROM as a Technical Data Package. The CD-ROM shall include a list or table of contents clearly indicating which application program is associated with each device. 2 copies of the BPOC Application Program's CD-ROM shall be submitted. software CD shall be clearly marked and labeled. Software, license and all passwords shall be submitted for each building on multi-building projects

(8) Server Software
All installed server software shall be submitted on CD-ROM as a Technical Data Package. The CD-ROM shall include a list or table of contents clearly indicating which application program is associated with each device. 1 copy of the server application program CD-ROM shall be submitted. software CD shall be clearly marked and labeled. Software, license and all passwords shall be submitted for each building on multi-building projects

(9) Coordination is required with DPW MES section for completion of software submittal requirements. (03/05/08)

1.5 PROJECT SEQUENCING

1.6 QUALITY CONTROL (QC) CHECKLISTS
The QC checklist in appendix A shall be completed initialed and signed as shown.
The QC Representatives shall verify each item in the Checklist and initial in the provided area to indicate that the requirement has been met. The QC Representative shall sign and date the Checklist prior to submission to the Government

1.7 DELIVERY AND STORAGE
Products shall be stored with protection from the weather, humidity, and temperature variations, dirt and dust, and other contaminants, within the storage condition limits published by the equipment manufacturer.

1.8 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS
The HVAC control System Operation and Maintenance Instructions shall include:
a. OPERATION AND MAINTENANCE DATA for each piece of control equipment.
b. Printouts of configuration settings for all devices.
c. Routine maintenance checklist. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.
d. Qualified service organization list.
e. Start-Up and Start-Up Testing Report.
f. Performance Verification Test (PVT) Procedures and Report.

1.9 MAINTENANCE AND SERVICE

1.9.1 Description of Work
The adjustment and repair of the system shall include the manufacturer's required sensor and actuator (including transducer) calibration, span and range adjustment.

1.9.2 Personnel and Fort Leonard Wood Security Requirments

Service personnel shall be qualified to accomplish work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any changes in personnel.

1.9.2.1 Fort Leonard Wood AR25-2 IT Security Requirements

Fort Leonard Wood IT Security Requirements for personnel loading and configuring Direct Digital Control software on contractor supplied and government owned computer hardware and Fort Leonard Wood Network access.

a. The DDC contractor shall start AR25-2 information assurance security requirements coordination through their security manager immediately after contract award.

b. The Following items shall be coordinated through the Information Assurance Security Officer (IASO) in the Management of Engineering Systems Branch of the Directorate of Public Works (DPW) phone # 573-596-1917.

(1) The operating system (OS) software if applicable shall be reinstalled on contractor supplied computers by the Government IT department, the contractor shall coordinate operating system (OS) installation with the Information Assurance Security Officer (IASO) in the Management of Engineering Systems branch of the Directorate of Public works (DPW). All computers shall remain on site@ DPW IASO office after Government (OS) configuration is complete. (03-05-08)

(2) Coordination is required for domain, internet protocol address and subnet values.

(3) DDC contractor shall submit to the DPW IASO the full name, date of birth, place of birth, and social security number of all personnel that will have access to government owned computers and access to the Fort Leonard Wood network.

(4) DDC contractor personnel that will perform warranty work shall maintain an active AKO account and CAC card(Common Access Card) for the duration of the warranty period.

1.9.3 Scheduled Inspections
Two inspections shall be performed at six-month intervals and all work required shall be performed. Inspections shall be scheduled in [June and December][___]. These inspections shall include:
a. Visual checks and operational tests of equipment.
b. Fan checks and filter changes for control system equipment.
c. Clean control system equipment including interior and exterior surfaces.
d. Check and calibrate each field device. Check and calibrate 50 percent of the total analog inputs and outputs during the first inspection. Check and calibrate the remaining 50 percent of the analog inputs and outputs during the second major inspection. Certify analog test instrumentation accuracy to be twice the specified accuracy of the device being calibrated. Randomly check at least 25 percent of all digital inputs and outputs for proper operation during the first inspection. Randomly check at least 25 percent of the remaining digital inputs and outputs during the second inspection.
e. Run system software diagnostics and correct diagnosed problems.
f. Resolve any previous outstanding problems.

1.9.4 Scheduled Work
This work shall be performed during regular working hours, Monday through Friday, excluding Federal holidays.

1.9.5 Emergency Service
The Government will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the system. A telephone number where the service supervisor can be reached at all times shall be provided. Service personnel shall be at the site within 24 hours after receiving a request for service. The control system shall be restored to proper operating condition.

1.9.6 Operation
Scheduled adjustments and repairs shall include verification of the control system operation as demonstrated by the applicable tests of the performance verification test

1.9.7 Work Requests
Each service call request shall be recorded as received and shall include its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. A record of the work performed shall be submitted within 5 days after work is accomplished.

1.9.8 System Modifications
Recommendations for system modification shall be submitted in writing. No system modifications, including operating parameters and control settings, shall be made without prior approval of the Government. Any modifications made to the system shall be incorporated into the Operations and Maintenance Instructions, and other documentation affected.

1.10 SURGE PROTECTION

1.10.1 Power-Line Surge Protection
Equipment connected to ac circuits shall be protected against or withstand power-line surges. Equipment protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

1.10.2 Surge Protection for Transmitter and Control Wiring
DDC hardware shall be protected against or withstand surges induced on control and transmitter wiring installed outdoors and as shown. The equipment protection shall be protected against the following two waveforms:

a. A waveform with a 10-microsecond rise time, a 1,000-microsecond decay time and a peak current of 60 amps.

b. A waveform with an 8-microsecond rise time, a 20-microsecond decay time and a peak current of 500 amperes.

1.11 INPUT MEASUREMENT ACCURACY

Sensors, transmitters and DDC Hardware shall be selected, installed and configured such that the maximum error of the measured value at the SNVT output of the DDC hardware is less than 150% of the maximum allowable error specified for the sensor or instrumentation.

1.12 BUILDING CONTROL NETWORK

The building control network shall consist of a backbone and one or more local control busses as specified.

1.12.1 Backbone Media

The backbone shall be a TP/FT-10 network in accordance with ANSI/EIA 709.3 or an IP network as specified according to the following criteria:

a. The backbone shall be an IP network as specified if both of the following conditions are met:

(1) the Network Bandwidth Calculations for a heavily loaded network show that more than 70% of the 78 kbps (kilobits per second) bandwidth is used or the Network Bandwidth Calculations for a normally loaded network show that more than 30% of the 78 kbps bandwidth is used.

(2) the Government has approved the Network Bandwidth Calculations submittal.

(3) The network bandwidth use of the as built network shall be tested and noted on the as built riser diagram drawing. (03-05-08)

b. The backbone shall be a TP/FT-10 network otherwise.

1.12.2 Control Network Requirements

The control network shall meet the following requirements:

a. The backbone shall have no control devices connected to it. Only ANSI/EIA 709.1B Routers and ANSI/EIA 709.1B TP/FT-10 to IP Routers or approved building level servers may be connected to the backbone.

b. The backbone shall be installed such that a web server/router at the Building Point of Connection (BPOC) location as shown may be connected to the backbone.

c. The local control bus shall use ANSI/EIA 709.1B over a TP/FT-10 network in doubly-terminated bus topology in accordance with ANSI/EIA 709.3

d. The local control busses shall be installed such that no node (device connected to the control network) has more than two ANSI/EIA 709.1B Routers and ANSI/EIA 709.3 Repeaters (in any combination) between it and the backbone, including the web server(BPOC) connected to the backbone.

e. All DDC Hardware shall connect to a local control bus.

f. All DDC Hardware shall be locally powered; link power is not acceptable.

g. The local control bus cable twisted pair conductors color code shall be white/blue or white-blue/blue, these colors shall be dedicated to the local control buss. (12/10/08)

h. The local control bus cable shall be shielded, plenum rated and have a purple jacket. The jacket color shall be dedicated to the local control bus cable. (12/10/08

1.12.3 Building Point of Connection(BPOC) Requirements

The DDC Building point of connection and hardware shall consist of hardware, inside-plant horizontal cables and connecting hardware to transport data (LAN) signals between equipment items in a building.

a. BPOC hardware and connections shall be located inside a Nema 12 enclosure as specified and shown.

b. A dedicated ¾" inch metal raceway and [jetline (dpw)] [two category six comm cables (corps)] shall be provided from the DDC BPOC hardware enclosure back to the telecommunications closet containing the building Wide Area Network (WAN) connections and devices.

[c. CAT 6 communication cables shall be terminated on the IT patch panel in the building comm. room that houses the WAN connections and terminate cabling in the BPOC enclosure with two RJ-45 jacks as shown .](12/10/07)

c. After raceway and jetline are installed coordinate immediately with DPW operations for cabling and RJ-45 jack installation.

d. The Contractor shall provide a patch cable from the BPOC hardware and patch into the LAN jacks.

e. BPOC hardware shall be configured for operation on the local area network (LAN).

f. BPOC hardware shall have the IP-852 routing option configured and enabled to communicate with the existing enterprise LNS UMCS.

g. BPOC shall have SOAP/XML web services interface

h. BPOC shall have all the latest software patches and software updates installed and running coordination with DPW MES required. BPOC I-LONe4 hardware and firmware shall be downgraded to I-LONe3 (9-19-08)

i. BPOC shall have a built in web server and web pages that allows access to data points on the building level DDC system as shown.

j. BPOC shall provide a Remote Network Interface(RNI) for the LonMaker Intergration Tool.

k. BPOC shall have monitoring and control capabilities of the building level Lonworks control network as shown using Lonworks Network Services.

l. BPOC hardware shall be located in mechanical equipment rooms with outside access if available.

m. BPOC shall support the Lonscanner Protocol Analyzer

1.13 LNS SERVER Requirements(12/10/07)

Contractor provided CPU and OS to be used for LNS Server and installed in an enclosure meet NEMA 250 type 12 requirements, with a continious hinghed and gasketed exterior door with 3-point latch kit handle, enclosure manufacture provided intergal hasp and staple for padlocking, door clamps and a data pocket in the door.(12/10/07) To include LonMaker and Lon DDE Server. Government computer equipment shall be used for software installation and configuration.

a. Windows XP Professional License (Army Gold Version to be loaded by DOIM prior to Contractor Loading Software), P4 Processor 2 GHz Minimum, Min 2 Gig Ram, CD-ROM Drive, Graphics card capable of 1280x1024 True color, 1 DVI, VGA & 1 S-Video (with add-in PCI-Express video card); Mouse & Keybord XP Compatible (USB); 80 Gig STA Hard Drive Minimum free space, not taking into account the size of the LNS applications for LNS network interface driver reqirements; 1 Gig/100 MB Network Interface Card NIC10/100/1000 LAN, J45); SLTA-10 Serial LonTalk Adapter installed, configured; LNS Server Installed and Configured; LNS Database Resides on PC

b. Domain shall be set to Facility Building Number.

c. LNS Server and Database shall be connected to the Lonworks TCPIP 852 Lon Network running under the Lonworks IP852 configuration server as a full client.

d. Contractor shall provide 1 Copy Echelon LNS DDE Server Software License (Model 37200-20 LNS DDE Server OEM Edition) to Directorate of Public Works (DPW) Systems Manager.

e. LNS Server shall NOT be connected to the Installation LAN without the approval of the DPW Systems Manager.

f. Uninterruptible Power Supply(UPS) shall power CPU for 30 minutes, UPS shall have automatic shutdown and restart feature.

g. A dedicated ¾" inch metal raceway and [jetline (DPW local req)] [two category six comm cable(corp req)] shall be provided from the DDC CPU hardware enclosure back to the telecommunications closet containing the building Wide Area Network (WAN) connections and devices.] (07-08-08)

[h. After raceway and jetline are installed coordinate immediately with DPW operations for cabling and jack installation.] DPW REQ.

[h. CAT 6 communication cables shall be terminated on the IT patch panel in the building comm. room that houses the WAN connections and terminate cabling in the CPU enclosure with one RJ-45 jack as shown .](12/10/07) CORPS REQ.

i. CPU server enclosure shall contain ventilation louvers on the side near the bottom of the enclosure and a 100 cfm ventilation fan venting out of the side of the enclosure near the top.

j. CPU server shall have a minimum of 1" inch of clearance on the sides and a minimum of 6" inches of clearance for the front and back.

k. Coordination is required with DPW for Computer hardware use and software installation. (12/10/07)

l. All passwords shall be provided to the DPW MES section. (03-05-08)

[1.13 EXISTING AREA LNS SERVER Requirements(12/10/07)

a. Domain shall be set to Facility area, coordinate with DPW MES section.

b. LNS Server and Database shall be connected to the Lonworks TCPIP 852 Lon Network running under the Lonworks IP852 configuration server as a full client.

c. Coordination is required with DPW for Computer hardware use and software installation. (12/10/07)]DPW REQ.

d. Contractor shall provide 1 Copy Echelon LNS DDE Server Software License (Model 37200-20 LNS DDE Server OEM Edition) to Directorate of Public Works (DPW) Systems Manager. (7/08/08)

e. LNS Server shall NOT be connected to the Installation LAN without the approval of the DPW Systems Manager

f. All passwords shall be provided to the DPW MES section. (08-11-08)

e. All required software shall be loaded on the server(8-11-08)

1.14 Panel Mounted Override Switches

a. A labeled manual override switch shall be provided for DDC outputs that enable chillers. Override switches shall be located at the DDC chiller controller.

b. A labeled manual override switch shall be provided for DDC outputs that enable boilers. Override switches shall be located at the DDC boiler controller.

c. Manual override switches shall meet user input device hardware requirements.

PART 2 PRODUCTS
PART 2 of this specification covers requirements for Products (equipment). Installation requirements for these products are covered in PART 3 of this Specification.

2.1 GENERAL EQUIPMENT REQUIREMENTS
Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of these and similar products. The standard products shall have been in a satisfactory commercial or industrial use for two years prior to use on this project. The two year use shall include applications of equipment and materials under similar circumstances and of similar size. DDC Hardware not meeting the two-year field service requirement shall be acceptable provided it has been successfully used by the Contractor in a minimum of two previous projects. The equipment items shall be supported by a service organization. Items of the same type and purpose shall be identical, including equipment, assemblies, parts and components. Manufacturer's catalog data sheets documenting compliance with product specifications shall be submitted as specified for each product installed under this specification.

2.1.1 Operation Environment Requirements
All products shall be rated for continuous operation under the following conditions:

a. Pressure: Pressure conditions normally encountered in the installed location.

b. Vibration: Vibration conditions normally encountered in the installed location.

c. Temperature:

(1) Products installed indoors: Ambient temperatures in the range of (32 to 112 degreesF) and temperature conditions outside this range normally encountered at the installed location.
(2) Products installed outdoors or in unconditioned indoor spaces: Ambient temperatures in the range of (-35 to +151 degreesF) and temperature conditions outside this range normally encountered at the installed location.

d. Humidity: 10% to 95% relative humidity, noncondensing and humidity conditions outside this range normally encountered at the installed location.

2.2 ENCLOSURES AND WEATHERSHIELDS

2.2.1 Enclosures
Enclosures shall meet the following minimum requirements:

a. Outdoors: Enclosures located outdoors shall meet NEMA 250 Type 4 requirements.

b. Mechanical and Electrical Rooms: Enclosures located in mechanical or electrical rooms shall meet NEMA 250 type 12 requirements, with a continious hinghed and gasketed exterior door with 3-point latch kit handle, enclosure manufacture provided intergal hasp and staple for padlocking, door clamps and a data pocket in the door.

c. Other Locations: Enclosures in other locations including but not limited to occupied spaces, above ceilings, and plenum returns shall meet NEMA 250 Type 1 requirements. Enclosures supplied as an integral (pre-packaged) part of another product are acceptable.

2.2.2 Weathershields
Weathershields for sensors located outdoors shall prevent the sun from directly striking the sensor. The weathershield shall be provided with adequate ventilation so that the sensing element responds to the ambient conditions of the surroundings. The weathershield shall prevent rain from directly striking or dripping onto the sensor. Weathershields installed near outside air intake ducts shall be installed such that normal outside air flow does not cause rainwater to strike the sensor. Weathershields shall be constructed of galvanized steel painted white, unpainted aluminum, aluminum painted white, or white PVC.

2.3 TUBING

2.3.1 Copper
Copper tubing shall conform to ASTM B 88 and ASTM B 88M

2.3.2 Stainless Steel
Stainless steel tubing shall conform to ASTM A 269

2.3.3 Plastic

Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with ASTM D 635, shall have UL 94 V-2 flammability classification or better, and shall withstand stress cracking when tested in accordance with ASTM D 1693. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

2.4 NETWORK HARDWARE

2.4.1 ANSI/EIA 709.1B Network Hardware

2.4.1.1 ANSI/EIA 709.1B Routers
ANSI/EIA 709.1B Routers (including routers configured as repeaters) shall meet the requirements of ANSI/EIA 709.1B and shall provide connection between two or more ANSI/EIA 709.3 TP/FT-10 channels.

2.4.1.2 ANSI/EIA 709.3 Repeaters
ANSI/EIA 709.3 Repeaters shall be physical layer repeaters in accordance with ANSI/EIA 709.3.

2.4.1.3 Gateways
Gateways shall perform bi-directional protocol translation from one non-ANSI/EIA 709.1B protocol to ANSI/EIA 709.1B. Gateways shall incorporate exactly two network connections: one shall be for connection to a TP/FT-10 network in accordance with ANSI/EIA 709.3 and the second shall be as required to communicate with the non-ANSI/EIA 709.1B network.

2.4.1.4 Building Point of Connection Hardware Requirements.

a. Processor- MIPS32

b. Channel Type- 72101-3 and 72102-3 TP/ft-10 free topology twisted pair, 72103-3, 72104-3 PL-20N or PL-20C power line, L-N coupling.

c. Lonworks Network Connector-screw terminals

d. Operating Input Voltage- 100-240VAC, 50-50 Hz

e. Controls- Service button, Reset button

f. Indicators - power, Ethernet activity, Digital inputs, Relay outputs, RNI connection Status and Lonworks Service.

g. Ethernet connector- RJ-45, 8 conductor

h. Ethernet Port-10/100BaseT, auto-selecting, auto polarity

i. Serial Ports- Isolated RS-485 and EIA-232 serial.

j. Serial Connector- Screw terminals

k. Modem Connector- RJ-11,6 conductor
l. Console Port- EIA-232

m. Console Connector- DB-9

n. Digital Inputs- 2 ea. optically isolated dry contact inputs, 30 V AC/DC

o. Relay Outputs- 2 SPST relays rated at 240VAC @ 10Aor 24VDC@10A

p. Impulse Meter Inputs- DIN 43 864

q. Impulse Meter Connector- Screw terminals

r. Operating Temperature 0-50*C

s. Dimensions- Height:3.51inches,Width:5.47inches,Depth: 2.60inches

t. Mounting- DIN, Enclosure 8TE

2.5 WIRE AND CABLE
All wire and cable shall meet the requirements of NFPA 70 and NFPA 90A in addition to the requirements of this specification.

2.5.1 Terminal Blocks
Terminal blocks which are not integral to other equipment shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.5.2 Control Wiring for Binary Signals
Control wiring for binary signals shall be 18 AWG copper and shall be rated for 300-volt service.

2.5.3 Wiring for 120-Volt Circuits
Wiring for 120-volt circuits shall be 18 AWG or thicker stranded copper and shall be rated for 600-volt service.

2.5.4 Control Wiring for Analog Signals
Control Wiring for Analog Signals shall be 18 AWG, copper, single- or multiple-twisted, minimum 50 mm (2 inch)lay of twist, 100% shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper

cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.5.5 Transformers
Transformers shall be UL 1585 approved. Transformers shall be sized so that the connected load is no greater than 80% of the transformer rated capacity.

2.6 AUTOMATIC CONTROL VALVES
Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall meet ANSI/ASME B16.34 or ANSI/ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150% of the system design operating pressure. Unless otherwise specified or shown, valve leakage shall meet ANSI/FCI 70-2 Class IV leakage rating (0.01% of valve Kv). Unless otherwise specified or shown, valves shall have globe-style bodies. Unless otherwise specified:

a. bodies for valves 40 mm (1.5 inches) and smaller shall be brass or bronze, with threaded or union ends

b. bodies for 50 mm (2 inch) valves shall have threaded ends

c. bodies for valves 50 to 80 mm (2 to 3 inches) shall be of brass, bronze or iron.

d. bodies for valves 65 mm (2.5 inches) and larger shall be provided with flanged-end connections.

e. for modulating applications, valve Kv (Cv) shall be within 100 to 125% of the Kv (Cv) shown.

f. for two position applications (where the two positions are full open and full closed) the Kv (Cv) shall be the largest available for the valve size.

f. valve and actuator combination shall be normally open or normally closed as shown.

2.6.1 Ball Valves
Balls shall be stainless steel or nickel plated brass. Valves shall have blow-out proof stems. In steam and high temperature hot water applications, the valve-to-actuator linkage shall provide a thermal break.

2.6.2 Butterfly Valves
Butterfly valves shall be threaded lug type suitable for dead-end service and modulation to the fully-closed position, with carbon-steel bodies and non-corrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from (-20 to +250 degreesF). The rated (Cv) for butterfly valves shall be the value (Cv) at 70% (60 degrees) open position. Valve leakage shall meetANSI/FCI 70-2 Class VI leakage rating.

2.6.3 Two-Way Valves
Two-way modulating valves used for liquids shall have an equal-percentage characteristic. Two-way modulating valves used for steam shall have a linear characteristic.

2.6.4 Three-Way Valves
Three-way modulating valves shall provide equal percentage flow control with constant total flow throughout full plug travel.

2.6.5 Duct-Coil and Terminal-Unit-Coil Valves
Control valves with either flare-type or solder-type ends shall be provided for duct or terminal-unit coils. Flare nuts shall be provided for each flare-type end valve.

2.6.6 Valves for Chilled-Water, Condenser-Water, and Glycol ServiceValve internal trim shall be Type 316 stainless steel. Valves (4 inches) and larger shall be butterfly valves.

2.6.7 Valves for High-Temperature Hot-Water, Hot-Water and Dual Temperature Service
Valves for hot water service between (210 degreesF) and (250 degreesF) and dual-temperature service shall have internal trim (including seats, seat rings, modulating plugs, and springs) of Type 316 stainless steel. Internal trim for valves controlling water below (210 degreesF) shall be brass, bronze or Type 316 stainless steel. Nonmetallic valve parts shall be suitable for a minimum continuous operating temperature of (250 degreesF) or (50 degreesF) above the system design temperature, whichever is higher. Valves (4 inches) and larger shall be butterfly valves. For high-temperature hot water service above (250 degreesF) valve bodies shall be carbon steel, globe type with welded ends on valves (1 inch) and larger. Valves smaller than (1 inch) shall have socket-weld ends. Packing shall be virgin polytetrafluoroethylene (PTFE). Internal valve trim shall be Type 316 stainless steel.

2.6.8 Valves for Steam Service
Bodies for valves (4 inches) and larger shall be iron or carbon steel. Internal valve trim shall be Type 316 stainless steel. If the specified (Cv) is not available the valve manufacturer's next largest size shall be used.

2.7 DAMPERS

2.7.1 Damper Assembly
A single damper section shall have blades no longer than (48 inch) and shall be no higher than (72 inch). Maximum damper blade width shall be (8in). Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream. Damper axles shall be (0.5 inch) minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed (0.04 inches water gauge) at (1,000ft/min) in the wide-

open position. Frames shall not be less than (2 inch)in width. Dampers shall be tested in accordance with AMCA 500-D.

2.7.2 Operating Linkages
Operating links external to dampers, such as crank arms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers, shall withstand a load equal to at least 300% of the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crank arms shall control the open and closed positions of dampers.

2.7.3 Damper Types

2.7.3.1 Flow Control Dampers
Outside air, return air, relief air, exhaust, face and bypass dampers shall be provided where shown and shall be parallel-blade or opposed blade type as shown on the Damper Schedule. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Unless otherwise shown, dampers shall be AMCA 500-D Class 2 and shall not leak in excess of (20cfm per square foot) at (4 inches water gauge) static pressure when closed. Outside air damper seals shall be suitable for an operating temperature range of (-40 to +167 degreesF). Dampers shall be rated at not less than (2000ft/min) air velocity.

2.7.3.2 Mechanical Rooms and Other Utility Space Ventilation Dampers
Utility space ventilation dampers shall be as shown. Unless otherwise shown, dampers shall be AMCA 500-D class 4 and shall not leak in excess of (80cfm per square foot) at (4 inches water gauge) static pressure when closed. Dampers shall be rated at not less than (1500ft/min) air velocity.

2.7.3.3 Smoke Dampers
Smoke-damper and actuator assembly shall meet the current requirements of NFPA 90A, UL 555, and UL 555S. Combination fire and smoke dampers shall be rated for (250 degreesF) Class II leakage per UL 555S.

2.8 SENSORS AND INSTRUMENTATION
Unless otherwise specified, sensors and instrumentation shall incorporate an integral transmitter or be provided with a transmitter co-located with the sensor. Sensors and instrumentation, including their transmitters, shall meet the specified accuracy and drift requirements at the input of the connected DDC Hardware's analog-to-digital conversion. Sensors and instrumentation, including their transmitters, shall meet or exceed the specified range.

2.8.1 Transmitters
The transmitter shall match the characteristics of the sensor. Transmitters providing analog values shall produce a linear 4-20 mAdc, 0-10 Vdc or SNVT output

corresponding to the required operating range and shall have zero and span adjustment. Transmitters providing binary values shall have dry contacts or SNVT output. Transmitters with SNVT output are Application Specific Controllers (ASCs) and shall meet all ASC requirements. (note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE)

2.8.2 Temperature Sensors

2.8.2.1 Sensor Ranges and Accuracy
Temperature sensors may be provided without transmitters Temperature sensors, including transmitter if used, shall have minimum operating ranges, minimum accuracy and maximum drift as specified below for the application:
a. Conditioned Space Temperature

(1) Operating Range:(+50 to +86 degrees F)
(2) Accuracy: +/- (1 degree F) over the operating range.
(3) Drift: Maximum (1 degree F) per year
b. Unconditioned Space Temperature
(1) Operating Range: (+20 to +150 degrees F)
(2) Accuracy: +/- (1 degree F) over the range of (+30 to +131 degrees F) and +/-(4 degrees F) over the rest of the operating range.
(3) Drift: Maximum (1 degree F) per year
c. Duct Temperature
(1) Operating Range:(+40 to +140 degrees F)
(2) Accuracy: +/-(2 degrees F).
(3) Drift: Maximum (2 degrees F) per year.
d. Outside Air Temperature
(1) Operating Range: (-30 to 130 degrees F).
(2) Accuracy:
(a) +/- (2 degrees F) over the range of (-30 to +130 degrees F).
(b) +/-(1 degree F) over the range of (+30 to +100 degrees F).
(3) Drift: Maximum (1 degree F) per year.
e. High Temperature Hot Water
(1) Operating Range: (+150 to +450 degrees F).
(2) Accuracy: +/-(3.6 degrees F).
(3) Drift: Maximum +/- (2 degrees F) per year.
f. Chilled Water
(1) Operating Range: (+30 to +100 degrees F)
(2) Accuracy: +/-(0.8 degrees F) over the range of(+35 to +65 degrees F) and +/- (2 degrees F) over the rest of the operating range
(3) Drift: Maximum(0.8 degrees F) per year
g. Dual Temperature Water
(1) Operating Range: (+30 to +240 degrees F)
(2) Accuracy: +/- (2 degrees F).
(3) Drift: Maximum (2 degrees F) per year
h. Heating Hot Water

(1) Operating Range: (+70 to +250 degrees F)
(2) Accuracy: +/-(2 degreesF).
(3) Drift: Maximum (2 degrees F) per year
i. Condenser Water
(1) Operating Range:(+30 to +130 degrees F)
(2) Accuracy: +/- (1 degree F).
(3) Drift: Maximum(1 degree F) per year

2.8.2.2 Point Temperature Sensors
Point Sensors shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper.

2.8.2.3 Averaging Temperature Sensors
Averaging sensors shall be a continuous element with a minimum length equal to 3m per square meter (1 foot per square foot) of duct cross-sectional area at the installed location. The sensing element shall have a bendable copper sheath.

2.8.2.4 Thermowells
Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, (2 inch) lagging neck and extension type well. Inside diameter and insertion length shall be as required for the application.

2.8.3 Relative Humidity Sensor
Relative humidity sensors shall use bulk polymer resistive or thin film capacitive type non-saturating sensing elements capable of withstanding a saturated condition without permanently affecting calibration or sustaining damage. The sensors shall include removable protective membrane filters. Where required for exterior installation, sensors shall be capable of surviving below freezing temperatures and direct contact with moisture without affecting sensor calibration. When used indoors, the sensor shall be capable of being exposed to a condensing air stream (100% RH) with no adverse effect to the sensor's calibration or other harm to the instrument. The sensor shall be of the wall-mounted or duct-mounted type, as required by the application, and shall be provided with any required accessories. Sensors used in duct high-limit applications shall have a bulk polymer resistive sensing element. Duct-mounted sensors shall be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage.Relative humidity (RH) sensors shall measure relative humidity over a range of 0% to 100% with an accuracy of +/-3%. RH sensors shall function over a temperature range of (25 to 130 degrees F) and shall not drift more than 2% per year.

2.8.4 Carbon Dioxide (CO2) Sensors
Carbon dioxide (CO2) sensors shall measure CO2 concentrations between 0 to 1000 parts per million (ppm) using non-dispersive infrared (NDIR) technology with an accuracy of +/-75 ppm and a maximum response time of 1 minute. The sensor shall be rated for operation at ambient air temperatures within the range of (32 to 122 degrees F) and relative humidity within the range of 0 to 95% (non-condensing). The sensor shall have a maximum drift of 2%.The sensor chamber shall be manufactured with a non-corrosive

material (such as gold-plating) that does not affect carbon dioxide sample concentration. Duct mounted sensors shall be provided with a duct probe designed to protect the sensing element from dust accumulation and mechanical damage.

2.8.5 Differential Pressure Instrumentation

2.8.5.1 Differential Pressure Sensors
Differential Pressure Sensor range shall be as shown or as required for the application. Pressure sensor ranges shall not exceed the high end range shown on the Points Schedule by more than 50%. The over pressure rating shall be a minimum of 150% of the highest design pressure of either input to the sensor. The accuracy shall be +/-2% of full scale.

2.8.5.2 Differential Pressure Switch
The switch shall have a user-adjustable setpoint. The setpoint shall not be in the upper or lower quarters of the range. The over pressure rating shall be a minimum of 150% of the highest design pressure of either input to the sensor. The switch shall have two sets of contacts and each contact shall have a rating greater than it's connected load. Contacts shall open or close upon rise of pressure above the setpoint or drop of pressure below the setpoint as shown.

2.8.6 Flow Sensors

2.8.6.1 Airflow Measurement Array (AFMA)
AFMAs shall contain an airflow straightener if required by the AFMA manufacturer's published installation instructions. The straightener shall be contained inside a flanged sheet metal casing, with the AMFA located as specified according to the published recommendation of the AFMA manufacturer. In the absence of published documentation airflow straighteners shall be provided if there is any duct obstruction within 5 duct diameters upstream of the AFMA. Air-flow straighteners, where required, shall be constructed of (.125 inch) aluminum honeycomb and the depth of the straightener shall not be less than (1.5 inches).The resistance to air flow through the AFMA, including the airflow straightener shall not exceed (0.08 inch water gauge) at an airflow of (2,000 fpm). AFMA construction shall be suitable for operation at airflows of up to(5,000 fpm) over a temperature range of(+40 to +120 degrees F).In outside air measurement or in low-temperature air delivery applications, the AFMA shall be certified by the manufacturer to be accurate as specified over a temperature range of (-20 to +120 degreesF).

a. Pitot Tube AFMA: Each Pitot Tube AFMA shall contain an array of velocity sensing elements. The velocity sensing elements shall be of the multiple pitot tube type with averaging manifolds. The sensing elements shall be distributed across the duct cross section in the quantity and pattern specified by the published installation instructions of the AFMA manufacturer.Pitot Tube AFMAs shall have an accuracy of +/-3% over a range of(500 to 2,500fpm).

b. Electronic AFMA: Each electronic AFMA shall consist of an array of velocity sensing elements of the resistance temperature detector (RTD) or thermistor type. The sensing

elements shall be distributed across the duct cross section in the quantity and pattern specified by the published application data of the AFMA manufacturer.
Electronic AFMAs shall have an accuracy of +/-3% percent over a range of (125 to 2,500 fpm) and the output shall be temperature compensated over a range of (32 to 212 degrees F).

2.8.6.2 Orifice Plate
Orifice plate shall be made of an austenitic stainless steel sheet of (0.125 inch) nominal thickness with an accuracy of +/-1% of full flow. The orifice plate shall be flat within (0.002 inches). The orifice surface roughness shall not exceed (20 micro-inches). The thickness of the cylindrical face of the orifice shall not exceed 2% of the pipe inside diameter or 12.5% of the orifice diameter, whichever is smaller. The upstream edge of the orifice shall be square and sharp. Where orifice plates are used, concentric orifice plates shall be used in all applications except steam flow measurement in horizontal pipelines.

2.8.6.3 Flow Nozzle
Flow nozzle shall be made of austenitic stainless steel with an accuracy of +/-1% of full flow. The inlet nozzle form shall be elliptical and the nozzle throat shall be the quadrant of an ellipse. The thickness of the nozzle wall and flange shall be such that distortion of the nozzle throat from strains caused by the pipeline temperature and pressure, flange bolting, or other methods of installing the nozzle in the pipeline shall not cause the accuracy to degrade beyond the specified limit. The outside diameter of the nozzle flange or the design of the flange facing shall be such that the nozzle throat shall be centered accurately in the pipe.

2.8.6.4 Venturi Tube
Venturi tube shall be made of cast iron or cast steel and shall have an accuracy of +/-1% of full flow. The throat section shall be lined with austenitic stainless steel. Thermal expansion characteristics of the lining shall be the same as that of the throat casting material. The surface of the throat lining shall be machined to a +/- (50 micro inch) finish, including the short curvature leading from the converging entrance section into the throat.

2.8.6.5 Annular Pitot Tube
Annular pitot tube shall be made of austenitic stainless steel with an accuracy of +/-2% of full flow and a repeatability of +/-0.5% of measured value. The unit shall have at least one static port and no less than four total head pressure ports with an averaging manifold.

2.8.6.6 Insertion Turbine Flowmeter
Insertion Turbine Flowmeter accuracy shall be +/-1% of reading for a minimum turndown ratio of 1:1 through a maximum turndown ratio of 50:1. Repeatability shall be +/-0.25% of reading. The meter flow sensing element shall operate over a range suitable for the installed location with a pressure loss limited to 1% of operating pressure at maximum flow rate. Design of the flowmeter probe assembly shall

incorporate integral flow, temperature, and pressure sensors. The turbine rotor assembly shall be constructed of Series 300 stainless steel and use Teflon seals.

2.8.6.7 Vortex Shedding Flowmeter
Vortex Shedding Flowmeter accuracy shall be within +/-0.8% of the actual flow. The flow meter body shall be made of austenitic stainless steel. The vortex shedding flowmeter body shall not require removal from the piping in order to replace the shedding sensor.

2.8.6.8 Positive Displacement Flow Meter
The flow meter shall be a direct reading, gerotor, nutating disk or vane type displacement device rated for liquid service as shown. A counter shall be mounted on top of the meter, and shall consist of a non-resettable mechanical totalizer for local reading, and a pulse transmitter for remote reading. The totalizer shall have a six digit register to indicate the volume passed through the meter in gallons, and a sweep-hand dial to indicate down to 0.25 gallons. The pulse transmitter shall have a hermetically sealed reed switch which is activated by magnets fixed on gears of the counter. The meter shall have a bronze body with threaded or flanged connections as required for the application. Output accuracy shall be +/-2% of the flow range. The maximum pressure drop at full flow shall be (5psig).

2.8.6.9 Flow Meters, Paddle Type
Sensor shall be non-magnetic, with forward curved impeller blades designed for water containing debris. Sensor accuracy shall be +/-2% of rate of flow, minimum operating flow velocity shall be (1 foot per second). Sensor repeatability and linearity shall be +/-1%. Materials which will be wetted shall be made from non-corrosive materials and shall not contaminate water. The sensor shall be rated for installation in pipes of (3 to 40 inch) diameters. The transmitter housing shall be a NEMA 250 Type 4 enclosure.

2.8.6.10 Flow Switch
Flow switch shall have a repetitive accuracy of +/-10% of actual flow setting. Switch actuation shall be adjustable over the operating flow range. The switch shall have Form C snap-action contacts, rated for the application. The flow switch shall have non flexible paddle with magnetically actuated contacts and be rated for service at a pressure greater than the installed conditions. Flow switch for use in sewage system shall be rated for use in corrosive environments encountered.

2.8.6.11 Gas Utility Flow Meter
Gas utility flow meter shall be diaphragm or bellows type (gas positive displacement meters) for flows up to (2500 SCFH) and axial flow turbine type for flows above(2500 SCFH), designed specifically for natural gas supply metering, and rated for the pressure, temperature, and flow rates of the installation. Meter shall have a minimum turndown ratio of 10 to 1 with an accuracy of +/-1% of actual flow rate. The meter index shall include a direct reading mechanical totalizing register and electrical impulse dry contact output for remote monitoring. For gas flows of less than (1500 cubic feet/second), the electrical impulse dry contact output shall provide not less than 1 pulse per (100 cubic

feet) of gas and shall not exceed 15 pulses per second for the installed application. For gas flows(1500 cubic-feet/second) or greater, the pulse rate shall not be the greatest pulse-rate available but not to exceed 15 pulses per second for the installed application. The electrical impulse dry contact output shall not require field adjustment or calibration.

2.8.7 Electrical Instruments
Electrical Instruments shall have an input range as shown or sized for the application. Unless otherwise specified, AC instrumentation shall be suitable for 60 Hz operation.

2.8.7.1 Watt or Watthour Transducers
Watt transducers shall measure voltage and current and shall output kW, kWh, or kW and kWh as shown. kW outputs shall have an accuracy of +/-0.25% over a power factor range of .1 to 1. kWh outputs shall be a pulse output and shall have an accuracy of +/-0.5% over a power factor range of .1 to 1.

2.8.7.2 Watthour Revenue Meter (with and without Demand Register)
All Watthour revenue meters shall measure voltage and current and shall be in accordance with ANSI C12.1 with an ANSI C12.20 Accuracy class of 0.2 and shall have pulse initiators for remote monitoring of Watthour consumption. Pulse initiators shall consist of form C contacts with a current rating not to exceed two amperes and voltage not to exceed 500 V, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations. Meter sockets shall be in accordance with ANSI C12.10.Watthour revenue meters with demand registers shall have an analog output for instantaneous demand in addition to the pulse initiators.

2.8.7.3 Current Transducers
Current transducers shall accept an AC current input and shall have an accuracy of +/-2% of full scale. An integral power supply shall be provided if required for the analog output signal. The device shall have a means for calibration.

2.8.7.4 Current Sensing Relays (CSRs)
Current sensing relays (CSRs) shall provide a normally-open contact with a voltage and amperage rating greater than its connected load. Current sensing relays shall be of split-core design. The CSR shall be rated for operation at 200% of the connected load. Voltage isolation shall be a minimum of 600 volts. The CSR shall auto-calibrate to the connected load.

2.8.7.5 Voltage Transducers
Voltage transducers shall accept an AC voltage input and have an accuracy of +/-0.25% of full scale. An integral power supply shall be provided if required for the analog output signal. The device shall have a means for calibration. Line side fuses for transducer protection shall be provided.

2.8.8 pH Sensor
The sensor shall be suitable for applications and chemicals encountered in water treatment systems of boilers, chillers and condenser water systems. Construction, wiring,

fittings and accessories shall be corrosion and chemical resistant with fittings for tank or suspension installation. Housing shall be polyvinylidene fluoride with O-rings made of chemical resistant materials which do not corrode or deteriorate with extended exposure to chemicals. The sensor shall be encapsulated. Periodic replacement shall not be required for continued sensor operation. Sensors shall use a ceramic junction and pH sensitive glass membrane capable of withstanding a pressure of (100 psig at 150 degrees F). The reference cell shall be double junction configuration. Sensor range shall be 0 to 12 pH, stability 0.05, sensitivity 0.02, and repeatability of +/-.05 pH value, response of 90% of full scale in one second and a linearity of 99% of theoretical electrode output measured at (76 degreesF).

2.8.9 Oxygen Analyzer
Oxygen analyzer shall consist of a zirconium oxide sensor for continuous sampling and an air-powered aspirator to draw flue gas samples. The analyzer shall be equipped with filters to remove flue air particles. Sensor probe temperature rating shall be (815 degrees F). The sensor assembly shall be equipped for flue flange mounting.

2.8.10 Carbon Monoxide Analyzer
Carbon monoxide analyzer shall consist of an infrared light source in a weather proof steel enclosure for duct or stack mounting. An optical detector/analyzer in a similar enclosure, suitable for duct or stack mounting shall be provided. Both assemblies shall include internal blower systems to keep optical windows free of dust and ash at all times. The third component of the analyzer shall be the electronics cabinet. Automatic flue gas temperature compensation and manual/automatic zeroing devices shall be provided. Unit shall read parts per million (ppm) of carbon monoxide in the range of 0 to500 ppm and the response time shall be less than 3 seconds to 90% value. Unit measurement range shall not exceed specified range by more that 50%. Repeatability shall be +/-2% of full scale with an accuracy of +/-3% of full scale.

2.8.11 Occupancy Sensors
Occupancy sensors shall have occupancy-sensing sensitivity adjustment and an adjustable off-delay timer with a range encompassing 30 seconds to 15 minutes. Occupancy sensors shall be rated for operation in ambient air temperatures ranging from (50 degreesF) to (104 degreesF) or temperatures normally encountered in the installed location. Sensors integral to wall mount on-off light switches shall have an auto-off switch. Wall switch sensors shall be decorator style and shall fit behind a standard decorator type wall plate. All occupancy sensors, power packs, and slave packs shall be UL listed.In addition to any outputs required for lighting control, the occupancy sensor shall provide a contact output rated at 1A at 24 Vac or a SNVT output.

2.8.11.1 Passive Infrared (PIR) Occupancy Sensors
PIR occupancy sensors shall have a multi-level, multi-segmented viewing lens and a conical field of view with a viewing angle of 180 degrees and a detection of at least 6 meters (20 feet) unless otherwise shown or specified. PIR Sensors shall provide field-adjustable background light-level adjustment with an adjustment range suitable to the

light level in the sensed area, room or space. PIR sensors shall be immune to false triggering from RFI and EMI.

2.8.11.2 Ultrasonic Occupancy Sensors
Ultrasonic sensors shall operate at a minimum frequency 32 kHz and shall be designed to not interfere with hearing aids.

2.8.11.3 Dual-Technology Occupancy Sensor (PIR and Ultrasonic)
Dual-Technology Occupancy Sensors shall meet the requirements of both PIR and Ultrasonic Occupancy Sensors.

2.8.12 Vibration Switch
Vibration switch shall be solid state, enclosed in a NEMA 250 Type 4 or Type 4X housing with sealed wire entry. Unit shall have two independent sets of Form C switch contacts with one set to shutdown equipment upon excessive vibration and a second set for monitoring alarm level vibration. The vibration sensing range shall be a true rms reading, suitable for the application. The unit shall include either displacement response for low speed or velocity response for high speed application. The frequency range shall be at least 2 Hz to 200 Hz. Contact time delay shall be 3 seconds. The unit shall have independent start-up and running delay on each switch contact. Alarm limits shall be adjustable and setpoint accuracy shall be +/-10% of setting with repeatability of plus or minus 2%.

2.8.13 Conductivity Sensor
Sensor shall include local indicating meter and shall be suitable for measurement of conductivity of water in boilers, chilled water systems, condenser water systems, distillation systems, or potable water systems as shown. Sensor shall sense from 0 to 10 microSeimens per centimeter (uS/cm) for distillation systems, 0 to 100 uS/cm for boiler, chilled water, and potable water systems and 0 to 1000 uS/cm for condenser water systems. Contractor shall field verify the ranges for particular applications and adjust the range as required. The output shall be temperature compensated over a range of (32 to 212 degreesF). The accuracy shall be +/-2% of the full scale reading. Sensor shall have automatic zeroing and shall require no periodic maintenance or recalibration.

2.8.14 Compressed Air Dew Point Sensor
Sensor shall be suitable for measurement of dew point from (-40 to +80 degreesF) over a pressure range of (0 to 150 psig). The transmitter shall provide both dry bulb and dew point temperatures on separate outputs. The end to end accuracy of the dew point shall be (+/-5 degreesF) and the dry bulb shall be (+/-1 degreeF). Sensor shall be automatic zeroing and shall require no normal maintenance or periodic recalibration.

2.8.15 NOx Monitor
Monitor shall continuously monitor and give local indication of boiler stack gas for NOx content. It shall be a complete system designed to verify compliance with the Clean Air Act standards for NOx normalized to a 3% oxygen basis and shall have a range of from 0 to 100 ppm. Sensor shall be accurate to +/-5 ppm. Sensor shall output NOx and oxygen

levels and binary output that changes state when the NOx level is above a locally adjustable NOx setpoint. Sensor shall have normal, trouble and alarm lights. Sensor shall have heat traced lines if the stack pickup is remote from the sensor. Sensor shall be complete with automatic zero and span calibration using a timed calibration gas system, and shall not require periodic maintenance or recalibration.

2.8.16 Turbidity Sensor
Sensor shall include a local indicating meter and shall be suitable for measurement of turbidity of water. Sensor shall sense from 0 to 1000 Nephelometric Turbidity Units (NTU). Range shall be field-verified for the particular application and adjusted as required. The output shall be temperature compensated over a range of (0 to 212 degreesF). The accuracy shall be +/-5% of full scale reading. Sensor shall have automatic zeroing and shall not require periodic maintenance or recalibration.

2.8.17 Chlorine Detector
The detector shall measure concentrations of chlorine in water in the range 0 to 20 ppm with a repeatability of +/-1% of full scale and an accuracy of +/-2% of full scale. The Chlorine Detector transmitter shall be housed in a non-corrosive NEMA 250 Type 4X enclosure. Detector shall include a local panel with adjustable alarm trip level, local audio and visual alarm with silence function.

2.8.18 Floor Mounted Leak Detector
Leak detectors shall use electrodes mounted at slab level with a minimum built-in-vertical adjustment of (0.125 inches). Detector shall have a binary output. The indicator shall be manual reset type.

2.8.19 Temperature Switch

2.8.19.1 Duct Mount Temperature Low Limit Safety Switch (Freezestat)
Duct mount temperature low limit switches (Freezestats) shall be manual reset, low temperature safety switches with a minimum element length of 3m per square meter (1 foot per square-foot) of coverage which shall respond to the coldest (18 inch) segment with an accuracy of +/- (3.6 degreesF). The switch shall have a field-adjustable setpoint with a range of at least (+30 to +50 degreesF). The switch shall have two sets of contacts, and each contact shall have a rating greater than its connected load. Contacts shall open or close upon drop of temperature below setpoint as shown and shall remain in this state until reset. The switch shall be temperature compensated.(9-18-08)

2.8.19.2 Pipe Mount Temperature Limit Switch (Aquastat)
Pipe mount temperature limit switches (aquastats) shall have a field adjustable setpoint between(60 to 90 degreesF), an accuracy of +/- (3.6 degreesF) and a (10 degreesF) fixed deadband.The switch shall have two sets of contacts, and each contact shall have a rating greater than its connected load. Contacts shall open or close upon change of temperature above or below setpoint as shown.

2.8.20 Damper End Switches

Each end switch shall be a hermetically sealed switch with a trip lever and over-travel mechanism. The switch enclosure shall be suitable for mounting on the duct exterior and shall permit setting the position of the trip lever that actuates the switch. The trip lever shall be aligned with the damper blade.

2.9 INDICATING DEVICES
All indicating devices shall display readings in English (inch-pound)] units.

2.9.1 Thermometers
Thermometers shall not contain mercury. Unless otherwise specified, thermometers shall have an accuracy of +/-3% of scale range. Thermometers shall have a range suitable for the application with an upper end of the range not to exceed 150% of the design upper limit.

2.9.1.1 Piping System Thermometers
Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 230 mm (9 inch) scale. Piping system thermometers shall have an accuracy of +/-1% of scale range. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern. Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

2.9.1.2 Air-Duct Thermometers
Air-duct thermometers shall have perforated stem guards and 45-degree adjustable duct flanges with locking mechanism.

2.9.2 Pressure Gauges
Gauges shall be suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Gauge range shall be suitable for the application with an upper end of the range not to exceed 150% of the design upper limit. Accuracy shall be +/-3% of scale range. Gauges shall meet requirements of ASME B40.1.

2.9.3 Low Differential Pressure Gauges
Gauges for low differential pressure measurements shall be a minimum of 90 mm (3.5 inch) (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauge range shall be suitable for the application with an upper end of the range not to exceed 150% of the design upper limit. Accuracy shall be plus or minus two percent of scale range.

2.10 OUTPUT DEVICES
Output Devices with SNVT input are ASCs and shall meet all ASC requirements in addition to the output device requirements. (note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE.)

2.10.1 Actuators

Actuators shall be electric (electronic). All actuators shall be normally open (NO), normally closed (NC) or fail-in-last-position (FILP) as shown. Normally open and normally closed actuators shall be of mechanical spring return type. Electric actuators shall have an electronic cut off or other means to provide burnout protection if stalled. Actuators shall have a visible position indicator. Electric actuators shall provide position feedback to the controller as shown. Actuators shall smoothly open or close the devices to which they are applied. Electric actuators shall have a full stroke response time in both directions of 90 seconds or less at rated load. Electric actuators shall be the direct-coupled type. Where multiple electric actuators operate from a common signal, the actuators shall provide an output signal identical to its input signal to the additional devices.

2.10.1.1 Valve Actuators

Valve actuators shall provide shutoff pressures and torques as shown on the Valve Schedule.

2.10.1.2 Damper Actuators

Damper actuators shall provide the torque necessary per damper manufacturer's instructions to modulate the dampers smoothly over its full range of operation and torque shall be at least .7 Nm (6 inch-pounds) per .93 square meters (1 square foot) of damper area for opposed blade dampers and 1 Nm (9 inch-pounds) per .93 square meters (1 square foot) of damper area for parallel blade dampers.

2.10.2 Relays

Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts enclosed in a dust proof enclosure. Each set of contacts shall incorporate a normally open (NO), normally closed (NC) and common contact. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150% of rated coil voltage.

2.11 USER INPUT DEVICES

User Input Devices, including potentiometers, switches and momentary contact push-buttons with SNVT output are Application Specific Controllers (ASCs) and shall meet all ASC requirements. (note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE) Potentiometers shall be of the thumb wheel or sliding bar type. Momentary Contact Push-Buttons may include an adjustable timer for their output. User input devices shall be labeled for their function.

2.12 MULTIFUNCTION DEVICES

Multifunction devices are products which combine the functions of multiple sensor, user input or output devices into a single product. Unless otherwise specified, the multifunction device shall meet all requirements of each component device. Where the requirements for the component devices conflict, the multifunction device shall meet the most stringent of the requirements.

2.12.1 Current Sensing Relay Command Switch
The Current Sensing Relay portion shall meet all requirements of the Current Sensing Relay input device. The Command Switch portion shall meet all requirements of the Relay output device except that it shall have at least one normally-open (NO) contact.

2.12.2 Thermostats
Thermostats shall be multifunction devices incorporating a temperature sensor and a temperature indicating device. Thermostats shall not contain mercury (Hg).
In addition, the thermostat shall have the following as specified and shown:

a. A User Input Device which shall adjust a temperature setpoint output.
b. A User Input Momentary Contact Button and an output indicating zone occupancy.
c. A three position User Input Switch labeled to indicate heating, cooling and off positions ('HEAT-COOL-OFF' switch) and providing corresponding outputs.
d. A two position User Input Switch labeled with 'AUTO' and 'ON' positions and providing corresponding outputs.
e. A multi-position User Input Switch with 'OFF' and at least two fan speed positions and providing corresponding outputs.

2.13. Flexible Pipe Connections
The flexible pipe connections shall be designed for (150 psi and 250 degreesF) service, and shall be constructed of rubber or tetrafluoroethylene resin tubing with a reinforcing protective cover of braided corrosion-resistant steel, bronze, monel, or galvanized steel. The connectors shall be suitable for the service intended and shall have threaded or soldered ends. The length of the connectors shall be as recommended by the manufacturer for the service intended.

2.13.1 Vibration Isolation Units
The vibration isolation units shall be standard products with published loading ratings, and shall be single rubber-in-shear, double rubber-in-shear, or spring type.

2.14 DIRECT DIGITAL CONTROL (DDC) HARDWARE

2.14.1 General Requirements
All DDC Hardware shall meet the following requirements:

a. It shall incorporate a "service pin" which, when pressed will cause the DDC Hardware to broadcast its 48-bit NodeID and its ProgramID over the network. The service pin shall be distinguishable and accessible.

b. It shall incorporate a light to indicate the device is receiving power.

c. It shall incorporate a TP/FT-10 transceiver in accordance with ANSI/EIA 709.3 and connections for TP/FT-10 control network wiring. It shall not have connections to any other network media type.

d. It shall not have connections to any other network media type.

e. It shall communicate on the network using only the ANSI/EIA 709.1B protocol.

f. It shall be locally powered; link powered devices are not acceptable.

g. LonMark external interface files (XIF files), as defined in the LonMark XIF Guide, shall be submitted for each type of DDC Hardware.

h. Application programs and configuration settings shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration settings.

i. It shall have all functionality specified and required to support the application (Sequence of Operation or portion thereof) in which it is used, including but not limited to:

(1) It shall provide input and output SNVTs as specified and required to support the sequence and application in which it is used.

(2) It shall be configurable via standard or user-defined configuration parameters (SCPT or UCPT), SNVT network configuration inputs (nci), or hardware settings on the controller itself as specified and as required to support the sequence and application in which it is used.

i. It shall meet FCC Part 15 requirements and have UL 916 or equivalent safety listing.

2.14.2 Hardware Input-Output (I/O) Functions
DDC Hardware incorporating hardware input-output (I/O) functions shall meet the following requirements:

a. Analog Inputs: DDC Hardware analog inputs (AIs) shall perform analog to digital (A-to-D) conversion with a minimum resolution of 8 bits plus sign or better as needed to meet the accuracy requirements specified in paragraph INPUT MEASUREMENT ACCURACY. Signal conditioning including transient rejection shall be provided for each analog input. Analog inputs shall be capable of being individually calibrated for zero and span. The AI shall incorporate common mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10,000 ohms.

b. Analog Outputs: DDC Hardware analog outputs (AOs) shall perform digital to analog (D-to-A) conversion with a minimum resolution of 8 bits plus sign, and output a signal with a range of 4-20 mAdc or 0-10 Vdc. Analog outputs shall be capable of being individually calibrated for zero and span.

c. Binary Inputs: DDC Hardware binary inputs (BIs) shall accept contact closures and shall ignore transients of less than 5 milli-second duration. Isolation and protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

d. Binary Outputs: DDC Hardware binary outputs (BOs) shall provide relay contact closures or triac outputs for momentary and maintained operation of output devices.
(1) Relay Contact Closures: Closures shall have a minimum duration of 0.1 second. Relays shall provide at least 180V of isolation. Electromagnetic interference suppression shall be provided on all output lines to limit transients to non-damaging levels. Minimum contact rating shall be one ampere at 24 Vac.
(2) Triac outputs: Triac outputs shall provide at least 180 V of isolation.

e. Pulse Accumulator: DDC Hardware pulse accumulators shall have the same characteristics as the BI. In addition, a buffer shall be provided to totalize pulses. The pulse accumulator shall accept rates of at least 20 pulses per second. The totalized value shall be reset to zero upon operator's command.

2.14.3 Application Specific Controller (ASC)
Application Specific Controllers (ASCs) have a fixed factory-installed application program (i.e. Program ID) with configurable settings. ASCs shall meet the following requirements in addition to the General DDC Hardware and DDC Hardware Input-Output (I/O) Function requirements:

a. ASC’s shall be LonMark Certified.

b. Unless otherwise approved, all necessary Configuration Parameters and network configuration inputs (ncis) for the sequence and application in which the ASC is used shall be fully configurable through an LNS plug-in. This plug-in shall be submitted as specified for each type of ASC (manufacturer and model). (note: configuration accomplished via hardware settings does not require configuration via plug-in)

2.14.3.1 Local Display Panel (LDP)
The Local Display Panel shall be an Application Specific Controller (ASC) with a display and navigation buttons. It shall provide display and adjustment of SNVT inputs and SNVT outputs as shown.

2.14.4 General Purpose Programmable Controller (GPPC)
A General Purpose Programmable Controller (GPPC) is not installed with a fixed factory-installed application program. GPPCs shall meet the following requirements in addition to the general DDC Hardware requirements and Hardware Input-Output (I/O) Function:

a. The programmed GPPC shall conform to the LonMark Interoperability Guide.

b. All programming software required to program the GPPC shall be delivered to and licensed to the project site as specified.

c. Copies of the installed GPPC application programs as source code compatible with the supplied programming software shall be submitted as specified. The submitted GPPC application program shall be the complete application necessary for the GPPC to function as installed and be sufficient to allow replacement of the installed controller with a GPPC of the same type.

2.15 COMPUTER HARDWARE

2.15.1 LNS CPU Hardware

Contractor provided Computer Hardware shall be a standard unmodified digital computer of modular design currently being manufactured. The modular components of the server shall be products of a single manufacturer which advertises service in all 48 contiguous states. Computer hardware shall meet the following minimum requirements.

Windows XP Professional License (Army Gold Version to be loaded by DOIM prior to Contractor Loading Software, , Mouse & Keybord XP Compatible (USB);; 1 Gig/100 MB N); LNS Server Installed and Configured; LNS Database Resides on PC

a.), P4 Processor 2 GHz Minimum
b. Random Access Memory (RAM): Min 2 Gig Ram
c. Communications ports: One serial port, one enhanced parallel port and one USB port in addition to any ports required for the keyboard and mouse.
d. Hard Drives and Controller: 80 Gig SATA Hard Drive Minimum free space, not taking into account the size of the LNS applications for LNS network interface driver requirements**.**
e. CD/DVD-RW Drive: Combo CD-RW with 32x read, 24x write and 16x rewrite and DVD-RW with 12x read; 4x re-write; 2x write.
f. Floppy Disk Drive and controller: N/A
g. Video output card: Graphics card capable of 1280x1024 True color, 1 DVI, VGA & 1 S-Video (with add-in PCI-Express video card); **at a minimum refresh rate of 70 Hz.**
h. Network Interface Card (NIC): network Interface Card NIC10/100/1000 LAN, J45
i. Monitor: N/A
j. Keyboard: 101 key keyboard having a minimum 64 character standard ASCII character set based on ANSI INCITS 154.
k. Mouse: Optical 2-button mouse with a minimum resolution of 400 dots per inch.

2.15.2 Workstation Hardware (Desktop and Laptop) Government Furnished

2.16 COMPUTER SOFTWARE

2.16.1 Operating System (OS)
a. The operating system (OS) will be Government furnished and installed software for government furnished computer equipment;

b. The operating system(OS) and license for contractor furnished computer hardware shall be provided by the contractor. (04-02-08)

2.16.2 Office Automation Software
Office Automation Software shall consist of the [e-mail,]spreadsheet and word processing portions of the project site's standard office automation software. Government supplied.

2.16.3 Virus Protection Software
Virus Protection Software shall consist of the project site's standard virus protection software complete with a virus definition update subscription. Government supplied.

2.16.4 Not Used

2.16.5 ANSI/EIA 709.1B Network Configuration Tool

The network configuration tool shall meet the following minimum requirements:

a. It shall solely use LonWorks Network Services (LNS) for all network configuration and management of ANSI/EIA 709.1B devices.

b. It shall be capable of executing all LNS compliant plug-ins.(4-24-08)

c. It shall be capable of performing network database reconstruction of an ANSI/EIA 709.1B control network, such that if connected to an existing ANSI/EIA 709.1B network it has the ability to query the network and create an LNS database for that network and an associated network drawing.

d. It shall allow configuration of the network while off-line such that an operator may set up changes to the network while disconnected from the network, and then execute all of them once connected.

e. It shall have a graphics-based user interface capable of commissioning, operation, design and maintenance of the control network. It shall be able to display and print a graphical representation of the control network.(4-24-08)

f. It shall be capable of generating and printing the following reports:

(1) Table containing domain/subnet/node address and node identifier for the entire network or any subset thereof, selected by the user.

(2) Table containing Standard Network Variable (SNVT) input and output details for any ANSI/EIA 709.1B device on the network

(3) Table containing Standard and User-Defined Configuration Properties (SCPTs and UCPTs) for any ANSI/EIA 709.1B device on the network.

g. It shall be capable of merging two existing standard LNS databases into a single standard LNS database.

h. It shall support remote access via Lonworks or IP networks.(03-05-08)

i. It shall permit multiple applications and users to manage and interact simultaneously with a network. (3-05-08)

j. It shall allow mulitiple users to access a shared LNS server via the Lonworks network, a local area network(LAN), or the internet.(03-05-08)

k. It shall include software for an IP-852 routing interface. (03-05-08)

2.16.6 Monitoring and Control Software
The monitoring and control (M&C) software shall be an LNS client-server software and graphic package. The software shall accommodate [3000] points. The server software shall support clients as specified and shown and shall support no less than [_5__] clients simultaneously without requiring additional server software installation. M&C software shall reside on the BPOC.

2.16.6.1 Passwords
The M&C software shall provide access to user-based M&C functionality. The M&C software shall have at least 4 levels of user permissions. Passwords shall support a minimum of eight(8) alpha-numeric characters and symbols. Passwords shall prompt users to change passwords every 180 days. User permission levels (from most restrictive to most permissive) shall include:
(1) M&C
a. Permission Level 1: View System Graphic Displays.
b. Permission Level 2: Permission Level 1 plus acknowledge alarms and set up (configure) trends and reports.
c. Permission Level 3: Permission Level 2 plus override SNVTs and set up (configure) alarms, schedules and demand limiting
d. Permission Level 4: Permission Level 3 plus create and modify System Graphic Displays and create custom programs.
Passwords shall not be displayed. The system shall maintain a disk file logging all activity of the system. If the file format is not plain ASCII text, the Contractor shall provide a means to export or convert the file to plain ASCII text. This file shall maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. Passwords shall not be logged. The

activity log shall be maintained at the server hardware. The system shall automatically provide a mechanism for archiving the log files for long term record storage.

(2)BPOC(12/10/07)
The BPOC software shall provide access to user-based M&C functionality. The BPOC software shall have at least 3 levels of user permissions. Passwords shall support a minimum of eight(8) alpha-numeric characters and symbols. Passwords shall prompt users to change passwords every 180 days. User permission levels (from most restrictive to most permissive) shall include:

a. Permission Level 1: View System Graphic Displays plus acknowledge alarms and
b. set up (configure) trends and reports.

c. Permission Leve2: Permission Level 1 plus override SNVTs and set up (configure) alarms, schedules.

d. Permission Level 3: Permission Level 2 plus administrator rights, create and modify system graphic web pages and create custom programs. Passwords shall not be displayed. The system shall maintain a disk file logging all activity of the system. This file shall maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. Passwords shall be logged. The activity log shall be maintained at the server hardware. The system shall automatically provide a mechanism for archiving the log files for long term record storage.

2.16.6.2 Protocol Drivers

The BPOC Software shall include drivers to other (non-ANSI/EIA 709.1B) protocols. The protocol driver shall allow all M&C Software functions to write values to and read values from points on the legacy system. The M&C software shall support reading points from the legacy system and writing these values to SNVTs on the ANSI/EIA 709.1B network, and reading SNVTs from the ANSI/EIA 709.1B network and writing these values to points on the legacy network. Use of the driver to integrate additional legacy systems shall not require programming but may require configuration.

2.16.6.3 System Graphic Displays
The monitoring and control (M&C) software and BPOC shall include graphical displays through which an operator can perform real-time access and manipulation of the M&C functions as specified and shown. The graphical displays shall consist of building-level system (air handler units, VAV boxes, chillers, boilers etc) graphic displays, alarm displays, scheduling displays, trending displays. Data associated with an active display shall be updated at least once every 5 seconds.

a. Navigation Scheme: System graphic displays of building-level systems and points shall be hierarchical displays using a building-to-equipment point-and-click navigation scheme. Each display shall show the building name and number. Each display shall show system wide data such as outside air temperature and humidity in the case of an HVAC system application.

(1) Each Building or Building Sub-Area display shall show the building foot print and basic floor plan, and shall clearly show and distinguish between the individual zones and the equipment serving each zone and space. The building display shall also show all space sensor and status readings, as applicable, for the individual zones such as space temperature, humidity, occupancy status, etc. The building display shall show the locations of individual pieces of monitored and controlled equipment.

(2) Each equipment display shall show a1 line representation of the individual pieces of equipment using the symbols and M&C point data types as specified. Different colors and textures shall be used to indicate various components and real time data. Color and texture meanings shall be consistent across all displays.

(3) Each display shall clearly distinguish between the following
point data types and information:
(a) Real-time data.
(b) User-entered data.
(c) Overridden or operator-disabled points.
(d) Devices in alarm (unacknowledged).
(e) Out-of-range, bad, or missing data.

b. Navigation Commands: The system graphic displays shall support English language operator commands via point-and-click mouse or keyboard entry for defining and selecting points, parameters, graphics, report generation, and all other functions associated with operation. The operator commands shall be usable from any operator workstation with individual operator passwords as specified.

(1) Command Input: Operator's commands shall be full words andacronyms selected to allow operators to use the system without extensive training or any data processing backgrounds. The system shall prompt the operator in full words and acronyms for all required information, identifying acceptable command formats. The operator's response shall be a point-and-click selection, word, phrase, or acronym including parameters where required.

(2) Command Input Errors: The system shall supervise operator inputs to ensure they are correct for proper execution. Operator input assistance shall be provided whenever a command cannot be executed because of operator input errors. The system shall explain to the operator why the command cannot be executed.
Conditions for which operator error assist messages shall be generated include:
(a) The command used is incorrect or incomplete.
(b) The operator is restricted from using that command.
(c) The command addresses an out-of-range or bad data point.

(d) The command addresses a point that does not exist.
(e) The command would violate constraints.

(3) Special Functions: The system shall provide the following point-and-click mouse functions, in addition to all other commandsspecified**:**

(a) HELP: shall produce an indexed or menu-driven display of all commands available to the operator. The HELP command, followed by a specific command shall produce a context sensitive listing with a short explanation of the purpose, use, and system reaction to that command.

(b) DISPLAY DIAGRAM: shall display diagrams of specific utility systems or other systems as specified.

(c) DIAGRAM DEVELOPMENT: shall allow the user to develop diagrams of specific utility systems or other systems as specified**.**

(d) PRINT REPORT: Shall allow the operator to initiate printing of reports.`

(4) Operator's Commands: The operator's commands shall provide the means for entry of control and monitoring commands, and for retrieval of information. Processing of operator commands shall commence within 1 second of entry, with some form of acknowledgment provided at that time. The operator's commands shall perform tasks, including:

(a) Request a display of any SNVT or calculated point or any group of related SNVTs and calculated points
(b) Startup and shutdown selected systems or devices.
(c) Override any SNVT point to an operator selected value.
(d) Release the override of a SNVT.
(e) Modify time and event scheduling.
(f) Initiate reports.
(g) Generate and format reports.

(5) System Graphic Display Hierarchy: The system graphic display shall have a hierarchical structure with at least five levels:
(a) Unit: The unit that a point is associated with, such as an AHU.
(b) Building Sub-Area: A part of a building.
(c) Building: The building that a point is located in or near.
(d) Building Group: A group of buildings.
(e) Facility: Installation included in the UMCS.

c. Display Editor: The display editor shall enable the user to create, modify, and delete displays and graphic symbols. The primary use shall be for adding and modifying one-line diagrams, status displays, system summaries, and system directories, as new

controllers, points, data, and other necessary changes are made. The basic functions shall include:
(1) Create and save displays and graphic symbols.
(2) Group and ungroup graphic symbols. The grouped symbol shall be manipulated as a single symbol.
(3) Modify a portion of a graphic symbol.
(4) Save graphic symbols as a library object.
(5) Rotate and mirror a graphic symbol.
(6) Delete a graphic symbol.
(7) Place a graphic symbol on a display.
(8) Cancel the display of a graphic symbol.
(9) Assign conditions which automatically initiate the display.
(10) Overlay alphanumerics and graphics.
(11) Save new, modified, or existing graphics as new graphics.
(12) Integrate real-time data with the display.
(13) Define the background color.
(14) Define the foreground color.
(15) Locate the symbols.
(16) Position and edit alphanumeric descriptors.
(17) Establish connecting lines.
(18) Establish sources of latest data and location of readouts.
(19) Display analog values as specified.
(20) Cursor control (up, down, right, left).
(21) Create and display alphanumeric displays.
(22) Assign graphics a depth such that when there are coincident graphics the one with the lower depth is displayed.
(23) Modify graphic properties based on SNVT values, calculated values or values obtained from a legacy system.
(24) Creating conditional displays such that different graphic symbols or text are displayed based on SNVT values, calculated values or values obtained from a legacy system.
(25) Symbols Library: The library of callable display symbols shall include: Pump, Motor, Two- and Three-way Valves, Flow Sensing Element, Point and Averaging Temperature Sensors, Pressure Sensor, Humidity Sensor, Single and Double Deck Air Handling Unit, Fan, Chiller, Boiler, Air Compressor, Chilled Water Piping, Steam Piping, Hot Water Piping, Ductwork, Unit Heater, Pressure Reducing Valve, Damper, Electric Meter, Limit Switch, Flow Switch, High- and Low- Point and Averaging Temperature Switches, High- and Low- Pressure Switches, Coil, Solenoid Valve, Filter, Condensing Unit, Cooling Tower, Variable Frequency Drive (VFD), Heat Exchanger, Current Sensing Relays. Symbols shall at a minimum conform to ASHRAE Fundamentals Handbook where applicable.

2.16.6.4 Scheduling
The M&C software shall be capable of changing the value of any SNVT in the LNS Database to any legal value according to a schedule. A minimum of 100 user-definable schedules shall be supported and the specified scheduling functions shall be operator

accessible and adjustable via graphics display. The graphics display shall include the following fields and functions:

a. Current date and time. The OS and M&C software shall automatically make Daylight Savings Time adjustments. Daylight savings time adjustment shall be capable of being disabled by the operator.
b. Building name and number.
c. System identifier and name.
d. System group. Systems shall be capable of being grouped by the user to perform according to a common schedule.
e. Weekly schedules. Each system shall have a weekly schedule based on a seven day per week schedule with independent schedules for each day of the week including no less than 6 value changes per day.
f. Holiday and special event schedules. System scheduling shall support holiday and special event calendar schedules independent of the daily schedule. Special event schedules shall include one-time events and recurring events. Scheduling of one-time events shall include the beginning and ending dates and times of the event. Holiday and special event schedules shall have precedence over device weekly schedules.

2.16.6.5 Alarms
The M&C and the BPOC software shall be capable of generating alarms and handling network variable inputs of type SNVT Alarm from the control network. BPOC Software shall be capable of handling and managing no less than 3,000 alarm points.
a. Alarm Data. Alarm data to be displayed and stored, as applicable and as specified, shall include:
(1) Identification of alarm including building, system (or sub-system), and device name.
(2) Date and time to the nearest second of occurrence.
(3) Alarm type:
(a) Unreliable: Indicates that the source device has failed due to the sensing device or alarm parameter being out-of-range or bad data.
(b) High Alarm.
(c) Low Alarm.
(4) Alarm set point and deadband(if analog).
(5) Engineering units.
(6) Current value or status of the alarm point.
(7) Alarm priority: There shall be two alarm priority levels; critical and informational. Critical alarms shall remain in alarm until acknowledged by an operator and the alarm condition no longer exists; informational alarms shall remain in alarm until the alarm condition no longer exists or until the alarm is acknowledged.
(8) Alarm Message: A unique message with a field of 60 characters shall be provided for each alarm. Assignment of messages to an alarm shall be an operator editable function.

(9) Alarm Secondary Message: Secondary messages shall be assignable by the operator for printing to provide further information, such as telephone lists or maintenance functions, and shall be editable by the operator. The system shall provide for 100 secondary messages, each with 25 lines of 60 characters each.
(10) Acknowledgement status of the alarm and, where acknowledged, the time and date of acknowledgement.
(11) User who acknowledged the alarm.
b. Alarm Notification and Routing: The M&C software shall be capable of performing alarm notification and routing functions. Upon receipt or generation of an alarm the M&C software shall immediately perform alarm notification and routing according to an assigned routing for that alarm. The M&C software shall support at least 50 alarm routes; an alarm route shall be a unique combination of any of the following activities:
(1) Generate a pop-up up display on designated workstation monitors. The pop-up display shall include identification of the alarm, date and time of the alarm, alarm message, and current value/status of the alarm point. Alarms shall be capable of being acknowledged from the pop-up display by operators with sufficient permissions. Pop-up displays shall be displayed until acknowledged.
(2) Send an e-mail message via simple mail transfer protocol (SMTP; RFC 821). The e-mail shall contain a scripted message and all alarm data. The e-mail recipient and scripted message shall be user configurable for each alarm route.
(4) Print alarms to designated alarm printers. The printed message shall be the same as the pop-up message.
c. Alarm Display and Acknowledgement. The BPOC software shall include an alarm display. A minimum of the most recent 100 system alarms shall be available for display as shown, along with all associated alarm data. Alarms shall be capable of being acknowledged from this display. Multiple alarms shall be capable of being acknowledged using a single command. Operator acknowledgment of one alarm shall not automatically be considered as acknowledgment of any other alarm nor shall it inhibit reporting of subsequent alarms.
d. Alarm Storage and Reports: The BPOC software shall store each alarm and its associated alarm data to hard disk. The stored data shall be user-sortable and formatted for printing.

2.16.6.6 Trending

The M&C and BPOC software shall be capable of performing real-time trending on a minimum of 3,000 points simultaneously with a minimum trending capacity of 100 points per second. The M&C and BPOC software shall be capable of displaying and printing a graphical representation of each trend, and of multiple trended points on the same graph. The software shall be capable of saving trend logs to a file. If the file format is not plain ASCII text in a Comma-Separated-Value (CSV) format, the Contractor shall

provide a means to export or convert the file to plain ASCII text in a CSV format. Each trend shall be user-configurable for:
a. Point to trend.
b. Sampling interval with a minimum sampling interval no greater than 1 second, and a maximum sampling interval no less than 1 hour.
c. Start and Stop Time of Trend: Start and stop times shall be determined by one or more of the following methods:
(1) Start Time and Stop Time
(2) Start Time and Duration
(3) Start Time and number of samples

2.17 Panel Mounted Override Switches
Panel mounted switches shall have the following.
a. Switches shall have Hand-Off-Auto settings.
b. Switches shall have LED command status indicators
c. Override switches shall meet user input device requirement.

2.18 Emergency Ventilation Shutdown button.
Provide hardware mounted 48”inches above the floor near entrance/exit doors in the interior of the building as shown. Hardware shall have the following:
a. Red solid lid labeled “Raise Lid-Push Button”.
b. Solid lid shall be padlockable .
c. Maintained push button
d. Emergency ventilation shutdown button shall be labeled- EMERGENCY VENTILATION STOP. (03-05-08)

2.19 UNINTERRUPTIBLE POWER SUPPLY (UPS)
The uninterruptible power supply (UPS) shall be a self contained device suitable for installation and operation at the location of CPU Server and Workstation hardware and shall be sized to provide a minimum of 30 minutes of operation of the connected hardware. Equipment connected to the UPS shall not be affected in any manner by a power outage of a duration less than the rated capacity of the UPS. UPS shall be complete with all necessary power supplies, transformers, batteries, and accessories and shall include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of AC input loss and low battery power. The UPS shall be UL 1778 approved. UPS powering Server Hardware shall support notification to the server via serial interface of impending battery failure. (12/12/07)

PART 3 EXECUTION
3.1 EXISTING CONDITIONS SURVEY
The Contractor shall perform a field survey, including testing and inspection of the equipment to be controlled and submit an Existing Conditions Report documenting the current status and it's impact on the Contractor's ability to meet this specification. For those items considered nonfunctional, the Contractor shall provide (with the report)

specification sheets, or written functional requirements to support the findings and the estimated costs to correct the deficiencies. As part of the report, the Contractor shall define the scheduled need date for connection to existing equipment. The Contractor shall make written requests and obtain Government approval prior to disconnecting any controls and obtaining equipment downtime. Existing devices which are not to be replaced shall be inspected, calibrated, and adjusted as necessary to place them in proper working order.

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 General Installation Requirements

3.2.1.1 HVAC Control System

The HVAC control system shall be completely installed, tested and ready for operation. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.2.1.2 Device Mounting Criteria

All devices shall be installed in accordance with manufacturer's recommendations and as specified and shown. Control devices to be installed in piping and ductwork shall be provided with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified. Spare thermowells shall be installed adjacent to each thermowell containing a sensor and as shown. Devices located outdoors shall have a weathershield.

a. A minimum of (3) three inches of clearance shall be maintained at network interface connections.

b. DDC control panels **shall not** have top penetrations.

c. Air Handling Unit Freezestats, Duct Smoke Detectors and Static pressure Hi limits mounted 8'feet above grade shall have a labeled hardware reset located in the DDC control panel that serves the AHU.

d. Outdoor air sensors and transmitters shall be located on north facing walls or installed in AHU outdoor intake ductwork at the intake louvers.

3.2.1.3 Labels and Tags

Labels and tags shall be keyed to the unique identifiers shown on the As-Built drawings. All Enclosures and DDC Hardware shall be labeled. All sensors and actuators in mechanical rooms shall be tagged. Airflow measurement arrays shall be tagged to show

flow rate range for signal output range, duct size, and pitot tube AFMA flow coefficient. Duct static pressure taps shall be tagged at the location of the pressure tap. Tags shall be plastic or metal and shall be mechanically attached directly to each device or attached by a metal chain or wire. Labels exterior to protective enclosures shall be engraved plastic and mechanically attached to the enclosure or DDC Hardware. Labels inside protective enclosures may be attached using adhesive, but shall not be hand written.
Metal raceways above drop ceilings that contain DDC wiring shall be clearly labeled.

3.2.2 DDC Hardware
DDC Hardware shall be installed in an enclosure. Except for DDC Hardware used to control Terminal Units, where multiple pieces of DDC Hardware are used to execute one sequence all DDC Hardware executing that sequence shall be on a common local control bus and isolated from all other DDC Hardware via an ANSI/EIA 709.1B Router or ANSI/EIA 709.3 Repeater.

a. All DDC Hardware installed shall have an ANSI/EIA 709.1B domain of assigned DPW building number and a subnet 255.255.255.0.

b. CPU hardware shall be installed in a ventilated enclosure and have a 110 volt convenience outlet installed and other devices as shown.(12/10/07)

3.2.3 Local Display Panel (LDP)
Local Display Panels shall be installed in each mechanical room containing an air handler and shall provide SNVT inputs for display and outputs for adjusting SNVT values as shown on the Points Schedule.

3.2.4 Gateways
Gateways may be used for communication with non-ANSI/EIA 709.1B control hardware subject to all of the following limitations:
a. Each gateway shall communicate with and perform protocol translation for non-ANSI/EIA 709.1B control hardware controlling one and only one package unit.
b. Non-ANSI/EIA 709.1B control hardware shall not be used for controlling built-up units.
c. Non-ANSI/EIA 709.1B control hardware shall not perform system scheduling functions.

3.2.5 Network Interface Jacks

a. Lon Network Interface Jack.
(1) A standard network interface jack shall be provided for each node on the control network. For terminal unit controllers with hardwired thermostats or sensors this network interface jack shall be located at the thermostat for terminal units or within 3 m (10 ft) of the controller. Locating the interface jack at the thermostat is preferred. For all other nodes the network interface jack shall be located within 3 m (10 ft) of the node. If the network interface jack is other than an **1/8 inch phone jack**, the Contractor shall provide an interface cable with a standard 1/8 inch phone jack on one end and a connector

suitable for mating with installed network interface jack on the other. No more than one type of interface cable shall be required to access all network interface jacks. **Contractor shall furnish [_5__] interface cable(s).** (03-05-08)

b. LAN Interface Network Cable (patch cable)
(1) Contractor shall provide a cat 6 patch cable from the RJ45 LAN jack connector located inside the DDC network control enclosures to the BPOC hardware and CPU hardware.

3.2.6 Room Instrument Mounting
Room instruments, including but not limited to wall mounted thermostats and sensors located in occupied spaces shall be mounted 1.5m (60 inches) above the floor unless otherwise shown on the Thermostat Schedule:
a. Thermostats for Fan Coil Units shall be unit mounted unless stated otherwise.

b. All other Thermostats shall be wall mounted.

3.2.7 Indication Devices Installed in Piping and Liquid Systems
Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.2.8 Duct Smoke Detectors
Contractor shall connect the DDC System to the auxiliary contacts provided on the Smoke Detector as required for system safeties and to provide alarms to the DDC system.

3.2.9 Occupancy Sensors
A sufficient quantity of occupancy sensors shall be provided to provide complete coverage of the area (room or space). Occupancy sensors shall be installed in accordance with NFPA 70 requirements and the manufacturer's instructions. Occupancy sensors shall not be located within 1.8 m (6 feet) of HVAC outlets or heating ducts. PIR and dual-technology PIR/ultrasonic sensors shall not be installed where they can "see" beyond any doorway. Ultrasonic sensors shall not be installed in spaces containing ceiling fans. Sensors shall detect motion to within 0.6 m (2 feet) of all room entrances and shall not trigger due to motion outside the room. The off-delay timer shall be set to [15] minutes unless otherwise shown. All sensor adjustments shall be made prior to beneficial occupancy, but after installation of furniture systems, shelving, partitions, etc. Each controlled area shall have one hundred percent coverage capable of detecting small hand-motion movements, accommodating all occupancy habits of single or multiple occupants at any location within the controlled room.

3.2.10 Temperature Limit Switch
A temperature limit switch (freezestat) shall be provided to sense the temperature at the location shown. A sufficient number of temperature limit switches (freezestats) shall be installed to provide complete coverage of the duct section. Manual reset limit switches shall be installed in approved, accessible locations where they can be reset easily. The

temperature limit switch (freezestat) sensing element shall be installed in a serpentine pattern and in accordance with the manufacturer's installation instructions.

3.2.11 Averaging Temperature Sensing Elements
Sensing elements shall be installed in a serpentine pattern located as shown.

3.2.12 Air Flow Measurement Arrays (AFMA))
Outside Air AFMAs shall be located downstream from the Outside Air filters. Pitot Tube AFMA shall not be used if the expected velocity measurement is below 3.5 m/s (700 fpm)[or for outside airflow measurements].

3.2.13 Duct Static Pressure Sensors
The duct static pressure sensing tap shall be located at 75% to 100% of the distance between the first and last air terminal units. If the transmitter is wired in a homerun configuration to an AHU controller, the transmitter shall be located in the same enclosure as the air handling unit (AHU) controller(s) for the AHU serving the terminal units.

3.2.14 Relative Humidity Sensors
Relative humidity sensors in supply air ducts shall be installed at least 3m (10 feet) downstream of humidity injection elements.

3.2.15 Flowmeters
The minimum straight unobstructed piping for the flowmeter installation shall be at least 10 pipe diameters upstream and at least 5 pipe diameters downstream and in accordance with the manufacturer's installation instructions.

3.2.16 Dampers

3.2.16.1 Damper Actuators
Actuators shall not be mounted in the air stream. Multiple actuators shall not be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.2.16.2 Damper Installation
Dampers shall be installed straight and true, level in all planes, and square in all dimensions. Dampers shall move freely without undue stress due to twisting, racking (parallelogramming), bowing, or other installation error. Blades shall close completely and leakage shall not exceed that specified at the rated static pressure. Structural support shall be used for multi-section dampers. Acceptable methods include but are not limited to U-channel, angle iron, corner angles and bolts, bent galvanized steel stiffeners, sleeve attachments, braces, and building structure. Where multi-section dampers are installed in ducts or sleeves, they shall not sag due to lack of support. Jackshafts shall not be used to link more than three damper sections. Blade to blade linkages shall not be used.Outside and return air dampers shall be installed such that their blades direct their respective air streams towards each other to provide for maximum mixing of air streams.

3.2.17 Valves

3.2.17.1 Ball Valves
Two-position (open/closed) ball valves may only be used on chilled water, condenser water, hot water, or steam applications. Modulating ball valves may only be used for chilled water and condenser water applications (modulating ball valves shall not be used on steam or hot water applications). In modulating applications a characterizing equal-percentage disc shall be used.

3.2.17.2 Butterfly Valves
In two-way control applications, valve travel shall be limited to 70% (60 degrees) open position.

3.2.18 Local Gauges for Actuators
Pneumatic actuators shall have an accessible and visible pressure gauge installed in the tubing lines at the actuator as shown.

3.2.19 Wire and Cable
Wire and Cable shall be installed without splices between control devices and in accordance with NFPA 70 and NFPA 90A. Instrumentation grounding shall be installed per the device manufacturer's instructions and as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings. Electrical work shall be as specified in Section 16415A
ELECTRICAL WORK, INTERIOR and as shown.
Wiring external to enclosures shall be run as follows:

a. Wiring other than low-voltage control and low-voltage network wiring shall be installed in raceways.

b. Low-voltage control and low-voltage network wiring not in suspended ceilings over occupied spaces shall be installed in raceways, except that nonmetallic-sheathed cables or metallic-armored cables may be installed as permitted by NFPA 70.

c. Low-voltage control and low-voltage network wiring in suspended ceilings over occupied spaces shall be installed in raceways, except:(1) nonmetallic-sheathed cables or metallic-armored cables may be installed as permitted by NFPA 70.

3.2.20 Copper Tubing
Copper tubing shall be hard-drawn in exposed areas and either hard-drawn or annealed in concealed areas. Only tool-made bends shall be used. Fittings for copper tubing shall be brass or copper solder joint type except at connections to apparatus, where fittings shall be brass compression type.

3.2.21 Plastic Tubing

Plastic tubing shall be run within covered raceways or conduit except when otherwise specified. Plastic tubing shall not be used for applications where the tubing could be subjected to a temperature exceeding (130 degreesF). Fittings for plastic tubing shall be for instrument service and shall be brass or acetal resin of the compression or barbed push-on type.Except in walls and exposed locations, plastic multitube instrument tubing bundle without conduit or raceway protection may be used where a number of air lines run to the same points, provided the multitube bundle is enclosed in a protective sheath, is run parallel to the building lines and is adequately supported as specified.

3.2.22 Connection to Liquid and Steam Lines

Tubing for connection of sensing elements and transmitters to liquid and steam lines shall be Series 300 stainless steel with stainless-steel compression fittings.

3.2.23 Connection to Ductwork

Connections to sensing elements transmitters in ductwork shall be plastic tubing.

3.2.24 Software Installation

Note: Work shall be performed on Fort Leonard Wood. IP address's will not be available on new construction until the IT network is installed

a. Software install shall be coordinated through the DPW Systems manager. The DDC contractor shall provide a complete software list to the DPW systems manager.(4-02-08)

b. DDC contractor shall install and validate software on government furnished computers as specified and shown. The Contractor shall provide hardware and software locks if required for access for all computers and servers. Coordinate install with DPW MES section.

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c. ANSI/EIA 709.1B Network Configuration Tool: The Contractor shall provide and install the network configuration tool software as specified and shown.

(1) The server version of the software shall be installed on server hardware if required, and client versions shall be installed on workstation or laptops and validated as specified and shown. (06-09-08)

d. Monitoring and Control Software: The Contractor shall install the monitoring and control software as specified and shown. The server version of the software shall be installed on server hardware, and client versions shall be installed on workstation or server hardware.

e. DDC Contractor will be required to load server software on IT servers remote to DPW.

f. All LNS plug-in software shall be provided and installed on 5 five government owned computers and validated at the project site with a government representative present.. Provide copies of software to program plug-ins if not currently on configuration server and laptops must be same version as used to program plugin. All passwords shall be provided to the DPW MES section (09/18/08)

g. GPPC programming software shall be provided and installed on 5 five government owned computers and validated at the project site with a government representative present.(9/18/08)

h. IP address's will not be available on new construction until the IT network is installed and established by the FLW IT department.(06-09-08)

i. Provide 1 LNS DDE Server OEM license to DPW MES branch (7/08/08)

3.2.25 Software and Firmware Updates
Software updates shall be provided for system, operating, application software, LNS Database, General Purpose Programmable Controller and Applications Specific Controllers and operation in the system shall be verified. Updates shall be incorporated into operations and maintenance manuals, and software documentation.

a. There shall be at least one scheduled update near the end of the first year's warranty period, at which time the latest release version of the system, operating and application software shall be installed and validated.

b. There shall be at least one scheduled review and possible update of the LNS Database near the end of the first year's warranty period; this shall be coordinated with the Directorate of Public Works site project manager.

c. There shall be at least one scheduled update near the end of the first year's warranty period to flash the firmware on the Application Specific Controllers with the latest updates to the manufactures specifications.

d. There shall be at least one scheduled update near the end of the first year's warranty period to flash the firmware on the General Purpose Programmable Controller in conjunction with the update of the LNS Database.

e. Coordination with government personnel required 10 days in advance.(9-18-08)

3.2.26 Connections to Utility Meters(06/09/08)
a. Buildings with a gas meter.
(1) Coordination is required with gas utility for termination. Phone # 314-607-0122
(2) Provide a dedicated 1 ¼" raceway and 22 GA. Shielded twisted pair cable with a drain wire from the gas meter pulse output to the BPOC pulse meter input 1.
(3) Raceway bends shall be made with long radius elbows or long mogul type conduit bodies.
(4) Configure the BPOC software to read 1 pulse equals 10 cubic feet of gas.
(5) Provide a graphic on the BPOC graphic pages and enable the data logger.
(6) Show point name and SNVT name on the point schedule drawing.

b. Buildings with electric meters.
(1)Coordination is required with power utility.
(2) Provide a 3 pair twisted pair cable with a drain from the meter to the DDC enclosure
(3) Raceways from electric meters outputs are in the electrical section.
(4) Provide Graphic's and Standard Network Variable's (SNVTS) for energy(KWh) and power demand(KW) and provide data logs for each point
(5) Show point names and SNVT names on the point schedule drawing.

c. Buildings without Utility Meters
(1) Provide a dedicated 1 ¼" raceway terminated with a pull box and jet line(pull string) from the gas riser back to DDC enclosure.
(2) Provide a dedicated 1 ¼" raceway terminated with a pull box and jet line(pull string) from the utility electric meter back to DDC enclosure.

3.2.27 CPU HARDWARE and SOFTWARE 6/09/08

a. CPU DDC hardware shall be mounted in an NEMA 12 enclosure that meets the requirements of this specification..

b. The enclosure that houses the CPU hardware shall have a intrusion alarm point that is viewable on the BPOC graphic pages and sent as a critical alarm e-mail as specified and shown..

c. The CPU hardware enclosure shall have a cooling fan and make-up air louver that provides 100 cfm of air as shown.

d. The CPU enclosure shall have an uninterruptible power supply that provide power for the CPU hardware as specified. (UPS).

e. CPU software install shall be coordinated with DPW MES section.

d. ANSI/EIA 852 Configuration Server: The Contractor shall install
and configure the ANSI/EIA 852 Configuration Server as specified and shown.

3.2.28 Emergency Ventilation Shutdown
Emergency ventilation shutdown button hardware shall shut off all building ventilation fans upon activation and provide an alarm input to the DDC hardware as shown.
(03-05-08)

3.3 DRAWINGS AND CALCULATIONS
Contractor shall prepare and submit shop drawings.

3.3.1 Network Bandwidth Usage Calculations
The Contractor shall perform Building Control Network Bandwidth Usage Calculations for a normally loaded and a heavily loaded control network. Calculations shall be

performed for network traffic on the backbone. A heavily loaded control network is characterized as one performing the following activities simultaneously:

a. Transmitting every point in the building indicated on Points Schedules as being available to the Building Point of Connection (BPOC) location in response to polling requests at 15-minute intervals (for trending at UMCS).
b. Transmitting five points to the Building Point of Connection (BPOC) location in response to polling requests at 2-second intervals.
c. Transmitting 100 points to the Building Point of Connection (BPOC) location in response to polling requests at 5-second intervals.
d. Transmitting occupancy commands from the Building Point of Connection (BPOC) location to every system schedule sequence in a one-minute interval.
e. Transmitting occupancy override commands from the UMCS to every system schedule sequence in a one-minute interval. A normally loaded control network is characterized as one performing the following activities simultaneously:
a. Transmitting every point in the building indicated on Points Schedules as requiring a trend to the UMCS in response to polling requests at 15-minute intervals (for trending at UMCS).
b. Transmitting 50 points to the UMCS in response to polling requests at 5-second intervals.
c. Transmitting occupancy commands from the UMCS to every system scheduler sequence in a one-minute interval.

3.3.2 DDC Contractor Design Drawings
Drawings shall be on 17 by 11 inches sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and identifiers shown. Each control system element on a drawing shall be assigned a unique identifier as shown. The DDC Contractor Design Drawings shall be delivered together as a complete submittal.
Deviations shall be approved by the Contracting Officer. DDC Contractor Design Drawings shall include the following:

a. Drawing Index and HVAC Design Drawing Legend: The HVAC Control System Drawing Index shall show the name and number of the building, military site, State or other similar designation, and Country. The Drawing Index shall list all Contractor Design Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. The Design Drawing Legend shall show and describe all symbols, abbreviations and acronyms used on the Design Drawings.

b. Valve Schedule: The valve schedule shall contain each valve's unique identifier, size, flow coefficient Kv (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure to torque data, dimensions, and access and clearance requirements data. The valve schedule shall contain actuator selection data supported by calculations of the force required to move and seal the valve, access and clearance requirements. A valve schedule shall be submitted for each HVAC system.

c. Damper Schedule: The damper schedule shall contain each damper's unique identifier, type (opposed or parallel blade), nominal and actual sizes, orientation of axis and frame, direction of blade rotation, actuator size and spring ranges, operation rate, positive positioner range, location of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The Damper Schedule shall include the AMCA 500-D maximum leakage rate at the operating static-pressure differential. A damper schedule shall be submitted for each HVAC system.

d. Thermostat and Occupancy Sensor Schedule: The thermostat and occupancy sensor schedule shall contain each thermostat's unique identifier, room identifier and control features and functions as shown. A thermostat and occupancy sensor schedule shall be submitted for each HVAC system.

e. Critical Alarm Handling Schedule: The critical alarm handling schedule shall contain the same fields as the critical alarm handling schedule Contract Drawing with Contractor updated information and any other project-specific information required to implement the alarm handling function. A critical alarm handling schedule shall be submitted for each HVAC system.

f. Equipment Schedule: The equipment schedule shall contain the unique identifier, manufacturer, model number, part number and descriptive name for each control device, hardware and component provided under this specification. An equipment schedule shall be submitted for each HVAC system.

g. Occupancy Schedule: The occupancy schedule drawing shall contain the same fields as the occupancy schedule Contract Drawing with Contractor updated information. An occupancy schedule shall be submitted for each HVAC system.

h. Points Schedule: The Points Schedule drawing shall contain the same fields as the Points Schedule Contract Drawing with Contractor updated information. A Points Schedule shall be submitted for each HVAC system. Point schedules shall be completed as specified and as described in the point schedule drawing instructions.

i. Riser diagram of building control network: The Riser Diagram of the Building Control Network shall show all network cabling, DDC Hardware, and Network Hardware including:
(1) All DDC Hardware with room number and location within room.
(2) DDC Hardware unique identifiers and common descriptive names.
(3) All Network hardware with room number and location within room.
(4) Network hardware unique identifiers.
(5) All cabling.
(6) Room number and location within room of all cabling termination points.
(7) Room number and location within room of all network interface jacks.

(8) As built drawing shall contain network bandwidth readings.(3-10-08)
A single riser diagram shall be submitted for each building.

k. Control System Schematics: The control system schematics shall be in the same form as the control system schematic Contract Drawing with Contractor updated information. A control system schematic shall be submitted for each HVAC system.

l. Sequences of Operation: The HVAC control system sequence of operation and shall be in the same format as the Contract Drawings and shall refer to the devices by their unique identifiers. No operational deviations from specified sequences will be permitted without prior written approval of the Government. Sequences of operation shall be submitted for each HVAC control system.

m. Controller, Motor Starter and Relay Wiring Diagram: The controller wiring diagrams shall be functional wiring diagrams which show the interconnection of conductors and cables to each controller and to the identified terminals of input and output devices, starters and package equipment. The wiring diagrams shall show necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for control systems and for packaged equipment control systems shall be identified back to the panel board circuit breaker number, controller enclosures, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown. Wiring diagrams shall be submitted for each HVAC control system.

3.3.3 Draft As-Built Drawings
The Contractor shall update the Contractor Design Drawings with all as-built data and submit as specified.

3.3.4 Final As-Built Drawings
The Contractor shall update the Draft As-Built Drawings with all final as-built data and submit as specified.
a. Contractor shall provide 5 hard copies of as built drawings as specified.
b. Contractor shall provide 2 copies of as built drawings as specified on CDROM in Microstation format.
c. 11”x17” laminated copy of the as built DDC control drawings shall be provided in the data pocket of the control enclosure. Drawings provided in each enclosure shall show the DDC system that the enclosure serves.

3.4 HVAC SYSTEMS SEQUENCES OF OPERATION

3.4.1 Alarm Handling
The Contractor shall install and configure DDC Hardware to provide alarm handling functionality for critical alarms as specified and shown, either in a piece of DDC Hardware dedicated to this function or in DDC Hardware

performing other functions. The DDC Hardware providing alarm handling functionality shall provide the following capabilities as required:
Configure critical alarm e-mails as specified and shown at the BPOC to send e-mails to the following e-mail address: leon.dpwddc@conus.army.mil

3.4.1.1 The following critical alarms shall be sent via e-mail.
a. CPU intrusion alarm.
b. Air Handling Units not running during occupied periods.
c. Chiller or condensing unit alarms if enabled.
d. Boiler alarms if enabled.
(06-09-08)

3.4.2 Scheduling
3.4.2.1 System Mode
AHUs shall operate in Occupied, Warm-Up-Cool-Down, or Unoccupied modes as Specified and shown. VAV boxes, Fan Coils, and other terminal equipment shall operate in Occupied or Unoccupied modes as specified and shown. Chillers, boilers, and other sources of heating/cooling for hydronic loads do not require scheduling; these systems receive requests for heating/cooling from their loads.

3.4.2.2 System Scheduler Requirements
The System Scheduler functionality shall reside in either a piece of DDC Hardware dedicated to this functionality. A single piece of DDC Hardware may contain multiple System Schedulers A unique System Scheduler shall be provided for: each AHU including it's associated Terminal Units, and a group of stand-alone Terminal Units acting according to a common schedule. Each System Scheduler shall provide the following functionality:

a. Scheduled Occupancy Input: Accept network variable of type SNVT_occupancy (as defined in the LonMark SNVT Master List). Input shall support the following possible values: OC_STANDBY, OC_OCCUPIED and OC_UNOCCUPIED.

b. Occupancy Override Input: Accept network variable of type SNVT_occupancy (as defined in the LonMark SNVT Master List). Input shall support the following possible values: OC_STANDBY, OC_OCCUPIED, OC_UNOCCUPIED, and OC_NUL.

c. Space Occupancy Inputs: For systems with multiple occupancy sensors, accept multiple inputs of network variable type SNVT_Occupancy (as defined in the LonMark SNVT Master List). Input shall support the following possible values: OC_OCCUPIED, OC_UNOCCUPIED, and OC_NUL. For systems with a single occupancy sensor, accept a network variable input of type SNVT Occupancy or a hardware binary input (BI) indicating the space occupancy status as Occupied or Unoccupied.

d. Air Handler Occupancy Output: For a System Scheduler for a system containing an air handler, output one or more SNVTs indicating the desired occupancy status as one of the following possible values: Warm-Up-Cool-Down (when required by the AHU Sequence of Operation), Occupied and Unoccupied.

e. Terminal Unit Occupancy Output: For a System Scheduler for a group of stand-alone terminal units acting according to a common schedule, or a group of terminal units served by a single air handler, output one or more SNVTs indicating the desired occupancy status as one of the following possible values: Occupied and Unoccupied.

f. Default Schedule: Incorporate a 24-hour 7-day default schedule as shown on the drawings which may be activated and deactivated by the System Scheduler Logic.

g. Communication Determination: Determine the time elapsed between receipts of the scheduled occupancy input SNVT, and use this elapsed time to activate and deactivate the Default Schedule as specified. (This provides the capability for the system scheduler to use its Default Schedule if it loses communication with the **BPOC**).

3.4.2.3 System Scheduler Output Determination
a. Air Handler Occupancy Output: If more than 120 minutes have passed since the last receipt of the Scheduled Occupancy input, the Air Handler Occupancy Output shall be determined by the default schedule and the Space Occupancy Inputs. Otherwise, the output shall be determined as follows:

(1) If the Override Occupancy Input **is not** OC_NUL, the Air Handler Occupancy Output shall be determined as follows:
(a) The output shall be Occupied when the Override Occupancy Input is OC_OCCUPIED.
(b) The output shall be Unoccupied when the Override Occupancy Input is OC_UNOCCUPIED.
(c) If the system Sequence Of Operation specifies Warm-Up-Cool-Down mode, the output shall be Warm-Up-Cool-Down when the Override Occupancy Input is OC_STANDBY.

(2) If the Override Occupancy Input is OC_NUL and the Schedule Occupancy input is OC_OCCUPIED, the Air Handler and Stand-Alone Terminal Unit Occupancy Output shall be OC_OCCUPIED.

(3) If the Override Occupancy Input is OC_NUL, the Schedule Occupancy input is not OC_OCCUPIED, and less than required number of Space Occupancy Inputs (as shown on the Occupancy Schedule Drawing) are OC_OCCUPIED (or the hardware BI is Unoccupied), the Air Handler Occupancy Output shall be determined by the Scheduled Occupancy Input

(a) The output shall be Occupied when the Scheduled Occupancy Input is OC_OCCUPIED.
(b) The output shall be Unoccupied when the Scheduled Occupancy Input is OC_UNOCCUPIED.
(c) If the system Sequence Of Operation specifies Warm-Up-Cool-Down mode the output shall be Warm-Up-Cool-Down when the Scheduled Occupancy Input is OC_STANDBY.

(4) If the Override Occupancy Input is OC_NUL and at least the required number (as shown on the Occupancy Schedule Drawing) of Space Occupancy Inputs are OC_OCCUPIED (or the hardware BI is Occupied), the Air Handler Occupancy Output shall be Occupied.

b. Terminal Unit Occupancy Output: If more than 120 minutes have passed since the last receipt of the Scheduled Occupancy input, the Terminal Unit Occupancy Output shall be determined by the default schedule. Otherwise, the output shall be determined as follows:
(1) If the Override Occupancy Input **is not** OC_NUL, the Terminal Unit Occupancy Output shall be determined as follows:
(a) The output shall be Occupied when the Override Occupancy Input is OC_OCCUPIED or OC_STANDBY (to allow AHU-dependent Terminal Units to operate in Occupied mode when their associated AHU is in Warm-Up-Cool-Down.
(b) The output shall be Unoccupied when the Override Occupancy Input is OC_UNOCCUPIED.
(2) If the Override Occupancy Input **is** OC_NUL, the AHU-Dependent Terminal Unit Occupancy Output shall determined as follows:
(a) The output shall be Occupied when the Scheduled Occupancy Input is OC_OCCUPIED or OC_STANDBY (to allow AHU-dependent Terminal Units to operate in Occupied mode when their associated AHU is in Warm-Up-Cool-Down.
(b) The output shall be Unoccupied when the Scheduled Occupancy Input is OC_UNOCCUPIED.

3.4.2.4 Air Handler System Scheduling
a. The AHU Occupancy Output SNVT shall be bound from the System Scheduler to the DDC Hardware that executes the Occupancy Mode Determination part of the Air Handler Sequence of Operation
b. For Air Handlers using occupancy sensors, the occupancy sensor output SNVT (of type SNVT_Occupancy) shall be bound to a Space Occupancy Input of the System Scheduler.
c. The Terminal Unit Occupancy Output SNVT shall be bound from the System Scheduler to each AHU-Dependent Terminal Unit.
d. AHU-Dependent Terminal Units with occupancy sensors shall have their Effective Occupancy SNVT (of type SNVT_Occupancy) bound to a Space Occupancy Input of the System Scheduler.

3.4.2.5 Stand-Alone Terminal Unit Scheduling

The Terminal Unit Occupancy Output shall be bound from the System Scheduler to the DDC Hardware that executes the Occupancy Mode Determination part of the Terminal Unit Sequence of Operation.

3.4.3 Sequences of Operation for Air Handling Units

3.4.3.1 All-Air Small Package Unitary System
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Fan ON-AUTO Switch
(1) ON: With the thermostat fan ON-AUTO switch in the ON position, the DDC Hardware shall start the fan and it shall run continuously.
(2) AUTO: With the thermostat fan ON-AUTO switch in the AUTO position, the DDC Hardware operates the fan according to HEAT-OFF-COOL[-EMERG HEAT] switch.

b. HEAT-OFF-COOL[-EMERG HEAT] Switch
(1) HEAT-COOL[-EMERG HEAT]: With the thermostat switch in the HEAT or COOL [or EMERG HEAT] positions, the DDC Hardware shall operate the package unit according to the Occupancy Mode.
(2) OFF: With the thermostat switch in the OFF position, the DDC Hardware shall de-energize the heating unit and cooling unit [and emergency supplemental heat].

c. Occupancy Modes
(1) Occupied: The unit DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.
(2) Unoccupied: The unit DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

d. Safeties: The unit shall run subject to the unit manufacturer's safeties.

e. Zone Temperature Control
(1) In the Occupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
(2) In the Unoccupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint (ZN-T-SP) as shown.
(3) The DDC Hardware shall cycle the fan, cooling unit, heating unit[, and emergency supplemental heat], in accordance with the HEAT-COOL[-EMERG HEAT] switch setting, to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP).

3.4.3.2 Heating and Ventilating Unit (or Unit Ventilator)
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. HAND-OFF-AUTO switches: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes:
(1) Occupied: The Unit's DDC Hardware shall be in the Occupied Mode when the input from the System Scheduler (SYS-OCC) is occupied [or when the local space occupancy input(s) (ZN-OCC) indicate that the space is occupied].
(2) Unoccupied: The Unit's DDC Hardware shall be in the Unoccupied Mode when the input from the System Scheduler (SYS-OCC) is unoccupied [and when the local space occupancy input(s) (ZN-OCC) indicate that the space is unoccupied].
[(3) Warm Up/Cool Down: The Unit's DDC Hardware shall be in the Warm Up/Cool Down Mode based on input from the System Scheduler.]

c. System Enable and Loop Enable
(1) Occupied mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Zone Temperature Control loop [and Mixed Air Damper Control]shall be enabled.

(2) Unoccupied mode: All control loops shall be disabled. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Zone Temperature Control loop shall be enabled.
[(3) Warm Up/Cool Down: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Zone Temperature Control loop [and Mixed Air Damper Control]shall be enabled.]
d. Proofs and Safeties
(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

(2) Proofs: Supply fan status (proof) (SF-S)
(3) Safeties:
(a) Heating Coil discharge air temperature low limit (freezestat) (HTG-DA-T-LL)
(b) Supply air smoke (SA-SMK)
[(c) Return air smoke (RA-SMK)]
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Zone Temperature Control
(1) When this loop is enabled, the DDC Hardware shall modulate the heating valve [and outside air, relief, and return air dampers in sequence] to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP). [Sequencing shall be as shown: Upon a rise in zone temperature above zone temperature setpoint (ZN-T-SP), subject to the zone temperature setpoint deadband as shown, the outside air, relief, and return air dampers shall modulate to maintain zone temperature at setpoint. During occupied mode, outside air damper minimum position (OA-D-MIN) shall be as shown.] Upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the heating valve shall modulate towards open to maintain zone temperature setpoint.

(2) When this loop is disabled, the heating valve shall be closed [and the outside air damper and relief damper shall be closed and the return damper shall be open].
[f. Mixed Air Damper ControlWhen this is enabled, the outside air and relief air dampers shall be open and the return air damper shall be closed. When this is disabled, the outside air and relief air dampers shall be closed and the return air damper shall be open.]

3.4.3.3 Single Zone with Heating and [DX][Cooling] Coils
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switch: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:
(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and all control loops shall be enabled.
(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Heating Coil Temperature Control loop shall be enabled. The Outside Air Flow Control, Economizer Damper Control, and [DX] Cooling Coil Control loops shall be disabled.
[(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Minimum Outside Air Flow Control loop shall be disabled. All other control loops shall be enabled.]

d. Proofs and Safeties:
(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.
(2) Proofs:
(a) Supply fan status (proof) (SF-S)
(3) Safeties:
(a) Heating coil discharge air temperature low limit (freezestat) (HTG-DA-T-LL)
(b) Supply air smoke (SA-SMK)
(c) Return air smoke (RA-SMK)
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Economizer Damper Control:
(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers (Economizer dampers) in sequence with the [DX] cooling coil control and heating coil control valve as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown.

(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.
(3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2degreesF) deadband.

g. Heating Coil Control: When this loop is enabled the DDC Hardware shall modulate the heating coil control valve in sequence with the cooling coil valve and economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. When this loop is disabled, the heating coil control valve shall be closed.

h. [DX] Cooling Coil Control: When this loop is enabled the DDC Hardware shall [stage the DX Unit] [modulate the cooling coil control valve] in sequence with the heating coil valve and economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. When this loop is disabled, the [DX unit shall be off] [cooling coil control valve shall be closed].

3.4.3.4 Single Zone with Dual-Temperature Coil
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switch: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:
(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and all control loops shall be enabled.
(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreeC (5 degreeF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Dual

Temperature Coil Temperature Control loop shall be enabled. The Minimum Outside Air Flow Control, and Economizer Damper Control loops shall be disabled.
[(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops enabled.]

d. Proofs and Safeties:
(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being
disabled and the AHU fan being commanded off until reset.
(2) Proofs: Supply fan status (proof) (SF-S)
(3) Safeties:
(a) Dual Temperature coil discharge air temperature low limit(freeze stat) (DT-DA-T-LL)
(b) Supply air smoke (SA-SMK)
(c) Return air smoke (RA-SMK)
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Economizer Damper Control:
(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers (Economizer dampers) to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown.
(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.
(3) Economizer Enable Logic. The economizer shall be ON when the
outside air dry bulb temperature is between the high limit
(ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreeC (2 degreeF) deadband.

g. Dual Temperature Coil Control:
(1) When this loop is enabled, the DDC Hardware shall select heating or cooling mode based on a pipe-mounted dual-temperature supply water sensor. A single sensor may be used for multiple instances of this sequence.

(2) The DDC Hardware shall modulate the coil control valve in sequence with the economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown.
(3) When this loop is disabled, the control valve shall be closed.

3.4.3.5 Single Zone with Heating and Cooling Coils and Return Air Bypass
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. HAND-OFF-AUTO switch: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS) command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:
(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and all control loops shall be enabled.
(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and the Heating Coil Temperature Control loop shall be enabled. All other control loops shall be disabled.[(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled.]

d. Proofs and Safeties:
(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.
(2) Proofs: Supply fan status (proof) (SF-S)
(3) Safeties:
(a) Heating coil discharge air temperature low limit (freezestat) (HTG-DA-T-LL)
(b) Supply air smoke (SA-SMK)

(c) Return air smoke (RA-SMK)
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Economizer Damper Control:
(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, return air, [and relief air dampers] (Economizer dampers) in sequence with the bypass and supply dampers and the heating coil control valve as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown.
(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.
(3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2degreesF) deadband.

g. Heating Coil Control: When this loop is enabled the DDC Hardware shall modulate the heating coil control valve in sequence with the bypass and supply dampers and the economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. When this loop is disabled, the heating coil control valve shall be closed.

h. Cooling Coil Control: When this loop is enabled the DDC Hardware shall open the 2-position cooling coil control valve. When this loop is disabled, the 2-position cooling coil control valve shall be closed.
i. Bypass and Supply Air Damper Control: When this loop is enabled the DDC Hardware shall modulate the bypass and supply air dampers in sequence with the heating coil control valve and the Economizer dampers as shown to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. When this loop is disabled the bypass damper shall be closed and supply air damper open.

3.4.3.6 Single Zone with Humidity Control
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switch: Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS)command and Safeties.

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or 1WarmUp/CoolDown].

c. System Enable and Loop Enable:
(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS) and all control loops shall be enabled.
(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS), the Preheat Coil Control loop and Reheat Coil Control loop shall be enabled and all other loops shall be disabled.
[(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled.]

d. Proofs and Safeties
(1) The supply fan and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.
(2) Proofs: Supply fan status (proof) (SF-S)
(3) Safeties:
(a) Preheat coil discharge air temperature low limit (freezestat) (PH-DA-T-LL)
(b) Supply air smoke (SA-SMK)
(c) Return air smoke (RA-SMK)
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air flow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Preheat Coil Control Loop: When this loop is enabled the DDC Hardware shall modulate the preheat coil valve to maintain the preheat coil discharge air temperature (PH-T) at setpoint (PH-T-SP) as shown. When this loop is disabled, the preheat coil valve shall be closed.

g. Cooling-and-Dehumidification Coil Control: When this loop is enabled the DDC Hardware shall modulate the cooling and dehumidification valve to maintain either the zone temperature (ZN-T) at setpoint (ZN-T-SP) or zone relative humidity (ZN-RH) at setpoint (ZN-RH-SP), whichever calls for more chilled water flow. The valve shall be modulated in sequence with the reheat valve and humidification valve as shown to avoid simultaneous cooling and reheating, and simultaneous dehumidification and humidification. When this loop is disabled, the coil valve shall be closed.

h. Reheat Coil Control: When this loop is enabled the DDC Hardware shall modulate the reheat coil valve to maintain the zone temperature (ZN-T) at setpoint (ZN-T-SP) as shown. The valve shall be modulated in sequence with the cooling-and-dehumidification valve as shown to avoid simultaneous cooling and reheating. When this loop is disabled, the coil valve shall be closed.

i. Humidification Control: When this loop is enabled the DDC Hardware shall modulate the humidifier valve to maintain zone relative humidity (ZN-RH) at setpoint (ZN-RH-SP). The valve shall be modulated in sequence with the cooling-and-dehumidification valve as shown to avoid simultaneous dehumidification and humidification. When the supply air duct humidity (SA-RH) rises above 80% relative humidity, the humidifier valve shall begin to modulate towards closed and shall, under proportional control, continue to gradually move towards closed until the supply air duct humidity reaches 90% relative humidity, at which point the humidifier valve shall be fully closed. When this loop is disabled, the humidifier valve shall be closed.

3.4.3.7 Multizone [Dual-Duct] [with][without] Return Fan
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. HAND-OFF-AUTO switches:
Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the supply fan

shall run subject to the Supply Fan Start/Stop (SF-SS)command and Safeties.
[Return fan motor starter shall accept a Fire Alarm Panel (FAP) signal
that takes precedence over all other starter inputs and switches shall
start the fan. The return fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the return fan
shall run subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the return fan
shall be off.
(3) AUTO: With the H-O-A switch in AUTO position, the return fan
shall run subject to the supply fan running.]

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:
(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). All control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.
(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS), the Hot Deck Coil Control loop and all Zone Temperature Control loops shall be enabled, and all other control loops shall be disabled.[(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside AirFlow Control loop shall be disabled and all control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.]

d. Proofs and Safeties:
(1) The supply fan[, return fan,] and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.
(2) Proofs:
(a) Supply fan status (proof) (SF-S)
(b)[Return fan status (proof) (RF-S)]
(3) Safeties:
(a) Mixed air temperature low limit (freeze stat) (MA-T-LL)
(b) Supply air smoke (SA-SMK)
[(c) Return air smoke (RA-SMK)](4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air follow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Mixed Air Temperature Control With Economizer:
(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers to maintain the mixed air temperature (MA-T) at setpoint (MA-T-SP) as shown.
(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.
(3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2degreesF) deadband.

g. Hot Deck Coil Control:
(1) When this loop is enabled the DDC Hardware shall modulate the hot deck heating coil valve to maintain the hot deck temperature (HD-T) at setpoint (HD-T-SP) as shown. When this loop is disabled, the hot deck coil valve shall be closed.
[(2) The DDC Hardware shall reset the hot deck temperature setpoint (HD-T-SP) using a linear reset schedule as shown. Reset of the setpoint (HD-T-SP) shall be based on [Outside Air Temperature] [Coldest Zone Temperature].

h. Cold Deck Coil Control: When this loop is enabled the DDC Hardware shall modulate the cold deck cooling coil valve to maintain the cold deck temperature (CD-T) at setpoint (CD-T-SP) as shown. When this loop is disabled, the cold deck cooling coil valve shall be closed.

i. Zone Temperature Control:
(1) The zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
(2) The DDC Hardware shall modulate the hot deck and cold deck dampers to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP). Sequencing shall be as shown: Upon a rise in zone temperature above zone temperature setpoint the zone cold deck damper shall modulate towards open as the hot deck damper modulates towards closed. Upon a fall in zone temperature below zone temperature setpoint the hot deck damper shall modulate towards open as the cold deck damper modulates towards closed.

3.4.3.8 Multizone with Hot Deck Bypass [with][without] Return Fan
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule.

Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. HAND-OFF-AUTO switches:
Supply fan motor starter shall accept a Fire Alarm Panel (FAP) signal
that takes precedence over all other starter inputs and switches and shall start the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The supply fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop (SF-SS)command and Safeties.[Return fan motor starter shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other starter inputs and switches shall start the fan. The return fan motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the return fan shall run subject to Safeties.
(2) OFF: With the H-O-A switch in OFF position, the return fan shall be off.
(3) AUTO: With the H-O-A switch in AUTO position, the return fan shall run subject to the supply fan running.]
b. Occupancy Modes: The system shall obtain its Occupancy Mode input
from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or WarmUp/CoolDown].

c. System Enable and Loop Enable:
(1) Occupied Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). All control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.
(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 3 degreesC (5 degreesF) deadband) the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS), and all Zone Temperature Control loops shall be enabled. The Minimum Outside Air Flow Control, Mixed Air Temperature Control With Economizer, and Cold Deck Coil Control loops shall be disabled.[(3) Warm Up / Cool Down Mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled. The Zone Temperature Control loops serviced by the AHU shall also be enabled.]

d. Proofs and Safeties:
(1) The supply fan[, return fan,] and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the fan starter circuit as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.
(2) Proofs:

(a) Supply fan status (proof) (SF-S)
(b)[Return fan status (proof) (RF-S)]
(3) Safeties:
(a) Mixed air temperature low limit (freeze stat) (MA-T-LL)
(b) Supply air smoke (SA-SMK
(c)[Return air smoke (RA-SMK)]
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

e. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall open the 2-position minimum outside air damper to introduce the minimum outside air follow quantity as shown. When this loop is disabled, the minimum outside air damper shall be closed.

f. Mixed Air Temperature Control With Economizer:
(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers to maintain the mixed air temperature (MA-T) at setpoint (MA-T-SP) as shown.
(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.
(3) Economizer Enable Logic. The economizer shall be ON when the outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2degreesF) deadband.

g. Cold Deck Coil Control: When this loop is enabled the DDC Hardware shall modulate the cooling coil valve to maintain the cold deck supply air temperature (SA-T) at setpoint (SA-T-SP) as shown. When this loop is disabled, the cooling coil valve shall be closed.

h. Zone Temperature Control: The Zone Temperature Control loops shall always be enabled.
(1) The zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
(2) The DDC Hardware shall modulate the zone bypass and cold deck dampers, and the zone reheat coil valve to maintain zone temperature (ZN-T) at setpoint (ZN-T-SP). Sequencing shall be as shown: Upon a rise in zone temperature above zone temperature setpoint, subject to the zone temperature setpoint deadband as shown, the zone cold deck damper shall modulate towards open as the bypass deck damper modulates towards closed. Upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the bypass damper shall be full open and the zone heating valve shall modulate towards open.

3.4.3.9 Variable Air Volume System [with][without] Return Fan
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. HAND-OFF-AUTO switches:
Supply fan variable frequency drive (VFD) unit shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other VFD inputs and switches and shall cause the VFD to run at 100% speed. The VFD shall accept an occupant accessible emergency shutoff switch as shown. The supply fan variable frequency drive (VFD) unit shall have an integral H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the supply fan shall start and run continuously, subject to Safeties. Fan speed shall be under manual-operator control.
(2) OFF: With the H-O-A switch in OFF position, the supply fan shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the supply fan shall run subject to the Supply Fan Start/Stop Signal (SF-SS) and Safeties. Fan speed shall be under control of the DDC Hardware.[Return fan variable frequency drive (VFD) unit shall accept a Fire Alarm Panel (FAP) signal that takes precedence over all other VFD inputs and switches and shall cause the VFD to run at 100% speed. The return fan variable frequency drive (VFD) unit shall have an integral H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the return fan shall run subject to Safeties. Fan speed shall be under manual-operator control.
(2) OFF: With the H-O-A switch in OFF position, the return fan shall be off.
(3) AUTO: With the H-O-A switch in AUTO position, the return fan shall run subject to the supply fan running. Fan speed shall be under control of the DDC Hardware.]

b. Occupancy Modes: The system shall obtain its Occupancy Mode input from the System Scheduler as specified and shown. The system shall operate in one of the following modes: Occupied, Unoccupied[, or Warm Up/Cool Down].
c. Proofs and Safeties:
(1) The supply fan[, return fan,] and all DDC Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hardwire interlocked to the VFD as shown. DDC Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.
(2) Proofs:
(a) Supply fan status (SF-S)
[(b) Return fan status (RF-S)]
(3) Safeties:
(a) Cooling coil discharge air temperature low limit (freezestat) (CLG-DA-T-LL)
(b) Supply air duct pressure high limit (SA-P-HL)
(c) Supply air smoke (SA-SMK)
(d) Return air smoke (RA-SMK)
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware

via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

d. System Enable and Loop Enable
(1) Occupied mode: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). All control loops shall be enabled. The Zone Temperature Control loops for VAV boxes serviced by the AHU shall also be enabled.
(2) Unoccupied mode: While the building temperature (BLDG-T) is above setpoint (BLDG-T-LL-SP) all control loops shall be disabled (except fan-powered VAV box Zone Temperature Control loops) and the supply fan shall not run. When BLDG-T drops below BLDG-T-LL-SP (with a 5 degreesF deadband the supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS), the Supply Duct Static Pressure Control[, Return Fan Volume Control][, Preheat Control] loops shall be enabled. The Minimum Outside Air Flow Control, Mixed Air Temperature Control, and Cooling Coil Control loops shall be disabled.
[(3) Warm Up/Cool Down: The supply fan shall be enabled (SYS-ENA) and commanded to run (SF-SS). The Minimum Outside Air Flow Control loop shall be disabled and all other control loops shall be enabled. The Zone Temperature Control loops for VAV boxes serviced by the AHU shall also be enabled.]

e. Fan Capacity Control:
(1) Supply Duct Static Pressure Control. When this loop is enabled the DDC Hardware shall modulate the supply fan variable frequency drive unit to maintain the duct static pressure (SA-P) at setpoint (SA-P-SP) as shown, as measured by the duct static pressure tap and sensor as shown. When this loop is disabled, the DDC Hardware capacity modulation output to the VFD shall be zero percent.
[(2) Return Fan Volume Control. When this loop is enabled the DDC Hardware shall modulate the return fan variable frequency drive unit to maintain a constant volumetric airflow difference at setpoint (F-DIFF-SP) as shown, as measured by the airflow measurement arrays located in the supply and return ducts as shown. When this loop is disabled, the output to the VFD shall be zero percent.]

f. Minimum Outside Air Flow Control: When this loop is enabled the DDC Hardware shall modulate the minimum outside air damper to maintain the minimum OA volumetric flow (MINOA-F) at setpoint (MINOA-F-SP) as shown. When this loop is disabled, the minimum outside air damper shall be closed.

g. Mixed Air Temperature Control With Economizer
(1) When this loop is enabled, and the Economizer is ON as determined by the Economizer Enable Logic, the DDC Hardware shall modulate the economizer outside air, relief, and return air dampers to maintain the mixed air temperature (MA-T) at setpoint (MA-T-SP) as shown.
(2) When this loop is disabled, or the Economizer is OFF as determined by the Economizer Enable Logic, the economizer outside air and relief air dampers shall be closed, and the return air damper shall be open.
(3) Economizer Enable Logic. The economizer shall be ON when the

outside air dry bulb temperature is between the high limit (ECO-HL-SP) and low limit (ECO-LL-SP) setpoints as shown. The Economizer shall otherwise be OFF. ECO-HL-SP and ECO-LL-SP shall each have a 1 degreesC (2 degreesF) deadband.

h. Cooling Coil Control: When this loop is enabled the DDC Hardware shall modulate the cooling coil valve to maintain the supply air temperature (SA-T) setpoint (SA-T-SP) as shown. When this loop is disabled, the cooling coil valve shall be closed.

[i. Preheat Coil Control: When this loop is enabled the DDC Hardware shall modulate the preheat coil valve to maintain the preheat coil discharge air temperature (PH-DA-T) at setpoint (PH-DA-T-SP) as shown. When this loop is disabled, the preheat coil valve shall be closed.]

3.4.4 Sequences of Operation for Terminal Units

3.4.4.1 Zone Temperature Control - Cooling-Only VAV Box Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. Occupancy Modes:
(1) Occupied: The VAV box DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is occupied or when the input from the System Scheduler (SYS-OCC) is occupied.
(2) Unoccupied: The VAV box DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is unoccupied and the input from the System Scheduler (SYS-OCC) is unoccupied.

b. Safeties: This system has no safeties.

c. Zone Temperature Control
(1) In the Occupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown. The DDC Hardware shall modulate the VAV box damper to maintain VAV box supply air flow (VAV-SA-F) at setpoint as measured by a multi-point flow sensing element at the inlet to the VAV box. Sequencing shall be as shown: Upon a rise in zone temperature (ZN-T) above zone setpoint (ZN-T-SP), subject to the zone temperature setpoint deadband as shown, the airflow setpoint shall be adjusted between minimum and maximum flow based on the difference between zone temperature and zone temperature setpoint as shown.
(2) In the Unoccupied Mode the VAV box damper shall be at its minimum position.

3.4.4.2 Zone Temperature Control - VAV Box with Reheat Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. Occupancy Modes:
(1) Occupied: The VAV box DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is occupied or when the input from the System Scheduler (SYS-OCC) is occupied.
(2) Unoccupied: The VAV box DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is unoccupied and the input from the System Scheduler (SYS-OCC) is unoccupied.

b. Safeties: VAV boxes with electric resistance heating elements shall require proof of air flow before activating the heating elements.
c. Zone Temperature Control:
(1) In the Occupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
(2) In the Unoccupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint as shown.
(3) The DDC Hardware shall modulate the VAV box damper to maintain VAV box supply air flow (VAV-SA-F) at setpoint as measured by a multi-point flow sensing element at the inlet to the VAV box. Sequencing shall be as shown: Upon a rise in zone temperature above zone temperature setpoint (ZN-T-SP), subject to the zone temperature setpoint deadband as shown, the airflow setpoint shall be adjusted between minimum and maximum flow based on the difference between zone temperature and zone temperature setpoint as shown. Upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the airflow shall be maintained at a fixed air flow setpoint (with a setting independent of the cooling minimum air flow), and the heating valve shall modulate towards open or the staged electric resistance heating coil(s) shall cycle on in sequence.

3.4.4.3 Zone Temperature Control - Fan Powered VAV Box
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. Occupancy Modes:
(1) Occupied: The VAV box DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is occupied or when the input from the System Scheduler (SYS-OCC) is occupied.
(2) Unoccupied: The VAV box DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) (ZN-OCC) indicate that the space is unoccupied and the input from the System Scheduler (SYS-OCC) is unoccupied.

b. Safeties: VAV boxes with electric resistance heating elements shall require proof of air flow before activating the heating elements.
c. Zone Temperature Control

(1) In the Occupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
(2) In the Unoccupied Mode the zone temperature setpoint (ZN-T-SP) shall be at the configured setpoint as shown.
(3) Sequencing shall be as shown:
(a) In occupied and unoccupied modes, upon a rise in zone temperature above zone temperature setpoint (ZN-T-SP), subject to the zone temperature setpoint deadband as shown, the airflow setpoint shall be adjusted between minimum and maximum based on the difference between zone temperature and zone temperature setpoint as shown. The DDC Hardware shall modulate the VAV box damper to mix supply and plenum return air as it maintains VAV box supply airflow (VAV-SA-F) at setpoint as measured by a multi-point flow sensing element at the inlet to the VAV box.
(b) In occupied mode, upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the VAV box fan shall cycle on (note that the fan is always on in the occupied mode for a series box), the DDC Hardware shall modulate the VAV box damper to mix supply and plenum return air to maintain a fixed air flow setpoint (with a setting independent of the cooling minimum air flow), and the heating valve shall modulate towards open or the staged electric resistance heating coil(s) shall cycle on in sequence.
(c) In unoccupied mode, upon a fall in zone temperature below zone temperature setpoint, subject to the deadband as shown, the VAV box fan shall cycle on (note that the fan is always on in the occupied mode for a series box), the VAV box damper shall be at its minimum position, and the heating valve shall modulate towards open or the staged electric resistance heating coil(s)shall cycle on in sequence.

3.4.4.4 Perimeter Radiation Control Sequence
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. Occupancy Modes
(1) Occupied: The radiator DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.
(2) Unoccupied: The radiator DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

b. Safeties: This system has no safeties.

c. Space Temperature Control
(1) In the Occupied Mode the DDC Hardware shall modulate the heating control valve to maintain space temperature at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.

(2) In the Unoccupied Mode the DDC Hardware shall modulate the heating control valve to maintain space temperature at the configured setpoint as shown.

3.4.4.5 Unit Heater and Cabinet Unit Heater
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. Off-Auto Switch
(1) OFF: With the thermostat OFF-AUTO switch in the OFF position, the DDC Hardware shall stop the fan and close the heating control valve.
(2) AUTO: With the thermostat OFF-AUTO switch in the AUTO position, the DDC Hardware shall control the unit in accordance with its Occupancy Mode.

b. Occupancy Modes
(1) Occupied: The unit heater DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.
(2) Unoccupied: The unit heater DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

c. Safeties: The unit shall run subject to the unit manufacturer's safeties.

d. Space Temperature Control
(1) In the Occupied Mode the DDC Hardware shall modulate the heating control valve and cycle the multi-speed fan to maintain space temperature at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
(2) In the Unoccupied Mode the DDC Hardware shall modulate the heating control valve and cycle the multi-speed fan to maintain space temperature at the configured setpoint as shown.

3.4.4.6 Gas-Fired Infrared Heater
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI)control
a. On-Off-Auto Switch
(1) ON: With the thermostat ON-OFF-AUTO switch in the ON position, the DDC Hardware shall energize the heater and the heater shall run continuously.
(2) OFF: With the thermostat ON-OFF-AUTO switch in the OFF position, the DDC Hardware shall de-energize the heater.
(3) AUTO: With the thermostat ON-OFF-AUTO switch in the AUTO position, the DDC Hardware shall control the heater in accordance with its Occupancy Mode.

b. Occupancy Modes

(1) Occupied: The unit DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied.
(2) Unoccupied: The unit DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied.

c. Safeties: The heater shall run subject to the unit manufacturer's safeties.

d. Space Temperature Control
(1) In the Occupied Mode the DDC Hardware shall operate the heater to maintain space temperature at the configured setpoint or at the occupant-adjustable setpoint via the wall-mounted thermostat, as shown.
(2) In the Unoccupied Mode the DDC Hardware shall operate the heater to maintain space setpoint at the configured unoccupied setpoint as shown.

3.4.4.7 Dual Temperature Fan-Coil Unit
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.
a. Off-Auto Switch
(1) OFF: With the thermostat OFF-AUTO switch in the OFF position, the DDC Hardware shall stop the fan and close the dual-temperature control valve.
(2) AUTO: With the thermostat OFF-AUTO switch in the AUTO position, the DDC Hardware shall control the unit in accordance with its Occupancy Mode.

b. Occupancy Modes
(1) Occupied: The unit DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.
(2) Unoccupied: The unit DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

c. Heat/Cool Modes: The DDC Hardware shall automatically switch the fan coil unit DDC Hardware between the heating and cooling modes and the resultant control action, based on a pipe-mounted dual-temperature supply water temperature sensor.

d. Safeties: The unit shall run subject to the unit manufacturer's safeties.

e. Space Temperature Control
(1) In the Occupied Mode the DDC Hardware shall modulate the dual-temperature control valve and cycle the multi-speed fan to maintain space temperature at the configured setpoint or at the occupant-adjustable setpoint via the [wall-mounted] thermostat, as shown.

(2) In the Unoccupied Mode the DDC Hardware shall modulate the dual-temperature control valve and cycle the multi-speed fan to maintain space temperature at the configured setpoint as shown.

3.4.5 Sequences of Operation for Hydronic Systems
3.4.5.1 Hydronic Heating Hot Water from Distributed [Steam][HTHW] Converter
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. System Enable and loop enable
(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled (SYS-ENA). If all systems served by this system are not enabled, this system shall not be enabled.
(2) When this system is enabled (SYS-ENA) and the hot water pump is proofed on, the Heat Exchanger Control loop shall be enabled.

b. HAND-OFF-AUTO Switch: The hot water pump motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the pump shall start and run continuously.
(2) OFF: With the H-O-A switch in OFF position, the pump shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the pump shall run subject to the Hot Water Pump Start/Stop (HW-PMP-SS) command.

c. Proofs and Safeties:
(1) DDC Hardware shall monitor all proofs and safeties.
(2) Proofs: Hot water pump status (HW-PMP-S)
(3) Safeties: None
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.
d. Heat Exchanger Valve Control: When this loop is enabled DDC Hardware shall modulate the [steam][high temperature hot water] valve to maintain the Hot Water Supply Temperature (HWS-T) at setpoint (HWS-T-SP). The Hot Water Supply Temperature Setpoint (HW-T-SP) shall be [determined from a linear reset schedule] as shown. When this loop is disabled, the valve shall be closed.

3.4.5.2 Hydronic Heating Hot Water From Single-Building Boiler
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. System Enable and loop enable
(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled (SYS-ENA). If all systems served by this system are not enabled, this system shall not be enabled.
(2) When this system is enabled (SYS-ENA) and the hot water pump is proofed on, the boiler control and hot water temperature control loops shall be enabled.

b. HAND-OFF-AUTO Switch: The hot water pump motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the pump shall start and run continuously.
(2) OFF: With the H-O-A switch in OFF position, the pump shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the pump shall run subject to the Hot Water Pump Start/Stop (HW-PMP-SS) command.

c. Proofs and Safeties:
(1) DDC Hardware shall monitor all proofs and safeties.
(2) Proofs: Hot water pump
(3) Safeties: None
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.
d. Boiler Control: When this loop is enabled, the DDC Hardware shall turn the boiler on. When this loop is disabled, the boiler shall be off.

e. Hot Water Temperature Control: When this loop is enabled the DDC Hardware shall modulate the 3-way mixing valve to maintain hot water supply temperature (HWS-T) at setpoint (HWS-T-SP). The Hot Water Supply Temperature Setpoint (HWS-T-SP) shall be [determined from a linear reset schedule] as shown. When this loop is disabled, the valve shall be in its normal (failsafe) position.

3.4.5.3 Hydronic Dual-Temperature System with [Steam][High Temperature Hot Water] and Chilled Water
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. System Enable and loop enable
(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled

(SYS-ENA). If all systems served by this system are not enabled, this system shall not be enabled.
(2) When this system is enabled (SYS-ENA), and the HEATING/COOLING switch is in HEATING and the dual-temperature return water temperature (DTWR-T) is above the dual-temperature return water low-limit temperature (DTWRR-T-LL) setpoint of 65 degreesF, the [single-building boiler] [Heat Exchanger Control loop] shall be enabled.
([3) When this system is enabled (SYS-ENA), and the HEATING/COOLING switch is in COOLING and the dual-temperature return water (DTWR-T) is below the dual-temperature return water high-limit temperature (DTWR-T-HL) setpoint of 85 degreesF, the chiller shall be enabled.]

b. Switchover valve operation
(1) With the HEATING/COOLING switch in the HEATING position, the switchover valve shall open the heat-cool system piping to the [heat exchanger] [boiler] and close the heat-cool system piping to the [central plant chilled water] [single-building chiller] whenever the dual-temperature return water temperature (DTWR-T) is above the dual temperature return water low-limit temperature (DTWR-T-LL) setpoint of 18 degreesC (65 degreesF).
(2) With the HEATING/COOLING switch in the COOLING position, the switchover valve shall open the heat-cool system piping to the [central plant chilled water] [single-building chiller] and close the heat-cool system piping to the [heat exchanger] [boiler] whenever the dual-temperature return water temperature (DTWR-T) is below the dual-temperature return water high-limit temperature (DTWR-T-HL) setpoint of 29 degreesC (85 degreesF).
(3) For any other combination of HEATING/COOLING mode switch position, DTWR-T-LL switch position, and DTWR-T-HL switch position, the heat-cool switchover valve shall maintain its last state.
(4) The DDC Hardware shall monitor the status of the DTWR-T-LL and DTWR-T-HL switches.

c. HAND-OFF-AUTO Switch: The Dual-Temperature water pump motor starter shall have an H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the pump shall start and run continuously.
(2) OFF: With the H-O-A switch in OFF position, the pump shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the pump shall run subject to the Dual-Temperature Water Pump Start/Stop (DTW-PMP-SS) System Enable (SYS-ENA) command.

d. Proofs and Safeties
(1) DDC Hardware shall monitor all proofs and safeties.
(2) Proofs: None
(3) Safeties: Heat exchanger differential pressure switch (HX-P-LL) shall be direct-hardwire interlocked to the [steam][high temperature hot water] valve.

(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.
e. Heat Exchanger Valve Control: When this loop is enabled and there is hot water flow through the heat exchanger as sensed by the differential pressure switch (HX-P-LL) safety, the DDC Hardware shall modulate the [steam][high temperature hot water] valve to maintain the Hot Water Supply Temperature (HWS-T) at setpoint (HWS-T-SP). The Hot Water Supply Temperature Setpoint (HW-T-SP) shall be [determined from a linear reset schedule] as shown. The DDC Hardware shall monitor the status of the HX-P-LL safety. When this loop is disabled, the valve shall be closed.]

3.4.5.4 Hydronic Secondary with Variable Speed Pump
Contractor shall install DDC hardware to perform this Sequence of Operation and to provide SNVT inputs, outputs and alarms as specified and shown on the Points Schedule. Unless otherwise specified, all modulating control shall be proportional-integral (PI) control.

a. System Enable and loop enable:
(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled (SYS-ENA). If all systems served by this system are not enabled, this system shall not be enabled.
(2) When this system is enabled (SYS-ENA) the Pressure Control loop shall be enabled.
b. HAND-OFF-AUTO Switch: The hot water pump variable frequency drive (VFD) unit shall have an integral H-O-A switch:
(1) HAND: With the H-O-A switch in HAND position, the pump shall start and run continuously. Pump speed shall be under manual-operator control.
(2) OFF: With the H-O-A switch in OFF position, the pump shall stop.
(3) AUTO: With the H-O-A switch in AUTO position, the pump shall run subject to the Hot Water Pump Start/Stop (HW-PMP-SS) command and pump speed shall be under control of the DDC system.
c. Proofs and Safeties
(1) DDC Hardware shall monitor all proofs and safeties.
(2) Proofs: None
(3) Safeties: None
(4) DDC Hardware reset of all proofs and safeties shall be via a local binary push-button (RST-BUT) input to the DDC Hardware, via a remote command to the DDC Hardware via SNVT or both (where the Contractor provides both reset functions and the operator can use either one to perform the reset), as shown on the Points Schedule drawing.

d. Pressure Control: When this loop is enabled the DDC Hardware shall modulate the pump variable frequency drive unit to maintain the pipe system pressure at setpoint as shown, as measured by the differential pressure tap and sensor as shown. When this loop is disabled, the DDC Hardware capacity modulation output to the VFD shall be zero percent.

3.5 CONTROLLER TUNING

The Contractor shall tune each controller in a manner consistent with that described in the ASHRAE Fundamentals Hdbk. Tuning shall consist of adjustment of the proportional, integral, and where applicable, the derivative (PID) settings to provide stable closed-loop control. Each loop shall be tuned while the system or plant is operating at a high gain (worst case) condition, where high gain can generally be defined as a low-flow or low-load condition. Upon final adjustment of the PID settings, in response to a change in controller setpoint, the controlled variable shall settle out at the new setpoint with no more than two (2) oscillations above and below setpoint. Upon settling out at the new setpoint the controller output shall be steady. With the exception of naturally slow processes such as zone temperature control, the controller shall settle out at the new setpoint within five (5) minutes. The Contractor shall return the controller to its original setpoint and shall record and submit the final PID configuration settings with the O&M Instructions and on the associated Points Schedule.

3.6 START-UP AND START-UP TEST

The Contractor shall perform the following startup tests for each control system to ensure that the described control system components are installed and functioning per this specification.

a. General: The Contractor shall adjust, calibrate, measure, program, configure, set the time schedules, set alarms, and otherwise perform all necessary actions to ensure that the systems function as specified and shown in the sequence of operation and other contract documents.

b. Systems Check: An item-by-item check shall be performed for each HVAC system;

(1) Step 1 - System Inspection: With the system shut down, it shall be verified that power and main air are available where required and that all output devices are in their failsafe and

normal positions. Each local display panel [and each M&C Client

]shall be inspected to verify that all displays indicate shutdown conditions.

(2) Step 2 - Calibration Accuracy Check: A two-point accuracy check of the calibration of each HVAC control system sensing element and transmitter shall be performed by comparing the SNVT output from the DDC Hardware the sensor is connected to the actual value of the variable measured at the sensing element. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensor accuracy. The calibration of the test instruments shall be traceable to National Institute Of Standards And Technology standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-DDC system readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

(3) Step 3 - Actuator Range Check: With the system running, a signal shall be applied to each actuator through the DDC Hardware controller. Proper operation of the actuators and positioners for all actuated devices shall be verified and the signal levels shall be recorded for the extreme positions of each device. The signal shall be varied from live zero to full range, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. Where applicable, it shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.
c. Weather Dependent Test: Weather dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the actual results shall be verified in the appropriate season.Test Report: Upon completion of the Start-Up Test, the Contractor shall prepare and submit a Start-Up and Start-Up Testing Report documenting the results of the tests performed and certifying that the system is installed and functioning per this specification, and is ready for the Performance Verification Test (PVT).

3.7 PERFORMANCE VERIFICATION TEST (PVT)

3.7.1 PVT Procedures

The performance verification test procedures shall explain, step-by-step, the actions and expected results that will demonstrate that the control system performs in accordance with the sequences of operation, and other contract documents. [The PVT shall include a one-point accuracy check of each sensor.][The PVT shall include inlet and outlet air temperature measurements for all AHU-dependent terminal units.]The PVT Procedure shall describe a methodology to measure and trend the network bandwidth usage on the network backbone and compare it to the Bandwidth Usage Calculation submittal. A control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

3.7.2 PVT Execution

The Contractor shall demonstrate compliance of the control system with the contract documents. Using test plans and procedures approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall measure and trend the Network Bandwidth Usage and compare it to the Bandwidth Usage Calculation submittal. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the Start-Up and Start-Up Testing Report and completion of balancing. The tests shall not be conducted during scheduled seasonal off periods of base heating and cooling systems.

3.7.3 PVT Report

Contractor shall prepare a PVT report documenting all tests performed during the PVT and their results. The PVT report shall include all tests in the PVT Procedures and any other testing performed during the PVT. Failures and repairs shall be documented with test results.

3.8 TRAINING

A training course shall be conducted on site for **[_5__]** operating staff members designated by the Government in the maintenance and operation of the system, including specified hardware and software. The training period, for a total of [**36**][___] hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site and the Government reserves the right to videotape the training sessions for later use. Audiovisual equipment and **[_5__]** sets of all other training materials and supplies shall be provided. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

3.8.1 Training Documentation
The Contractor shall prepare training documentation consisting of:
a. Course Attendee List: A List of course attendees which shall be developed in coordination with and signed by the **[HVAC]** shop supervisor.

b. Training Manuals: Training manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Where the Contractor presents portions of the course material by audiovisuals, copies of those audiovisuals shall be delivered to the Government as a part of the printed training manuals. Training manuals shall be delivered for each trainee with two additional copies delivered for archival at the project site.
c. Quick Reference Commisioning Guide: Training manuals shall include a step by step quick reference commissioning guide for all DDC hardware that has a TP/FT-10 transceiver and a NodeID. Quick reference guide shall be clearly labeled identifying the hardware it references.

3.8.2 Training Course at site Content
For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each controller enclosure, the layout of one of each type of unitary equipment and the locations of each, the location of each control device external to the panels, preventive maintenance, troubleshooting, diagnostics, calibration of sensors, adjustment, commissioning, tuning, repair procedures, use of LNS Plug-ins, use of BPOC software and use of the GPPC Programming software . Typical systems and similar systems may be treated as a group, with instruction on the physical layout
of one such system. The results of the performance verification test and the Start-Up and Start-Up Testing Report shall be presented as benchmarks of HVAC control system performance by which to measure operation and

maintenance effectiveness.

3.8.3. Training off site.
A training course shall be conducted for 2 operating staff members designated by the contracting officer at the DDC controls manufacture training facility in the maintenance and operation of the DDC system, including specified hardware and software. The training period shall be a total of 36 hours of normal working time, shall be conducted within 30 day after successful completion of the performance verification test. The training shall be conducted at the controls equipment suppliers factory authorized training center. Audiovisual equipment and 2 sets of all other training supplies and materials shall be provided. A training day is defined as 8 hours of classroom instruction, including 2 fifteen minute breaks and excluding lunch time, Monday through Friday, during the daytime shift in effect at the training facility. The Contractor shall provide all per diem and transportation from the 2 operating staff members place of residence to the training site and all return transportation from the training site to the 2 staff members place of residence. The contractor shall provide all meals , rooms and accessories for training the 2 operating staff members.

3.8.3.1 Off site training course content at Controls manufacture training facility.
For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, commissioning, tuning, repair procedures, use of LNS Plug-ins, ANSI/EIA 709.1B Network configuration Tool, use of BPOC software and hardware, Central workstation PC monitoring and control software and use of the GPPC Programming software. Instructors shall be U.S. citizens.

3.9 Points Schedule Drawing Instructions

DRAWING INSTRUCTIONS

Points Schedule

Overview

The Points Schedule conveys a great deal of information critical to the design, installation, and subsequent performance of the control system. It includes hardware input/output information, device ranges and settings, ANSI 709.1 communications protocol data, and information about data that is to be used at the operator workstation by the Monitoring and Control software.

Some columns in the Points Schedule relate to functionality provided by the Monitoring and Control (M&C) Software. These columns indicate SNVTs which the building (DDC) Contractor must provide for use by the UMCS. When the building system is then integrated into a UMCS, these columns tell the UMCS Contractor what functionality to configure at the M&C Software.

DDC Contractor Instructions:

THE CONTRACT DRAWING POINTS SCHEDULES ASSUME THAT THE ENTIRE SEQUENCE OF OPERATION IS PERFORMED IN A SINGLE PIECE OF DDC HARDWARE. IN CASES WHERE MULTIPLE PIECES OF DDC HARDWARE ARE USED (INCLUDING ANSI-709.1 SENSORS AND ACTUATORS), SEPARATE THE POINTS SCHEDULE INTO SEPARATE TABLES EACH WITH ITS OWN HEADER INFORMATION (SEE BELOW) SO THAT EACH PIECE OF DDC HARDWARE HAS A TABLE DEDICATED TO IT. ALL TABLES FOR A SINGLE SEQUENCE OF OPERATION SHALL BE ON A SINGLE DRAWING WHICH MAY SPAN MULTIPLE SHEETS. SHOW COMMUNICATION BETWEEN MULTIPLE PIECES OF DDC HARDWARE PERFORMING A COMMON SEQUENCE THROUGH THE USE OF NVI AND NVO ENTRIES IN THE I/O COLUMN (SEE I/O COLUMN INSTRUCTIONS BELOW), ADDING ROWS TO THE TABLE(S) AS NEEDED.

POINT SCHEDULES ARE NOT REQUIRED FOR THE ALARM GENERATION SEQUENCE OF OPERATION; THE ONLY INFORMATION REQUIRED FOR THIS SEQUENCE IS THE "ALARM GENERATOR DDC HARDWARE INFORMATION" HEADER.

Responsibilities

The designer is responsible for the initial set of Points Schedule entries. The DDC Contractor is responsible for the bulk of the entries and submits the Points Schedule as a Design Drawing for government approval, then finalizes it as an as-built submittal. The as-built is then used as a contract drawing for use by the UMCS Contractor. Contractor responsibilities are described in the specifications and in the Points Schedule drawing notes.

- Entries required of the **designer** are shown bracketed as: [___]
- Entries required of the **UMCS Contractor** are shown bracketed as: / ___ /
- Entries required of the **DDC Contractor** are shown bracketed as: < ___ >
- Spaces where no entry is ordinarily required contains a tilde: " ~ " (equivalent to an "n/a" or null value)

Many designer or contractor entries have already been filled in on the sample drawings. In these cases, the value is a recommended value that must be verified or changed by the appropriate party (as indicated by the bracket type). Brackets that do not contain values (ie [___], <___>, or /___/) indicate that an entry is required. When editing the Points Schedules, delete the brackets after verifying/providing the entry. Do not leave cells blank, instead show the tilde (“~”) to indicate a null value or that no further entry is required.

UMCS and DDC Contractor Instructions:

ENTRIES SHOWN BRACKETED AS: < ___ > ARE REQUIRED ENTRIES FROM THE DDC CONTRACTOR. SOME ENTRIES WITHOUT BRACKETS MAY BE REQUIRED IN SOME INSTANCES AS DESCRIBED IN THESE INSTRUCTIONS.

ENTRIES SHOWN BRACKETED AS: / ___ / ARE REQUIRED ENTRIES FROM THE UMCS CONTRACTOR. SOME ENTRIES WITHOUT BRACKETS MAY BE REQUIRED IN SOME INSTANCES AS DESCRIBED IN THESE INSTRUCTIONS.

SPACES WHERE NO ENTRY IS ORDINARILY REQUIRED CONTAINS A TILDE: “ ~ “ (EQUIVALENT TO AN “N/A” OR NULL VALUE)

WHEN AN ENTRY APPEARS INSIDE OF BRACKETS, IT IS A RECOMMENDED ENTRY THAT MUST BE VERIFIED OR CHANGED BY THE APPROPRIATE PARTY (AS INDICATED BY THE BRACKET TYPE). WHEN EDITING THE POINTS SCHEDULES, DELETE THE BRACKETS AFTER VERIFYING/PROVIDING THE ENTRY. DO NOT LEAVE CELLS BLANK, INSTEAD SHOW THE TILDE (“~”) TO INDICATE A NULL VALUE OR THAT NO FURTHER ENTRY IS REQUIRED.

Points Schedule Description and Instructions

Points Schedule columns and entries are described below. In each case, designer responsibilities are described, followed by the Contractor responsibilities.

Header Information

DDC Hardware Identifier

A unique identifier is used to identify the control hardware device on the Points Schedule, Control System Schematic and other drawings and helps to maintain consistency between drawings. Note that this DDC Hardware identifier is different than the NodeID and the Node field of the address, which are described below.

DDC Contractor Instructions:

DDC HARDWARE IDENTIFIER: SHOW THE IDENTIFIER FOR EACH PIECE OF DDC HARDWARE. MAINTAIN CONSISTENCY AND UNIQUENESS OF DDC HARDWARE IDENTIFIERS BETWEEN ALL DRAWINGS.

DDC Hardware Location

Physical location of the DDC Hardware, minimally this is the room number the DDC Hardware is located in.

DDC Contractor Instructions:

DDC HARDWARE LOCATION: SHOW THE PHYSICAL LOCATION OF THE DEVICE. LOCATION SHALL INCLUDE THE BUILDING AND ROOM NUMBER AND MAY ALSO INCLUDE FURTHER INFORMATION SUCH AS ENCLOSURE/PANEL IDENTIFICATION.

Node Address

The logical address of the node (DDC Hardware) on the network, which consists of three fields: domain, subnet, and node.

DDC Contractor Instructions:

NODE ADDRESS: USE THE DOMAIN VALUE AND SUBNET RANGES SPECIFIED. SHOW THE DOMAIN, SUBNET AND NODE ADDRESSES FOR ALL DEVICES ON THE NETWORK.

Node ID

A unique 48-bit identifier assigned (at the factory) to each ANSI-709.1 device. Sometimes called the Neuron ID.

DDC Contractor Instructions:

NODE ID: SHOW THE MANUFACTURER SUPPLIED NODE ID FOR EACH DEVICE.

Alarm Generator DDC Hardware Information Header

DDC Contractor Instructions:

ALARM GENERATOR DDC HARDWARE INFORMATION: FOR ALL POINTS REQUIRING AN ALARM, CONFIGURE DDC HARDWARE TO PROVIDE ALARM GENERATION AS SPECIFIED IN SECTION 15951. IF THE ALARM GENERATION IS NOT PERFORMED IN THE DDC HARDWARE CONTAINING THE POINT TO BE ALARMED, SHOW THE DDC HARDWARE IDENTIFIER, LOCATION, ADDRESS AND NODE ID FOR THE DDC HARDWARE PERFORMING THE ALARM GENERATION ON THE POINTS SCHEDULE. IF THE ALARM GENERATION IS PERFORMED IN THE DDC HARDWARE CONTAINING THE POINT TO BE ALARMED, INDICATE THIS BY RECORDING “INTEGRATED“ AS THE DDC HARDWARE IDENTIFIER.

General Columns Description and Instructions

Function

Basic description of the function performed by this group of points.

Name

This is the point name.

DDC Contractor Instructions:

NAME COLUMN: SHOW POINT NAMES AS NEEDED AND AS INDICATED BY BRACKETS (<___>). THE NAME SHALL BE CONSISTENT WITH POINT NAMES SHOWN ON ALL OTHER DRAWINGS AND SHALL USE THE ESTABLISHED POINT ABBREVIATIONS.

DDC Contractor Instructions:

NAME COLUMN: USE THE POINT NAMES SHOWN ON THE POINTS SCHEDULE FOR ALL GRAPHIC DISPLAYS

Description

Summary description of the point.

Setting

Shows setpoints and settings related to each point.

DDC Contractor Instructions:

SETTING COLUMN: CONFIGURE DEVICES TO USE THE SETPOINTS AND SETTINGS SHOWN. WHEN A SETPOINT OR SETTING IS NOT SHOWN, USE VALUES IN ACCORDANCE WITH THE SPECIFICATION AND SHOW THE SETPOINT OR SETTING USED. INCLUDE THE APPROPRIATE ENGINEERING UNITS FOR ENTRIES IN THIS COLUMN.

Range

Shows the range of values associated with the point. For example, it could be a zone temperature setpoint adjustment range, a sensor measurement range, occupancy values for an occupancy input, or the status of a safety.

DDC Contractor Instructions:

RANGE COLUMN: CONFIGURE DEVICES TO USE THE RANGES SHOWN. WHEN A RANGE IS NOT SHOWN, USE VALUES IN ACCORDANCE WITH THE SPECIFICATION AND SHOW THE RANGE USED. FOR SENSORS SHOW THE ACTUAL SENSOR RANGE (THIS RANGE MUST AT LEAST ENCOMPASS THE RANGE SPECIFIED IN SECTION 15951). FOR DAMPER ACTUATORS SHOW THE ACTUAL RANGE OVER WHICH THE VALVE OR DAMPER IS ACTUATED. INCLUDE THE APPROPRIATE ENGINEERING UNITS FOR ENTRIES IN THIS COLUMN.

nci/CP Name

The name of the network configuration input (nci) or configuration parameter (CP) for this setting as specified.

DDC Contractor Instructions:

nci/CP NAME COLUMN: ENTRIES IN THIS COLUMN ARE ONLY REQUIRED FOR GENERAL PURPOSE PROGRAMMABLE CONTROLLERS (GPPC) OR APPROVED APPLICATION SPECIFIC CONTROLLERS (ASC) LACKING LONWORKS NETWORK SERVICES (LNS) PLUG-INS. SHOW ALL NETWORK CONFIGURATION INPUTS (nci) OR CONFIGURATION PROPERTIES (CP) THAT RELATE TO THE POINT. FOR CPS OF A USER-DEFINED NETWORK CONFIGURATION PARAMETER TYPE (UCPT), PROVIDE EITHER THE STANDARD NETWORK VARIABLE TYPE (SNVT) THAT RELATES TO THE CP, OR (FOR UCPTS NOT BASED ON A SNVT) PROVIDE DETAILED DESCRIPTIONS OF THE FIELDS AND UNITS OF EACH CP. EXPAND ROWS AND USE ADDITIONAL SHEETS AS REQUIRED TO PROVIDE CONFIGURATION PROPERTY DESCRIPTIONS.

I/O Type

Shows the input/output signal type (if any) associated with the point. Point types can be either hardware I/O:

Analog Input (AI), Analog Output (AO), Binary Input (BI), Binary Output (BO))

or network variable points:

Network Variable Input (NVI), Network Variable Output (NVO).

DDC Contractor Instructions:

I/O TYPE COLUMN: SHOW THE I/O TYPE FOR EACH POINT AS ONE (OR MORE) OF THE FOLLOWING:

- AI FOR ANALOG INPUTS
- AO FOR ANALOG OUTPUTS
- BI FOR BINARY INPUTS
- BO FOR BINARY OUTPUTS
- NVO FOR NETWORK VARIABLE OUTPUTS

- NVI FOR NETWORK VARIABLE INPUTS

IF MORE THAN ONE PIECE OF DDC HARDWARE IS USED TO IMPLEMENT A SEQUENCE AND THE VALUE OF A PHYSICAL INPUT TO ONE IS NEEDED BY THE OTHER, SHOW THE POINT AS BOTH A HARDWARE INPUT (AI OR BI) AND A NETWORK VARIABLE OUTPUT (NVO) ON THE FIRST AND AS A NETWORK VARIABLE INPUT (NVI) TO THE OTHER DDC HARDWARE. SIMILARLY FOR OUTPUTS SHOW A NETWORK VARIABLE OUTPUT (NVO) ON ONE CONTROLLER, AND A NETWORK VARIABLE INPUT (NVI) AND HARDWARE OUTPUT (AO OR BO) ON THE OTHER.

AN ENTRY OF NVO IS ONLY REQUIRED FOR OUTPUTS THAT ARE USED BY ANOTHER PIECE OF DDC HARDWARE; POINTS THAT HAVE SNVTS ONLY FOR DISPLAY OR TRENDING AT AN LDP OR M&C SOFTWARE WORKSTATION ARE ASSUMED TO NE NVOS AND DO NOT NEED AN NVO ENTRY IN THE I/O COLUMN.

FOR EVERY ENTRY OF NVO OR NVI SHOW THE SNVT NAME AND TYPE IN THE SNVT NAME AND SNVT TYPE COLUMNS UNDER LDP AND M&C DISPLAY.

LDP and M&C Display Columns

LDP View Req'd An *"X"* entry in this column indicates that the point is to be viewable from a Local Display Panel (LDP).

M&C Disp Req'd

An *"X"* entry in this column indicates that the point is to be displayed on a workstation via Monitoring and Control (M&C) software.

DDC Contractor Instructions:

DDC CONTRACTOR: AN "X" IN THIS COLUMN INDICATES THAT A SNVT FOR THIS POINT MUST BE AVAILABLE FROM THE DDC HARDWARE PERFORMING THE SEQUENCE FOR THIS SYSTEM. PROVIDE A SNVT OUTPUT FOR THESE POINTS AND SHOW THE SNVT NAME AND SNVT TYPE. (SEE INSTRUCTIONS FOR THE "SNVT TYPE" COLUMN)

DDC Contractor Instructions:

DDC CONTRACTOR: AN "X" IN THIS COLUMN INDICATES THAT THE GRAPHICAL DISPLAY FOR THIS SYSTEM MUST DISPLAY THE VALUE OF THIS POINT. UNLESS OTHERWISE APPROVED,

GRAPHIC DISPLAYS SHALL USE THE POINT NAME, AS SHOWN IN THE “NAME” COLUMN, FOR THE POINT.

M&C Trend Req’d

An “**X**” entry in this column indicates that the point is to be trended by the Monitoring and Control (M&C) software.

DDC Contractor Instructions:

M&C TREND REQ’D COLUMN: FOR ALL POINTS WITH AN X IN THIS COLUMN A SNVT FOR THIS POINT SHALL BE AVAILABLE. PROVIDE A SNVT OUTPUT FOR THESE POINTS AND SHOW THE SNVT NAME AND SNVT TYPE. (SEE INSTRUCTIONS FOR THE “SNVT TYPE” COLUMN)

DDC Contractor Instructions:

M&C TREND REQ’D COLUMN: FOR ALL POINTS WITH AN “X” IN THIS COLUMN, SET UP A TREND AT THE M&C SOFTWARE AS SPECIFIED.

SNVT Type

DDC Contractor Instructions:

SNVT TYPE COLUMNS: IF THE SNVT TYPE IS SHOWN ON THE POINT SCHEDULE CONTRACT DRAWING, THE PROVIDED SNVT SHALL BE OF THIS TYPE. IF NECESSARY, A SNVT TYPE TRANSLATOR MAY BE USED TO CONVERT TO THIS SNVT TYPE. IF THE USE OF A TYPE TRANSLATOR RESULTS IN THE SHARING OF A SNVT BETWEEN DDC HARDWARE, IT MUST BE DOCUMENTED ON THE POINTS SCHEDULES. WHERE NO SNVT TYPE IS SHOWN, SHOW THE SNVT TYPE.

FOR ALARMS, SHOW THE SNVT TYPE FOR THE ALARM OUTPUT OF THE DDC HARDWARE PERFORMING THE ALARM GENERATION.

Overrides Columns

LDP Ovrd Req’d An “**X**” entry in this column indicates that the point can be overridden (adjusted) from a Local Display Panel (LDP).

DDC Contractor Instructions:

DDC Contractor Instructions:

<u>LDP OVRD REQ'D COLUMN:</u> FOR ALL POINTS WITH AN X IN THIS COLUMN PROVIDE A SNVT INPUT BY WHICH THE VALUE OF THE POINT CAN BE OVERRIDDEN. SHOW THE SNVT NAME AND TYPE FOR EACH POINT REQUIRING AN OVERRIDE.

M&C Ovrd Req'd

An "**X**" entry in this column indicates that the point can be overridden (adjusted) from an operator workstation.

DDC Contractor Instructions:

<u>M&C OVRD REQ'D COLUMN:</u> FOR ALL POINTS WITH AN X IN THIS COLUMN USE THE SNVT NAME AND TYPE SHOWN TO PROVIDE OVERRIDE CAPABILITY. CONFIGURE THE M&C SYSTEM DISPLAYS TO ALLOW AN OPERATOR TO OVERRIDE THESE POINTS AS SPECIFIED.

Alarms Columns

Alarm Condition

This column shows the conditions under which an alarm occurs.

DDC Contractor Instructions:

<u>ALARM CONDITION COLUMN:</u> PROVIDE A NETWORK VARIABLE OF TYPE SNVT_ALARM OR SNVT_ALARM_2 FOR EACH POINT WITH AN ALARM CONDITION. CONFIGURE THE ALARM SNVT TO HAVE A PRIORITY OF 0 FOR ALARMS WITH AN ENTRY OF "INFO" IN THE ALARM PRIORITY COLUMN, AND A PRIORITY OF 3 FOR ALARMS WITH AN ENTRY OF "CRIT" IN THE ALARM PRIORITY COLUMN. FOR ALL ALARMS WITH AN "X" IN THE BUILDING ROUTING REQ'D COLUMN, BIND THIS ALARM SNVT TO THE DDC HARDWARE PERFORMING THE REDUNDANT ALARM HANDLING (SEE BUILDING ROUTING REQ'D COLUMN INSTRUCTIONS).

Alarm Priority

This column shows the priority for alarms as either Critical (CRIT) or Informational (INFO). As specified critical alarms remain in alarm until acknowledged by an operator and the alarm condition no longer exists; informational alarms shall remain in alarm until the alarm condition no longer exists or until the alarm is acknowledged.

DDC Contractor Instructions:

<u>ALARM PRIORITY COLUMN:</u> SEE ALARM CONDITION COLUMN

DDC Contractor Instructions:

ALARM PRIORITY COLUMN: WHEN CONFIGURING THE ALARM HANDLING AT THE M&C SOFTWARE, USE THE ALARM PRIORITY SHOWN TO DETERMINE IF THE ALARM IS CRITICAL (CRIT) OR INFORMATIONAL (INFO).

M&C Routing Name

This column shows the alarm routing that is to be used for each alarm. The entry in this column corresponds to an Alarm Routing Group as shown on the Alarm Routing Schedule drawing.

UMCS Contractor Instructions:

M&C ROUTING NAME COLUMN: CONFIGURE ALARM HANDLING AT THE M&C SERVER ACCORDING TO THE ALARM ROUTING SHOWN ON THE POINTS SCHEDULE, THE ALARM ROUTING SCHEDULES AND AS SPECIFIED.

Bldg Routing Req'd

An X in this column indicates that the redundant alarm handling is required for this alarm. Redundant alarms are primarily used for (extremely) critical processes and are intended to be redundant with alarms sent to a UMCS such that in the event the UMCS is 'down' an alarm will still be sent.

DDC Contractor Instructions:

BLDG ROUTING REQ'D COLUMN: PROVIDE REDUNDANT ALARM HANDLING AS SPECIFIED FOR EACH ALARM WITH AN X IN THIS COLUMN. SEE ALARM CONDITION COLUMN.

Points Schedule Application Notes

These notes describe Points Schedule entries for specific rows shown in the Schedule.

Analog and Binary Inputs

Any analog input (AI) or binary input (BI) can be viewed from an LDP or displayed using M&C software at a workstation, but AI's and BI's should not overridden from an LDP or workstation. In the event an AI or BI must be overridden, such as during start-up testing, it can be overridden using a network configuration tool.

System Reset Button (RST-BUT)

The activation of any safety will result in system shutdown. The system remains shutdown until manually reset devices are reset and the system RST-BUT as a binary input (BI) local to the DDC controller is pressed. Reset could also be performed from a workstation or local display panel (LDP) using a network variable input (NVI) SNVT.

DDC Contractor Instructions:

SYSTEM RESET BUTTON (RST-BUT): IF THE "I/O TYPE" COLUMN CONTAINS "BI", THE SYSTEM MUST BE CAPABLE OF BEING RESET VIA A LOCAL HARDWARE PUSH-BUTTON.

IF THERE IS AN "X" IN THE LDP OVRD REQ'D OR M&C OVRD REQ'D COLUMN, THE SYSTEM MUST ALSO BE CAPABLE OF BEING RESET VIA SNVT INPUT (SEE INSTRUCTIONS FOR M&C OVRD REQ'D AND LDP OVRD REQ'D COLUMNS)

DDC Contractor Instructions:

SYSTEM RESET BUTTON (RST-BUT): IF THERE IS AN AN "X" IN M&C OVRD REQ'D COLUMN, CONFIGURE M&C SOFTWARE GRAPHIC DISPLAYS TO PROVIDE SYSTEM RESET CAPABILITY.

System Occupancy (SYS-OCC)

Most systems will obtain their occupancy mode command (OCC, UNOCC, Warm-up/Cool-down) from a System Scheduler. The occupancy mode for the system is overridden via an override input to the System Scheduler, not to the DDC Hardware performing the specific system sequence of operations, so the system should never have an 'X' in either the M&C or LDP Override columns.

Systems which do not require scheduling will not have a SYS-OCC row shown on the Points Schedule. For example, many infrared heating systems operate according to a manual on/off or occupancy sensor.

DDC Contractor Instructions:

SYSTEM OCCUPANCY (SYS-OCC): SHOW OCC, UNOCC, WUCD (WARM-UP/COOL-DOWN) IN THE RANGE COLUMN BASED ON THE SYSTEM-SPECIFIC SEQUENCE OF OPERATIONS AND OCCUPANCY SCHEDULE.

Systems that do not require scheduling should not have the SYS-OCC row shown in the Points Schedule. One example might be Infrared heating systems where the occupancy mode of the IR system is dictated by the occupant via manual system on/off control or via an occupancy sensor.

Zone Occupancy (ZN-OCC) and Effective Occupancy (EFF-OCC)

The operational mode (occupied or unoccupied) of a piece of DDC Hardware used to provide environmental control of a space or zone can be dictated by either the System Scheduler (SYS-OCC) or by a binary input (BI) occupancy signal from the zone (ZN-OCC). This BI occupancy signal (ZN-OCC) can be from either an occupancy sensor or from an (occupant accessible) push button.

The EFF-OCC signal is a network variable output (NVO) from the DDC Hardware (controller) which indicates the current operational mode for the system. This output is used for monitoring of the system and (for terminal units requiring air handler service) as an input to the System Scheduler to allow the System Scheduler to place the serving AHU into occupied mode.

LDP View and Override

Minimum Outside Air Flow

The minimum outside air flow is the quantity of outside air required for fresh air or for makeup. Where the outside air flow is controlled using DDC Hardware, an air flow measurement array, and a flow control damper, this is shown as the minimum outside air flow setpoint (MINOA- F-SP). Otherwise (where there is no closed loop control), the minimum OA flow quantity is shown in the Points Schedule as "Minimum Outside Air Flow Setting". It does not have a point NAME because it is not an actual signal (not measured using an installed sensor).

DDC Contractor Instructions:

MINIMUM OUTSIDE AIR FLOW: FOR SYSTEMS CONTROLLING TO A MINOA SETPOINT, USE THE MINOA-F-SP SHOWN WHEN CONFIGURING THE DDC HARDWARE PERFORMING THE SEQUENCE OF OPERATION. FOR OTHER SYSTEMS SET THE MINIMUM OUTSIDE AIR FLOW TO THE MINIMUM OUTSIDE AIR FLOW SETTING SHOWN AS SPECIFIED.

PID Loop Settings

The PID Loop Settings are all the settings required to configure PID control, including but not limited to the P, I and D gains, deadbands and reset schedules.

DDC Contractor Instructions:

PID LOOP SETTINGS: SHOW ALL PID LOOP SETTINGS IN THE SETTINGS COLUMN, INCLUDING ENGINEERING UNITS FOR EACH SETTING. ADJUST ROW HEIGHT AS NEEDED TO SHOW ALL PID SETTINGS.

Filters

Unit Status

The Unit Status point indicates if the system is operating in heating/cooling mode. This status is used as a monitored point at the M&C Software and as a heating/cooling request to a chiller, boiler or heat exchanger. For systems other than heat exchangers, a network variable of type SNVT_HVAC_STATUS is used for this point and the range shown for this point applies to the mode Field of the SNVT. For heat exchangers a network variable of type SNVT_SWITCH is used.

Heating Request and Cooling Request

DDC Hardware controlling chillers, boilers and heat exchangers receive Unit Status inputs from their serviced equipment in the form of heating/cooling requests. The Chiller, Boiler or Heat Exchanger System Enable schedule shows under what conditions the equipment will be enabled.

APPENDIX A
QC CHECKLIST
DPW DIRECT DIGITAL CONTROL QC CHECKLIST
This checklist is not all-inclusive of the requirements of this specification
and should not be interpreted as such.

Initial each item in the space provided (|____|) verifying that requirement has been met. Items should be verified for Closeout:

1. DDC contractor has met AR 25 security requirements for loading and configuring software on government owned computer equipment. |____|

2. All DDC Hardware (nodes) are numbered on Control System Schematic Drawings. |____|

3. Signal lines on Control System Schematic are labeled with the signal type. |____|

4. Local Display Panel (LDP) Locations are shown on Control System Schematic drawings|____|.

5. Points Schedule drawings have been sub-divided by device (DDC Hardware), including DDC Hardware node numbers |____|.

6. All DDC Hardware as shown is installed on a TP/FT-10 local control bus. |____|

7. All Application Specific Controllers (ASCs) are LonMark certified. |____|

8. Communication between DDC Hardware is only via ANSI/EIA 709.1B using SNVTs. Other protocols and network variables other than SNVTs have not been used. |____|

9. Explicit messaging has not been used. |____|

10. System Scheduler functionality has been installed for all HVAC systems and default schedules have been configured at each System Scheduler.
(a) AHU Schedules |____|
(b) VAV Terminal Unit Schedules |____|

(c) Cabinet Unit heater Schedule |____|
(d) Unit Heater Schedule |____|
(e) Fan Coil Unit Schedule |____|

11. All sequences are performed as specified using DDC Hardware. |____|

12. On site Training schedule dates and course attendee list has been developed and coordinated with DPW maintenance shops and submitted. |____|

13. Off site Training schedule dates and course attendee list has been developed and coordinated with course attendee's and submitted. |____|

14. Building Point of Connection(BPOC) requirements are completed as specified and shown..
(a) Graphic's completed as specified. |____|
(b) System Schedule's configured as specified. |____|
(c) Datalogs have been configured as specified. |____|
(d) IP 852 routing has been licensed, configured and enabled as specified. |____|
(e) All Software and license has been submitted to DPW systems manager. |____|
(f) FTP password is set|____|
(g) User passwords have been configured. |____|
(h) Correct Channel Mode: IP 852 standard|____|
(i) Is RNI used in conjunction with IP-852|____|
(k) IP 852 enabled in Visio|____|

15. CPU hardware and has been installed as specified.
(a) CPU enclosure. |____|
(b) UPS installed. |____|
(c) Circulation fan and louvers. |____|
(d) RJ-45 jack installed in enclosure. |____|

16. LNS Plug-ins have been loaded on required computer hardware and validated. |____|

17. LNS Database loaded and configured on required computer hardware. |____|

18. Programming software for each type of General Purpose Programmable Controller (GPPCs) has been installed on required computer hardware and validated.

19. LNS Plug-ins have been submitted on CD-ROM to the DPW Systems Manager, and licensed for all ASCs.

20. Programming software for each type of General Purpose Programmable Controller (GPPCs) has been submitted on CD-ROM to DPW Systems manager and licensed to the project site as shown |____|

21. Server software has been licensed and submitted to the DPW systems manager.

(7-08-08)

22. Two (2) copies on CD-ROM of Installed GPPC Application programs shall be submitted as a technical data package to the DPW Systems Manager for each model of DDC Hardware provided under this specification. CD-ROM shall include list or table of contents. |____|

23. Two (2) copies on CD-ROM of External interface files (XIF files) shall be submitted as a technical data package to DPW Systems Manager for each model of DDC Hardware provided under this specification. CD-ROM shall include a table of contents. |____|

24. Two(2) copies on CD-ROM of the LonWorks Network Services (LNS) Database for each building control network has been submitted to DPW Systems manager and is up-to-date and accurately represents the final installed system. CD-ROM shall be clearly marked identifying job and bldg. number(s). |____|

25. All software has been licensed to U.S.Army with Fort Leonard Wood DPW Systems Manager as the agent and turned over to the DPW Systems Manager located in bldg. 2200 |____|

26. A software list for all software used on this project with version, type and all software passwords have been provided to the DPW systems manager.(03-05-08)

27. 5 copies of O&M Instructions including software users manuals, indexed and in booklet form have been completed and submitted. |____|

28. Laminated copy of Final as built drawings in data pocket of control enclosures. |____|

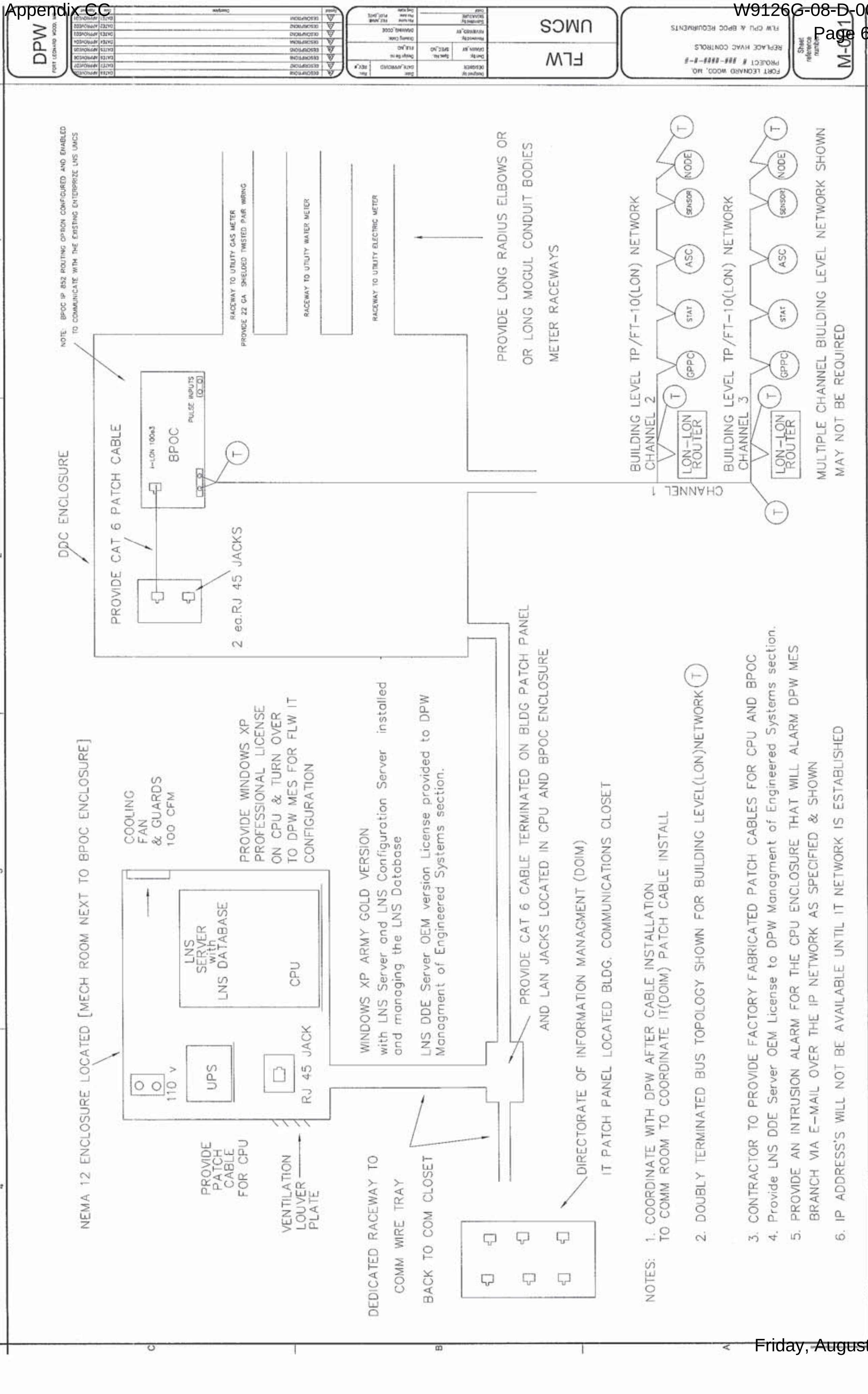
29. 5 copies of Final As-built Drawings, including the Points Schedule drawing completed as specified, drawings accurately represent the final installed system. |____|

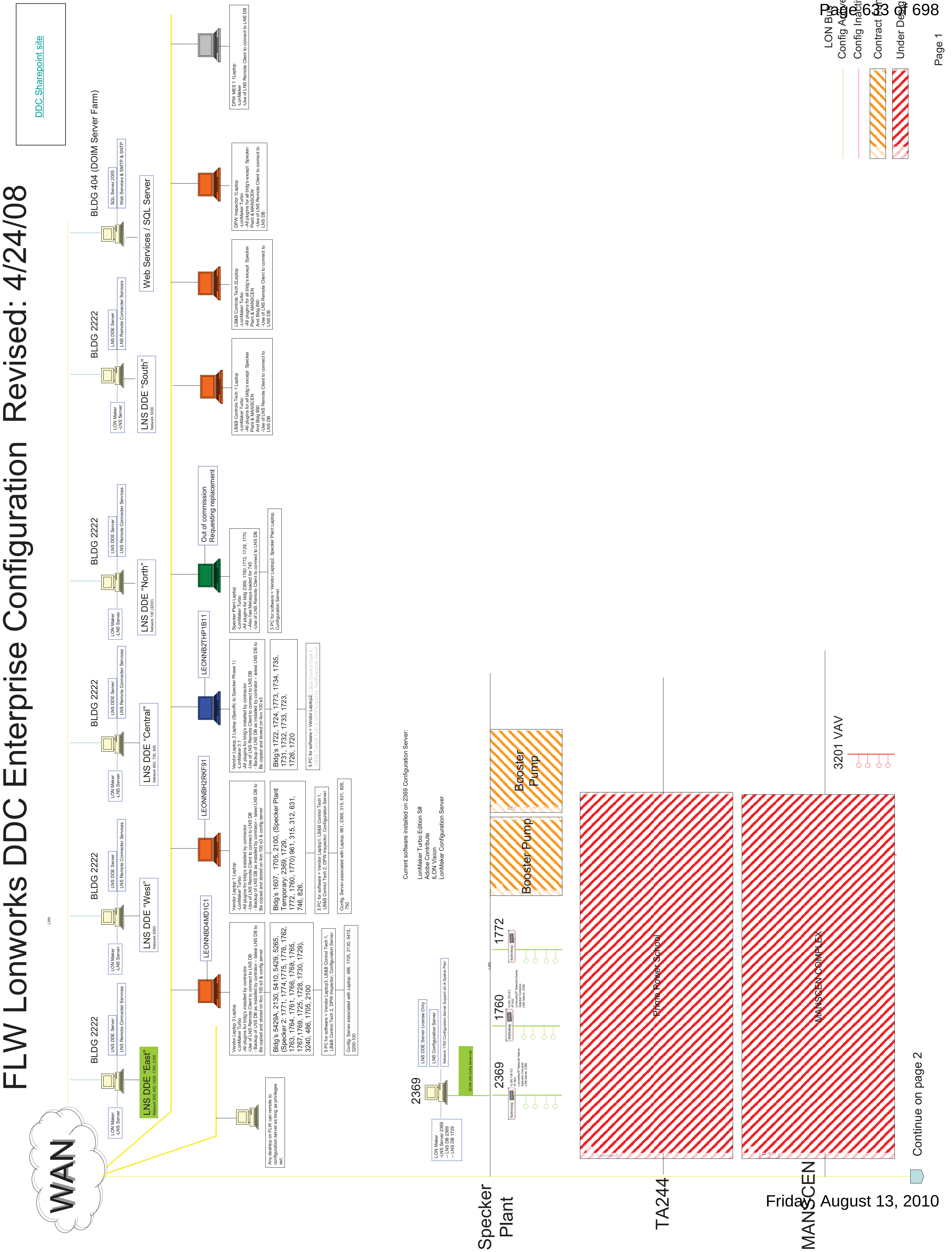
30. 2 copies of the as built drawings submitted on a labeled CD-ROM in Microstation or Autocad format.|____|

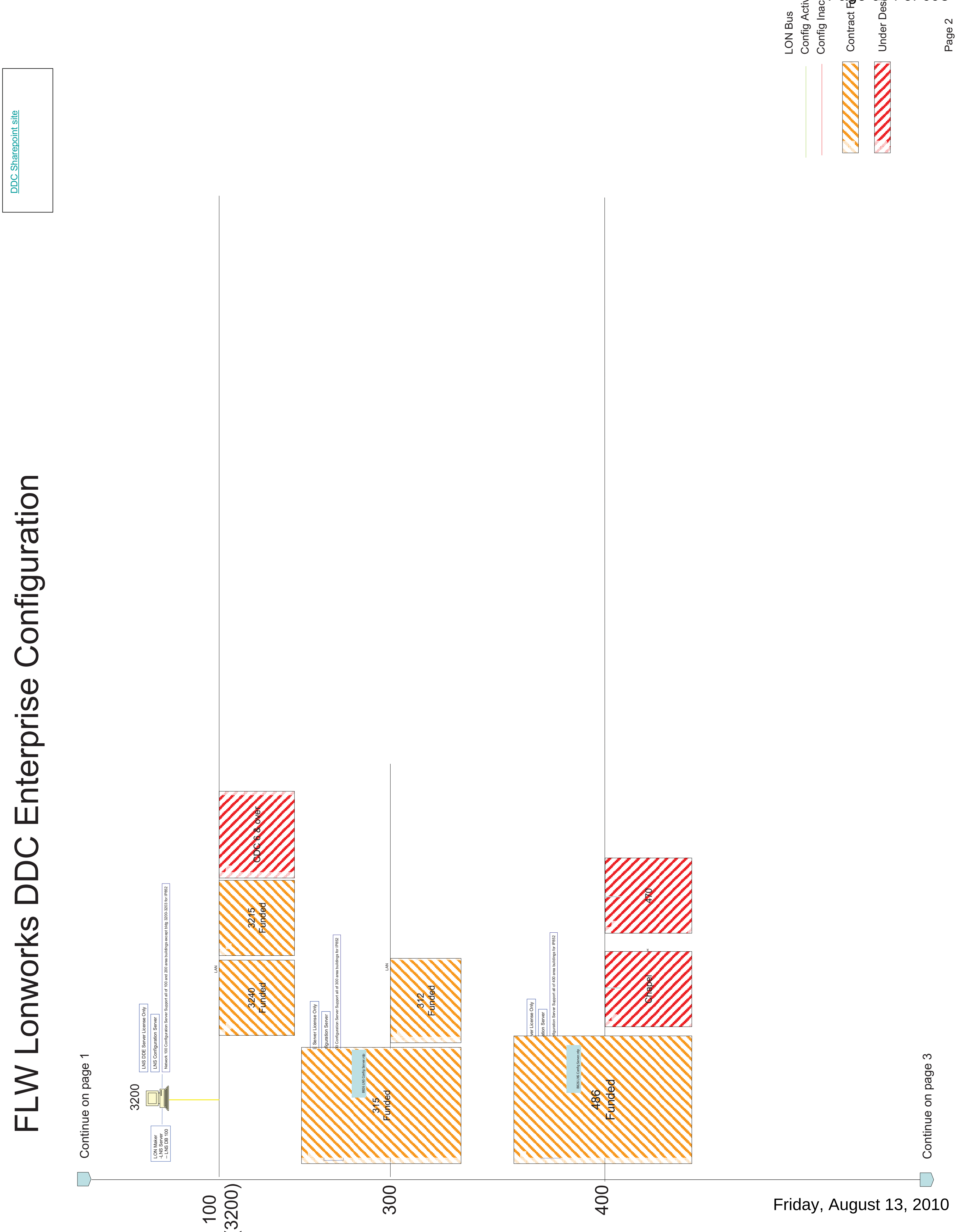
30. On site training course has been completed. |____|

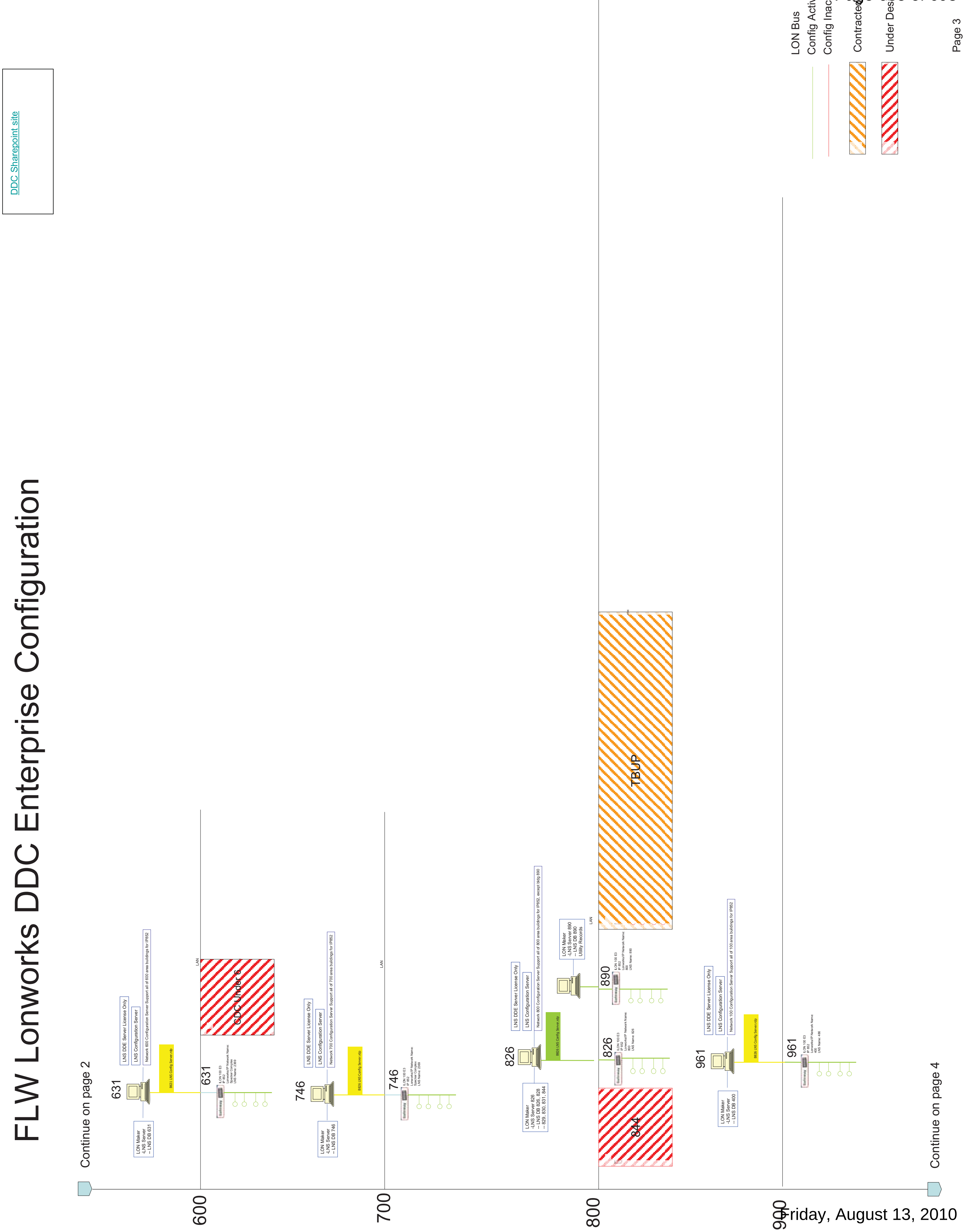
31. Off site training has been completed. |____|

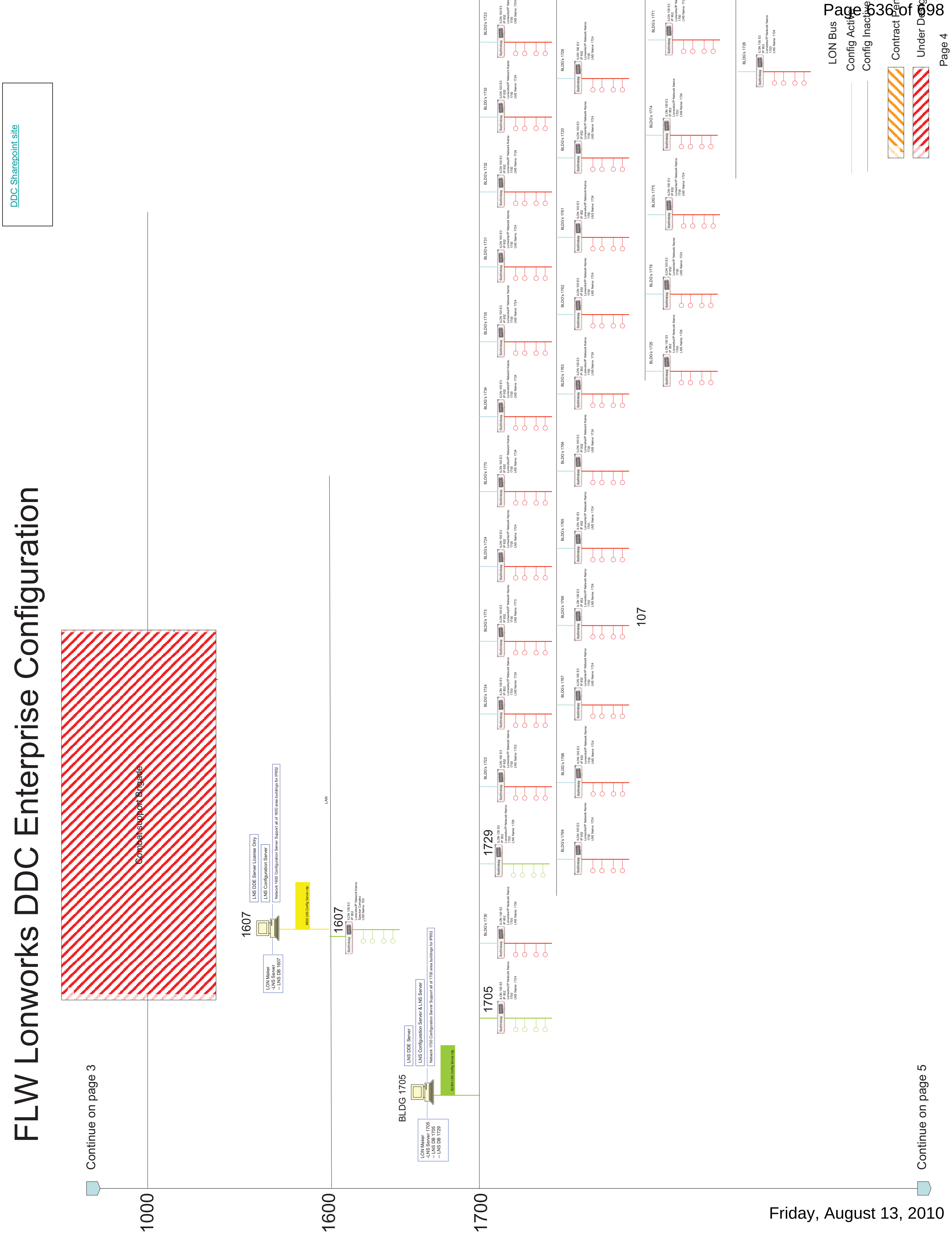
(QC Representative Signature) (Date)


DPW
FLW
UMCS
FORT LEONARD WOOD, MO.
PROJECT # ###-####-### #-#-#
REPLACE HVAC CONTROLS
FLW CPU & BPOC REQUIREMENTS
M-001
NOTE: BPOC IP 852 ROUTING OPTION CONFIGURED AND ENABLED TO COMMUNICATE WITH THE EXISTING ENTERPRIZE LNS UMCS
RACEWAY TO UTILITY GAS METER
PROVIDE 22 GA SHIELDED TWISTED PAIR WIRING
RACEWAY TO UTILITY WATER METER
RACEWAY TO UTILITY ELECTRIC METER
PROVIDE LONG RADIUS ELBOWS OR
OR LONG MOGUL CONDUIT BODIES
METER RACEWAYS
DDC ENCLOSURE
PROVIDE CAT 6 PATCH CABLE
i-LON 100e3
BPOC
PULSE INPUTS
2 ea.RJ 45 JACKS
BUILDING LEVEL TP/FT-10(LON) NETWORK
CHANNEL 2
CHANNEL 3
CHANNEL 1
LON-LON ROUTER
GPPC
STAT
ASC
SENSOR
NODE
T
MULTIPLE CHANNEL BIULDING LEVEL NETWORK SHOWN
MAY NOT BE REQUIRED
NEMA 12 ENCLOSURE LOCATED [MECH ROOM NEXT TO BPOC ENCLOSURE]
COOLING FAN & GUARDS 100 CFM
LNS SERVER with LNS DATABASE
CPU
110 v
UPS
RJ 45 JACK
PROVIDE PATCH CABLE FOR CPU
VENTILATION LOUVER PLATE
PROVIDE WINDOWS XP PROFESSIONAL LICENSE ON CPU & TURN OVER TO DPW MES FOR FLW IT CONFIGURATION
WINDOWS XP ARMY GOLD VERSION with LNS Server and LNS Configuration Server installed and managing the LNS Database
LNS DDE Server OEM version License provided to DPW Managment of Engineered Systems section.
PROVIDE CAT 6 CABLE TERMINATED ON BLDG PATCH PANEL AND LAN JACKS LOCATED IN CPU AND BPOC ENCLOSURE
DEDICATED RACEWAY TO COMM WIRE TRAY BACK TO COM CLOSET
DIRECTORATE OF INFORMATION MANAGMENT (DOIM) IT PATCH PANEL LOCATED BLDG. COMMUNICATIONS CLOSET
NOTES:
1. COORDINATE WITH DPW AFTER CABLE INSTALLATION TO COMM ROOM TO COORDINATE IT(DOIM) PATCH CABLE INSTALL
2. DOUBLY TERMINATED BUS TOPOLOGY SHOWN FOR BUILDING LEVEL(LON)NETWORK (T)
3. CONTRACTOR TO PROVIDE FACTORY FABRICATED PATCH CABLES FOR CPU AND BPOC
4. Provide LNS DDE Server OEM License to DPW Managment of Engineered Systems section.
5. PROVIDE AN INTRUSION ALARM FOR THE CPU ENCLOSURE THAT WILL ALARM DPW MES BRANCH VIA E-MAIL OVER THE IP NETWORK AS SPECIFIED & SHOWN
6. IP ADDRESS'S WILL NOT BE AVAILABLE UNTIL IT NETWORK IS ESTABLISHED


FLW Lonworks DDC Enterprise Configuration Revised: 4/24/08
DDC Sharepoint site
WAN
LAN
BLDG 404 (DOIM Server Farm)
SQL Server 2005
Web Services & SMTP & SNTP
Web Services / SQL Server
BLDG 2222
LON Maker
-LNS Server
LNS DDE Server
LNS Remote Connecter Services
LNS DDE "South"
Network 5000
LNS DDE "North"
LNS DDE "Central"
LNS DDE "West"
Network 6000
LNS DDE "East"
LEONNBD4MD1C1
LEONNBH2RKF91
LEONNB2THP1B11
Out of commission
Requesting replacement
DPW MES 1 1Laptop
-LonMaker
-Use of LNS Remote Client to connect to LNS DB
DPW Inspector 1Laptop
-LonMaker Turbo
-All plugins for all bldg's except Specker Plant & MANSCEN
-Use of LNS Remote Client to connect to LNS DB
LB&B Controls Tech 2Laptop
LB&B Controls Tech 1 Laptop
Specker Plant Laptop
3 PC for software = Vendor Laptop2, Specker Plant Laptop, Configuration Server
Vendor Laptop 2 Laptop (Specific to Specker Phase 1)
Bldg's 1722, 1724, 1773, 1734, 1735, 1731, 1732, 1733, 1723, 1726, 1720
Vendor Laptop 1 Laptop
Bldg's 1607, 1705, 2100, (Specker Plant Temporary: 2369, 1729, 1772, 1760, 1770) 961, 315, 312, 631, 746, 826,
Vendor Laptop 3 Laptop
Bldg's 5429A, 2130, 5410, 5429, 5265, (Specker 2: 1771, 1774, 1775, 1776, 1762, 1763, 1764, 1761, 1766, 1768, 1765, 1767, 1769, 1725, 1728, 1730, 1729), 3240, 486, 1705, 2100
Any desktop on FLW can remote to configuration server as long as privileges set.
Current software installed on 2369 Configuration Server:
LonMaker Turbo Edition S#
Adobe Contribute
ILON Vision
LonMaker Configuration Server
LNS DDE Server License Only
LNS Configuration Server
2369
1760
1772
3201 VAV
Booster Pump
Booster Pump
Prime Power School
MANSCEN COMPLEX
Specker Plant
TA244
MANSCEN
Continue on page 2
LON Bus
Config Active
Config Inactive
Contract Ended
Under Design
Page 1

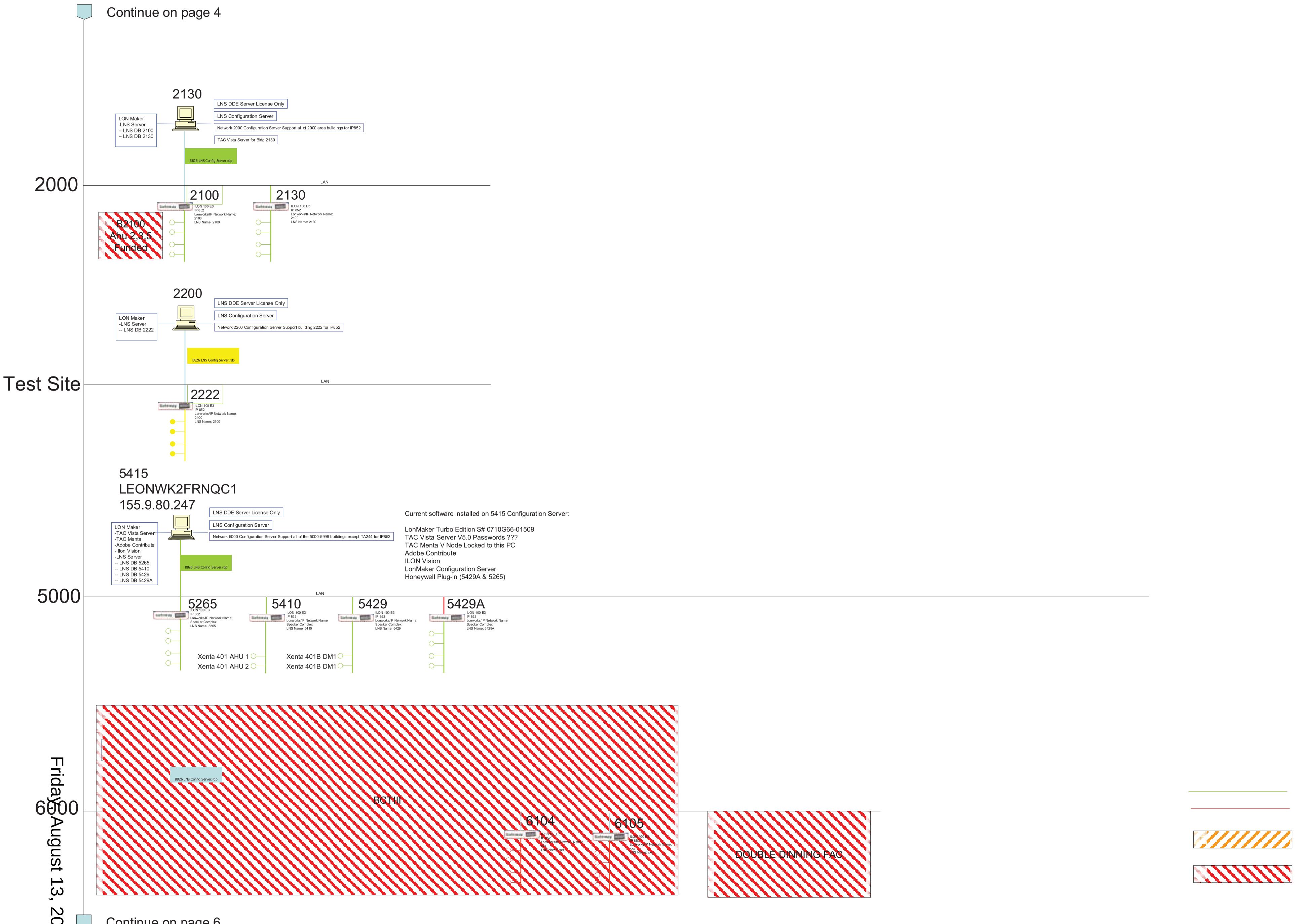

FLW Lonworks DDC Enterprise Configuration
DDC Sharepoint site
LON Bus
Config Active
Config Inactive
Contract Funded
Under Design
Page 2
Continue on page 1
Continue on page 3
3200
LON Maker
-LNS Server
-- LNS DB 100
LNS DDE Server License Only
LNS Configuration Server
LAN
3240
Funded
3215
Funded
CDC 6 & over
312
Funded
315
Funded
Chapel
470
486
Funded
100
(3200)
300
400


FLW Lonworks DDC Enterprise Configuration
DDC Sharepoint site
LON Bus
Config Active
Config Inactive
Contracted/Funded
Under Design
Page 3
Continue on page 2
Continue on page 4
600
700
800
900
631
746
826
890
961
844
TBUP
DDC Under C
LAN
LNS DDE Server License Only
LNS Configuration Server
LON Maker
-LNS Server
-- LNS DB 631
-- LNS DB 746
-- LNS DB 400
-- LNS DB 890
Utility Records


FLW Lonworks DDC Enterprise Configuration
DDC Sharepoint site
Continue on page 3
Continue on page 5
Combat support Brigade
1000
1600
1700
1607
1705
1729
107
BLDG 1705
LAN
LON Bus
Config Active
Config Inactive
Contract Pending
Under Design
Page 4

FLW Lonworks DDC Enterprise Configuration

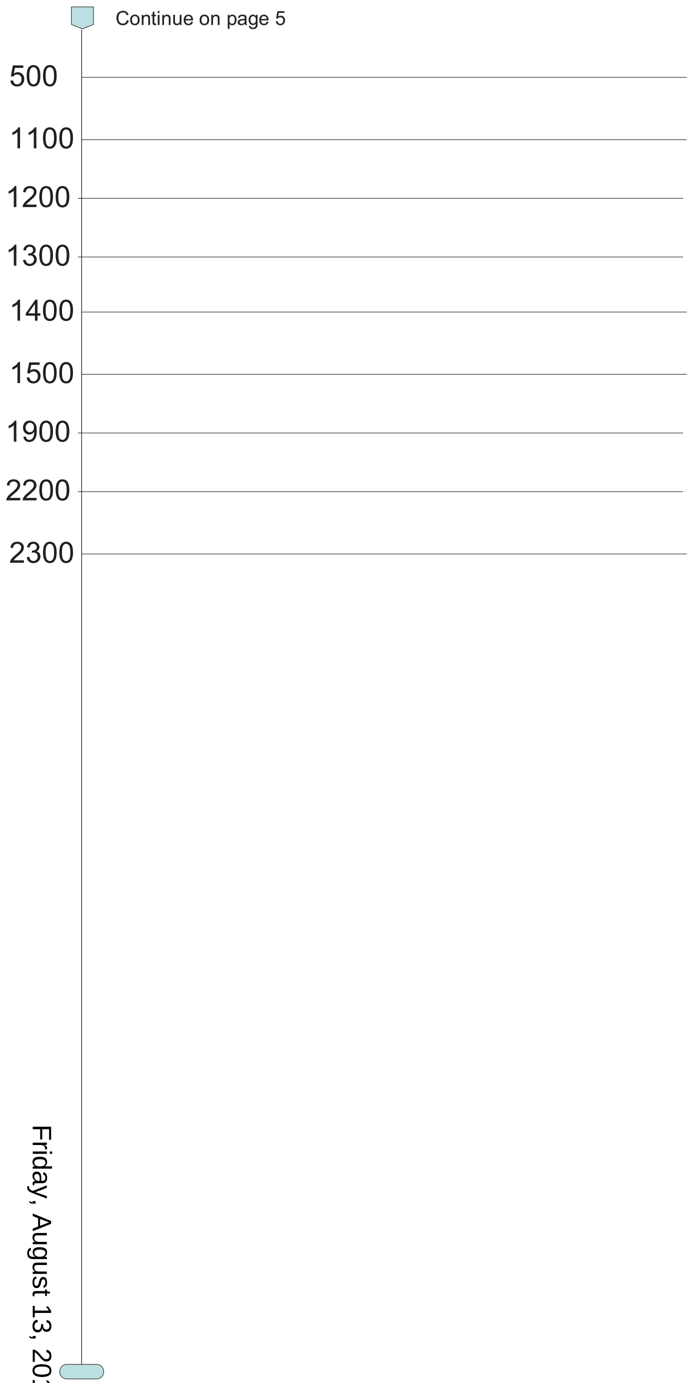
DDC Sharepoint site



FLW Lonworks DDC Enterprise Configuration

DDC Sharepoint site

Continue on page 5

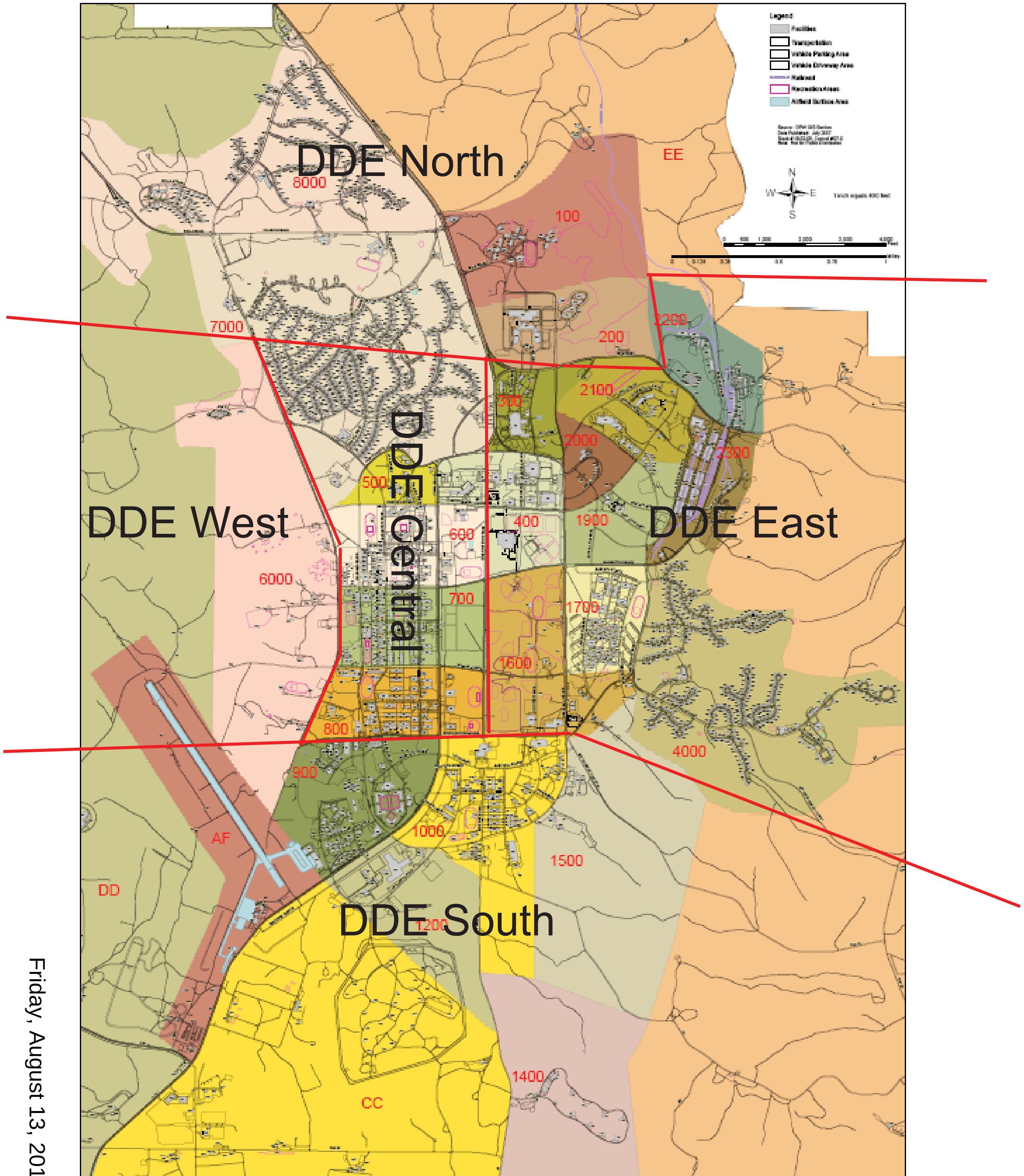


LON Bus
Config Active
Config Inactive
Contract Funded
Under Design

FLW Lonworks DDC Enterprise Configuration

[DDC Sharepoint site]

DDE Split



Lon Works

- Who worked with Corps from LonMark?

Notes for specs

ILON 100

- Astronomical Clock - Green - East West Light Dimming.
- Alarming SMTP - E-mail add to spec - what email to use. Have Holly add to existing.
- Re - accredit for Army.
- Problem - has multiple connections TP/FT10 - MODBUS - MBU
- Have Holly lockdown WSDL via WebParams
- USE MD5 Authentication Key - Manual passing the key only
- Enalbe Security parameters for Security access reset. Require Security Access.
- VXworks - unix like os
- Enable SNTP use DOIM SNTP Server
- Define who to send e-mails to
- Define what to log
- Pulse metering data types: Watt-hours, Kilowatt & Liters
- Pulse metering outputs: how do we want to accumulate NV or Logs or SOAP/XML
- Define when to clear logs
- Define when to use cirular logs
- Define when to input physical read of meters to adjust pulse meter in SQL

Lon scanner Protocal Analyzer

- Check with Roger if we have. Have contractor supply output - What do we ask for???
-

LNS

- LNS use database called POET
- POET uses port 6001 & 6002

IP-852

- use SNTP
- PC on for commision & decommison

Energy

- Check with Dale if a broadcast (web service) is sent for peak demand.

if so use ILON to automaticly reduce demand.

Routeadd.bat

- route add 192.168.1.0 mask 255.255.255.0 %computername%

Page “Last”

APPENDIX DD

Project Specific Requirements

1 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

2 AVAILABILITY AND USE OF UTILITY SERVICES

2.1 Payment for Utility Services

All temporary utility connections and services for site trailers, field offices, construction power, etc., shall be at the Contractor's expense. The utility usage during construction, and until the time of beneficial occupancy by the Government, shall be paid for by the Contractor at the prevailing rates charged by the Government, or where the utility is produced by the Government, at reasonable rates as determined by the Contracting Officer. The Contractor shall carefully conserve utilities, if any, that are furnished without charge. The Contractor shall establish a Utilities Sales Agreement with the DPW Energy Branch 15 working days before final connection of any utility is desired. Contractor must contact the DPW Energy Branch at 573-596-0645 with the following information to establish a utility sales contract:

a. Company Name
b. POC on-site
c. POC for signing contract (must be an authorized person to sign a legal document on behalf of the company.
d. Company Address
e. Company Phone Number
f. On-site Phone Number
g. E-mail Address
h. Location of Work

Once contract is signed the DPW Energy Branch will email the utility company with authorization to provide utilities to your company.

2.2 Meters and Temporary Connections

a. When a utility is serviced from a Government-owned utility distribution system, the Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain all necessary temporary connections, distribution lines, and distribution equipment, and all meter assemblies required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall provide the Contracting Officer a detailed utility connection and metering plan for approval a minimum of 5 working days prior to the desired utility connection. The Government will approve the Contractor's installation for connection after inspection. After receiving approval, the Contractor shall make the final utility connection.

b. When a utility is serviced from a non-Government-owned utility distribution system, the Contractor shall notify the Contracting Officer in writing of the utility requirement so that service can be coordinated through the DPW Operations Branch with the appropriate utility service provider. The utility service connection charge, to include any required distribution lines, distribution equipment, and meter assemblies, shall be at the Contractor's expense. The Contractor shall not install any utility distribution system components for, nor make any connections to, a non-Government utility system.

c. The water and waste-water distribution systems are currently Government owned, with the privatization of these utility systems to a non-Government entity pending the final decision of the solicitation that is currently being conducted. The natural gas and electrical distribution systems are non-Government owned.

d. All temporary electrical services from the electrical utility distribution system, to and including the meter assembly, shall be provided by the Electrical Utility at the Contractor's expense. The Contractor shall contract directly with the Utility for all temporary power connection requirements. The point of demarcation for the Utility's electrical service will be the load side connections of the Electrical Utility provided meter assembly. The Contractor shall furnish and install all temporary service equipment on the load side of the utility service demarcation point. The Contractor shall coordinate all temporary service locations and requirements with the Electrical Utility, Laclede Electric Cooperative.

2.3 Advance Deposit

An advance deposit is not required for the utilities usage that is to be paid to the Government. However, a deposit, or upfront payment, may be required by the Utility for the connection fee to a non-Government distribution system.

2.4 Final Meter Reading

Before final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading. If the utility is serviced from a Government-owned utility distribution system, the Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall remove all the temporary distribution lines, distribution equipment, meter assemblies, and associated paraphernalia. If the utility is serviced from a non-Government-owned utility distribution system, the Contractor shall notify and coordinate with the Utility for the removal of the temporary service lines and equipment that is owned by the Utility. The Contractor shall remove all temporary lines and equipment on the load side of the utility service demarcation point.

3 CONTRACTOR'S TEMPORARY FACILITIES

3.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

3.2 Storage Area

The Contractor shall construct a temporary 6 foot high chain link fence around trailers and materials. The fence shall include plastic strip inserts so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

3.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

3.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

3.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

3.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

3.7 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

4 GOVERNMENT FIELD OFFICE

4.1 Resident Engineer's Office

The Contractor shall furnish bottled drinking water with cooler.

There shall be two private offices, one at each end of the facility. Each private office shall be furnished with one desk, two office chairs, two cushioned fold up chairs, and one four drawer legal size file cabinet.

The center area between the offices shall be a conference area furnished with a minimum 16' x 3' conference table and 12 chairs. The center area will also have one desk with office chair. The center area shall also be provided with one plans rack with a minimum of 10 rack clips and a minimum 6' x 2.5' plan table.

The entire facility including the furniture provided by the Contractor will remain the property of the Contractor and shall be removed from the site no sooner than 30 calendar days after completion of the work.

5 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

6 CLEANUP

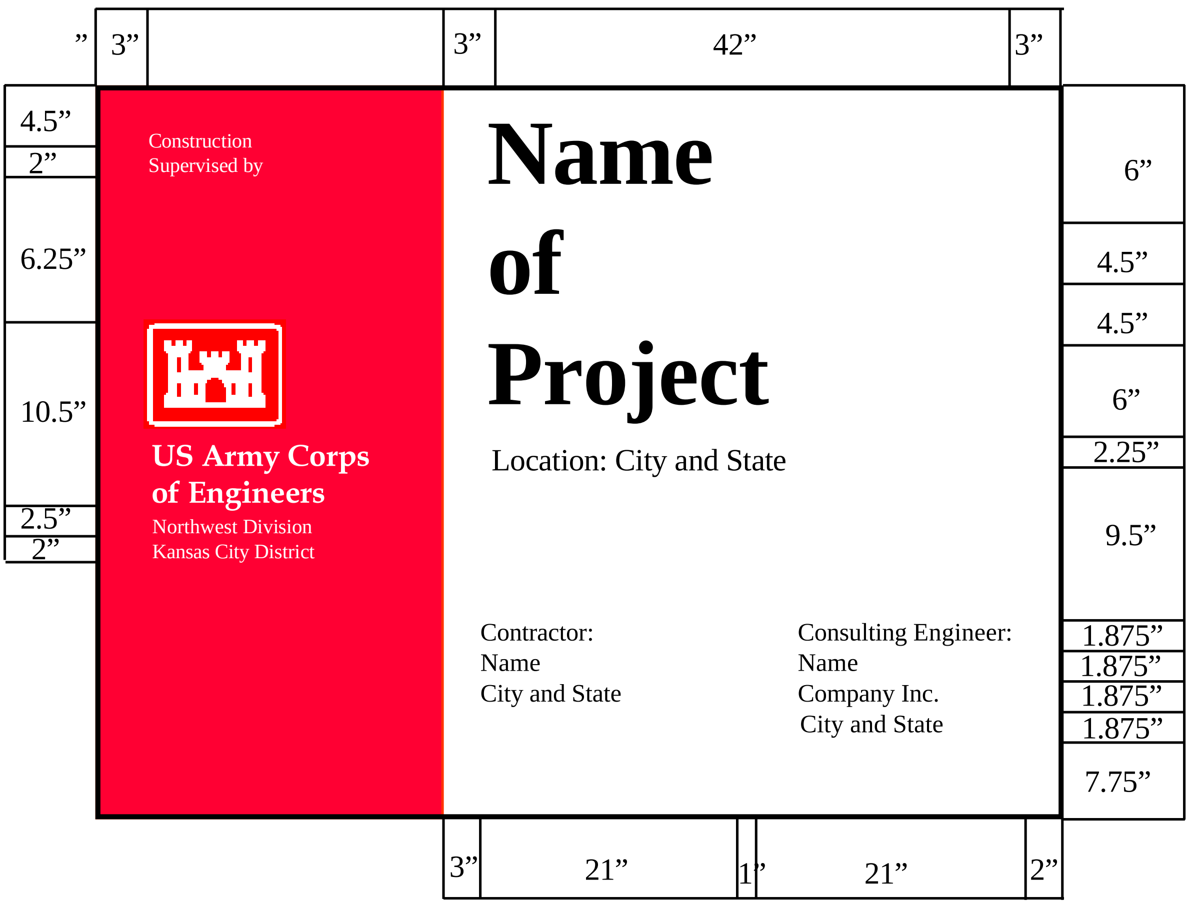
Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

7 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

The graphic format for this 4’x 6’ sign panel follows the legend guidelines and layout as specified below. The large 4’x 4’ section of panel on the right is to be white with black legend. The 2’x 4’ section of the sign on the left with with the full Corps signature (reverse version) is to be screen printed Communications Red on the White background.

This sign is to be placed with the Safety Performance Sign (See Fig. 2).



Legend Group 1: One to two-line description of Corps relationship to project
Color White
Typeface 1.25” Helvehca Regular
Maximum line lenth: 19”

Legend Group 2: Division\ District Name Placed below 10.5” Reverse Signature (6” Castle).
Color: White
Typeface: 1.25” Helvetica Regular

Legend Group 3: One- to three-line project title legend describes the work beging done under this contract.
Color: Black
Typeface: 3” Helvetica Bold
Maximum line length: 42”

Legend Group 4: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).
Color: Black
Typeface: 1.5” Helveticia Regular
Maximum line length: 42”

Cross-align the first line of Legend Group 4 with the first line of the Corps Signature (US Army Corps) as shown.

Legend Groups 5a-b: One- to five-line identification of prime contractors including: type (arcthitect, general contractor, etc.), corporate or firm name, city, state.
Use of Legend Group 5 is optional.
Color: Black
Typeface: 1.25” Helvetica Regular
Maximum line length: 21”

All typography is flush left and rag right, upper and lower case with initial capitals only as shown. Letter- and word-spacing to follow Corps standands

Sign Type	Legend Size	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-01	Various	4’ x 6’	4” x 4”	HDO-3	48”	WH-RD/BK

CONSTRUCTION SIGN (CORPS OF ENGINEERS DESIGN)
(Use with Fig 2)

Fig. 1

SAFETY PERFORMANCE SIGN

Each contractor's safety record is to be posted on Corps managed or supervised construction projects and mounted with the construction project identification sign.

The graphic format, color, size and typefaces used on the sign are to be reproduced exactly as specified below. The title with First Aid logo in the top section of the sign and the performance record captions are standard for all signs of the type. Legend Groups 2 and 3 below identify the project and the contractor and are to be placed on the sign as shown.

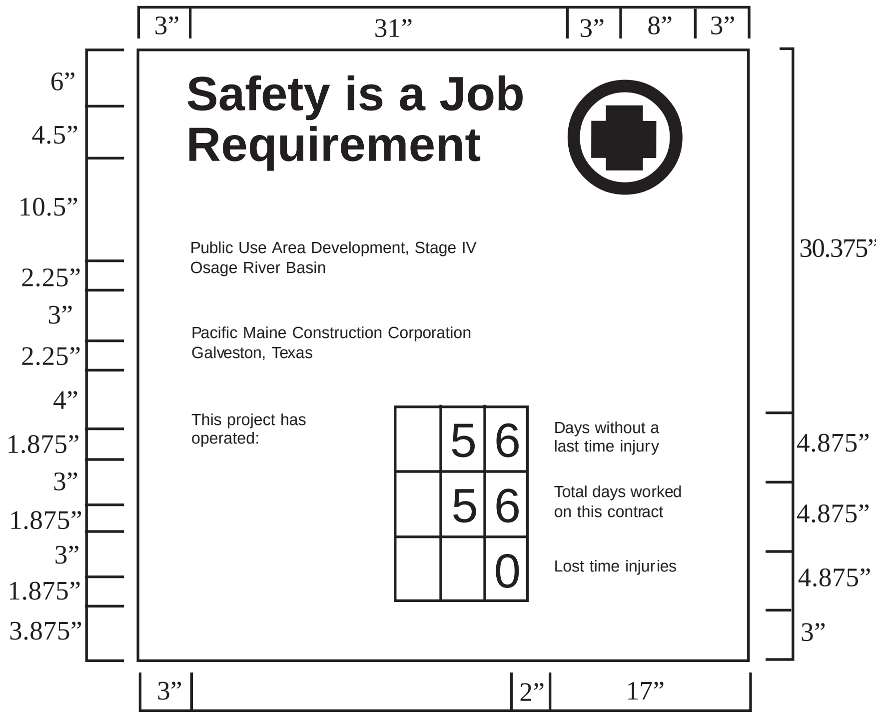
Safety record numbers are mounted on individual metal plates and are screw mounted to the background to allow for daily revisions to posted safety performance record.

Legend Group 1: Standard two-line title "Safety is a Job requirement" with (8 od.) Safety Green First Aid logo.
Color: to match PMS 347
Typeface: 3" Helvetica Bold
Color: Black

Legend Group 2: One to two-line project title legend describes the work being done under this contract and name of host project.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 3: One to two-line identification; name of prime contractor and city, state address.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 4: Standard safety record captions as shown.
Color: Black
Typeface: 12.5" Helvetica Regular



Sign Type	Legend Size	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-02	Various	4' X 4'	4" X 4"	HDO-3	48"	WH/BK - GR

Replaceable numbers are to be mounted on white .060 aluminum plates and screw-mounted to background.
Color: Black
Typeface: 3" Helvetica Regular
Plate size: 2.5" X 5"

All typography is flush left and rag right. Upper and lower case with initial capitals only as shown. Letter - and word - spacing to follow Corps standards.

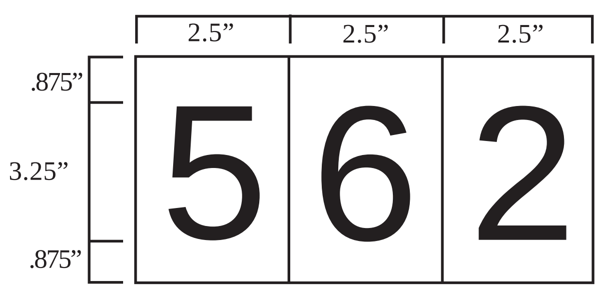


Fig. 2

APPENDIX EE

Interior Design Standards

Interior Design Standards

Part 1 – The follow ing is an excerpt from the Fort Leonard Wood Installation Design Guide concerning the Interior Design Checklist.

The following checklist is optional and is designed for use on major projects.

INTERIOR DESIGN REVIEW CHECKLIST

1. Installation	**Project**	**Date**
Job Description		
Building No.	**Building Cost$**	
Evaluator Furnishing	**Cost$**	
Using Agency Coordinator	**Phone#**	
Designer Phone#		

ITEM YES		**NO**	**N/A**
2. Is the interior design integral to the facility design?			
- Interior design is specified by the using agency.			
- Scope of work includes building related interior design.			
- Scope of work includes furniture related interior design.			
- Design incorporates Army Installation Design Guide and Standards criteria.			
- DPW representative was a member of Pre-selection and/or Selection Boards.			
Preselection member:			
Selection member:			
3. Was the designer provided interior design criteria?			
- Unified Facilities Criteria (UFC) 3-120-02, Design Guide: Interiors			
- Design Guide for facility type designed.			
- Army Installation Design Guide and Standards.			

ITEM YES		NO	N/A
4. The design has been reviewed and the following are acceptable?			
For building related interior design?			
- Statement of Design Objective			
- Sketches			
- Color Board			
- Furniture Plan			
- Exterior Materials and Finishes			
- Graphic Design			
Hand Drawn Sketches			
Digital image files (JPG, BMP, etc.)			
3D Model			
Animation (AVI, etc.)			
- Interior Design Finish Schedule			
- Government Furnished Material List			
Items for Installation of Furniture and Accessories			
-Predesign Evaluation:			
Maintenance Data			
Floor Systems			
Electrical Equipment and Task/Supplemental Lighting			
- Interior Element Specification			
Cost Estimates:			
Maintenance and Repair			
New Work			
Equipment-in-place and Furnishings			
For furniture related interior design:			
- Typical furniture layout			
- Furnishing, fabrics and finishes board			
- Furnishings plan			
- Sketch perspectives			
- Colored rendering			

ITEM YES		NO	N/A
- Photographs			
- Catalog Cuts			
- Furnishing illustration sheets			
- Furnishing placement lists			
- Furnishing order forms			
- Furnishing contract specifications			
5. Does the interior design address the following functions?			
- Communications			
- Storage/filing			
- Display surfaces			
- Work surfaces			
- Conference Space(s)			
- Privacy			
- Lighting			
- Planting			
- Spatial considerations			
- Color/texture characteristics			
- Reflectance values			
- Acoustical considerations			
- Mechanical fixture placement			
- Electronic support			
- Furnishings/accessories			
- Work, training or paper flow			
- Hardware selection			
- Graphics/signage			
- Force Protection			
- Physical Security			
- Fire Safety			

ITEM YES		NO	N/A
6. Construction and installation phase			
- Positive first impression is created			
- Coordinated color scheme, interior reflecting exterior			
- Area & shape of spaces match function & support mission			
- Furnishings support function of space			
- Creative use of interior design spaces			
- Retained designer to review and approve contractor submittals			
- Retained designer to oversee the installation of furnishings			
- Color boards were required and reviewed			
- Interior appearance policy is implemented			

Describe actions taken to ensure quality interior design to all negative responses on an attached sheet. Maintain a copy of this interior design review checklist and all negative responses in the DPW project file.

I hereby certify that the information provided is in compliance w ith the guidelines of the installation or applicable IDG, except as justified as non-compliance.

Designer of Record	**Date**		
Concur			
Deny (Explanation of denial is attached.)			
Master Planner	**Date**		
Accept			
Deny (Explanation of denial is attached.)			
Command Review (Where Applicable)	**Date**		

ITEM YES		NO	N/A

Part 2 – The follow ing is an excerpt from the Fort Leonard Wood Installation Design Guide concerning the Interior Design Finish Standards.

I.1 Finish Standards

Each building needs to have its own identity, which will orient visitors to the installation. Standardized finishes provide a unifying element and are important for administrative and financial reasons. They provide flexibility, are easier to manage and are more cost effective.

Since it is not possible to change to new standards all at once, it is important to at least try to maintain a certain standard for each building. When small projects are completed within a building, the new materials or furnishings must still work with the existing space. If the newer standards will not coordinate with the existing finishes and furniture, a different selection may be required. For example, if the carpet is worn and needs to be replaced, a carpet should be selected that is similar to the new standard but that will coordinate with the existing colors and materials. Whenever possible, projects should be planned for a larger contiguous area of work so that the new standards may be installed. Changing only a small portion of the finishes can be unsuccessful if the end result is obvious. The durability, maintenance and quality of the finishes should be based on the particular image and function of the space and the building.

I.2 Common Finish Recommendations

All door hardware to be a consistent finish – satin finished stainless steel.

All outlet and switch cover plates to be ivory to blend with the neutral color scheme.

All toilet accessories to be brushed stainless steel.

Acoustical ceiling grid to be white. All ceiling mounted accessories: grilles, speakers, smoke detectors, etc. to be white to match ceiling. (Exceptions: sprinkler heads)

All doors within a building to be finished the same –either painted or stained.

All artwork to have black metal frames.

Refer to specifications for additional detail for all fixtures, furnishings and finishes.

Color selections, when not indicated for finishes, to be approved by Department of Public Works (DPW).

I.3 Administrative Finish Recommendations

Administration buildings on the Post are typically masonry with multiple penetrations to allow daylight into the space. There are more architectural elements on the exterior and interior to create focal points and add interest. The interiors are typically warm, comfortable, inviting and professional.

The individual finish selections are referenced by the alphanumeric code which is used in the index and specifications.

CPT-1 Carpet
CPT-2 Accent Carpet
PT-1 Wall Paint
PT-2 Accent Paint
PT-3 Ceiling Paint
PT-4 Multi-color Paint
PL-1 Plastic Laminate
PL-2 Plastic Laminate VCT-1 Vinyl Floor Tile
VCT-2 Vinyl Floor Tile — Slip Resistant
VS-1 Rubber Stair Tread VB-1 Rubber Base
WO-1 Walk-off Mat
VWC-1 Vinyl Wallcovering VWC-2Vinyl Wallcovering
FWC-1 Fabric Textile Wallcovering
CT-1 Ceramic Floor Tile
CT-2 Ceramic Floor Tile — Accent
CT-3 Ceramic Wall Tile
CT-4 Ceramic Wall Tile — Accent
ACT-1 Acoustic Ceiling Tile WD-1 Wood Finish

I.4 Specifications

08710 — Hardware

Item:
Locksets/Latchsets
Item code:
HW-1
Description:
Heavy duty mortise lock with lever handle conforming to Federal Specification FFH-106C/GEN 7-19-74 and ANSI A156.13. Ensure it meets ADA Standards
Material Finish:
Satin Finish Stainless Steel

Item:
Door Closers
Description:
Surface mounted closer with sliding track arm. Provide hold open on all doors except fire doors. Mount closers inside rooms. Avoid mounting closers in corridors. Do not mount closers on door head.
Material/Finish:
Painted-aluminum color (BHMA 689)

09300 –Ceramic Tile

Item:
Ceramic Floor Tile
Item code:
CT-1, CT-2
Description:
2"X2" (51X51 mm) unglazed ceramic mosaic tile for restroom floors.
Color/Pattern:
Color and finish per DPW.

Item:
Ceramic Wall Tile
Item code:
CT-3, CT-4
Description:
4-1/4"X4-1/4" (108X108 mm) glazed ceramic tile scored
to look like 2"X2" (51X51 mm) tile for restroom walls. *Color/Pattern:*
Color and finish per DPW.

09511 –Ceiling Materials

Item:
Acoustical Ceiling Tile
Item code:
ACT-1
Description:
Standard for all new installations is 24"X24" (610X610 mm) system. Acoustical fissured 24"X48" (614X1219 mm) ceiling panels scored in the center to give appearance of 24"X24" (610X610 mm) panels for existing ceiling grid system only. Use scored tile in retrofit areas to match existing 24"X24" (610X610 mm) tiles.
24"X24" (610X610 mm)
Material/Finish:
Mineral base panels with white painted finish. Use black tile for specialty applications such as audio/visual rooms that require blackout and use only with black grid.

Item:
Ceiling Suspension System
Description:
15/16" (24 mm) exposed tee suspension grid.
Material/Finish:
Steel with baked white enamel finish. Use backed enamel black finish for specialty applications such as audio/visual rooms that require blackout and use only with black tile.

09660 – Resilient Tile Flooring

Item:
Vinyl Composition Tile
Item code:
VCT-1
Description:
Class 2 through pattern, smooth surface, 1/8"X12"X12" (3X305X305 mm) vinyl tile.
Color/Pattern:
Color and pattern per DPW.
Adhesives:
Water resistant type recommended by manufacturer suitable for the substrate.

Item:
Slip Resistant Vinyl Composition Tile
Item code:
VCT-2
Description:
For use at building entries. Class 2 through pattern, abrasive mineral coating factory applied to surface of tile in a grid pattern, 1/8"X12"X12" (3X305X305 mm) vinyl tile.
Color/Pattern:
Color and pattern per DPW.
Adhesives:
Water resistant type recommended by manufacturer suitable for the substrate.

Item:
Rubber Stair Tread
Item code:
V S - 1 *Description:*
Johnsonite or equal. Conform to ASTM F-1344-93, Standard specification for rubber floor tile. Treads: 131/4" (33.66 cm) overall depth, 1/4" (6 mm) gauge, Heavy duty Safe-T-Grip (G), Square Nose Risers: Smooth, 1/4" (6 mm) gauge.
Color/Pattern:
Color and pattern per DPW.

09660 – Resilient Base

Item:
Rubber Base
Item code: VB-1
Description:
4"X1/8" (63X3 mm) rubber wall base. Cove profile at all flooring surfaces. Provide in polls for seamless installation *Color/Pattern:*
Color and pattern per DPW.

09680 – Carpet

Item:

Office and General Use Carpet

Item code:

CPT-1, CPT-2,

Description:

Carpet for office and general commercial uses to meet the following minimum requirements.

Face Construction: Tufted or woven level loop, multilevel loop, cut and loop or woven. Fully cut pile is not acceptable.

Face Fiber: 100% branded nylon – either Antron, Ultron or Zeftron nylon with anti-stain treatment. Type 6, 6 or 6 branded by fiber manufacturer.

Gauge: Minimum 1/10 inch (3 mm)

Stitches: 13.5 per inch (25 mm) for woven and cut and loop. 10.3 per inch (25 mm) for loop.

Pile Height: Minimum 9/32" (7 mm) for cut and loop. (.281) Minimum 5/32" (4 mm) for loop (.156) Minimum 7/32" (6 mm) for loop (.219)

Pile Weight: Minimum 79 oz. (2.2 kg) for cut and loop.

[30 oz. (0.8 kg) for cut and loop] Minimum 64 oz. (1.8 kg) for loop. [28 oz. (0..79 kg) for bonded] Minimum 70 oz. (2.0 kg) for woven. [28 oz. (0.79 g) loop pile]

Average Density: 6000 minimum

Primary Backing: Polypropylene

Static Control: Built into the fiber; less than 3.5 Kv., for normal office environments; less than 2.0 Kv. for computer/technical rooms.

Fire Characteristics: Radiant flux - .45 or greater; Smoke density: -450 or less

Wear Classification: Severe

Color/Pattern:

Color and pattern per DPW. Multiple colors (3 or greater in open areas.)

Item:

Carpet Tile

Description:

Carpet to meet the following minimum requirements. Weave: Tufted

Surface Texture: Cut pile.

Face Yarn: 100% branded nylon – either Antron, Ultron or Zeftron nylon with anti-stain treatment. Type 6, 6 or 6 branded by fiber manufacturer.

Dve Method: Solution or approved yarn dye

Gauge: Minimum 1/8 inch (3 mm)

Stitches: 9 per inch (25 mm)

Pile Height: .177" (5 mm) to .203" (5 mm)

Face Weight: 28 oz. (0.79 kg) per sq. yd. (1 sq. yd. = 0.836 sm)

Total Weight: 138.4 oz. (3.9 kg) per sq. yd. (1 sq. yd. = 0.836 sm)

Average Density: 6000 minimum

Standard Backing: to be equal to Milliken PVC-Free Comfort Plus® cushion

Static Control: Built into the fiber; less than 3.5 Kv., for normal office environments; less than 2.0 Kv. for computer/technical rooms.

Fire Characteristics: Radiant flux - .45 or greater; Smoke density: -450 or less

Wear Classification: Severe

Color/Pattern:

Color and pattern per DPW. Color and material to match the color scheme for the building.

09920 – Painting

Item:
Interior Solid Color Paint
Item code: PT-1, PT-2, PT-3
Application:
All interior wall surfaces and gypsum board ceilings. *Color/Quality:*
Color per DPW. Provide manufacturer's first quality materials.
Paint Schedule:
<u>Eggshell Finish:</u> Gypsum board, plaster and cementitious surface.
<u>Semi-gloss:</u> Wood trim, doors, door frames, and metal surfaces.

Item:
Interior Multi-Color Paint
Item code:
PT-4
Application:
Office environments, commercial spaces, and smooth textured walls.
Color:
Color per DPW.
Material:
Spray applied polychromatic, polymer paint consisting of discrete beads of pigment coated with resin and suspended in an aqueous solution. Use materials recommended by manufacturer for substrate to be applied.
Material Compatibility:
Provide block fillers, primers, finish coat materials and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
Material Quality: Provide the best-quality grade of multicolored coatings. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.

09950 — Wallcoverings

Item:
Vinyl Walicovering
Item code:
VWC-1, VWC-2
Application:
For use in conference rooms, offices, break rooms, corridors and other high use areas. (Also for installation over concrete block.)
Color/Pattern:
Color per DPW.
Description:

Federal Spec: CCC-W-408, Type II
Fire Characteristics:
ASTM E84 Flame spread not more than 25. Smoke developed not more than 50.
Backing:
Sheeting

Item:
Textile Wallcovering
Item code:
FWC-1 *Application:*
For use in executive offices and conference rooms for 0-6 officers and above.
Color/Pattern:
Color per DPW.
Description:
Federal Spec: CCC-W-408
Fire Characteristics:
ASTM E84 Flame spread not more than 25. Smoke
developed not more than 50.
Fiber Content:
100% Olefin
Backing: Acrylic

10100 – Visual Display Boards

Item:
Marker / Tack Boards
Description:
Porcelain enamel marker boards and plastic impregnated cork tack boards.
Material / Finish:
Design: match design of systems furniture or related building finish standard, for a coordinated system.
Marker Boards: Provide balanced, high pressure-laminated porcelain enamel boards of 3-ply construction consisting of face sheet, core material, and backing. Provide writing surface with gloss finish for use with liquid felt-tipped markers.
Tack boards: Provide seamless sheet, 1/4" (6 mm) thick hardboard backing.
Accessories: Provide chalk tray for marker boards. Provide four markers (red, green, brown and black) and an eraser for each unit.

Item:
Bulletin Board Cabinet
Application:
For use in lobbies and common areas for display *Material / Finish:*
Black anodized aluminum, square profile frame with
double doors. 3" (76 mm) depth with black hook fabric.
Item:
Trophy Display Case
Application:

For use in lobbies and common areas for display. *Material / Finish:*
Black anodized aluminum frame with clear tempered glass on 4" (102 mm) solid base.

10800 — Washroom Accessories

Item:
Soap Dispenser
Description:
Recessed drawer-type soap vessel. 9-1/2" (241 mm) wide X 5-1/2" (140 mm) high X 4" (102 mm) deep. (If recessed unit cannot be installed, use similar surface mounted model.)
Material / Finish:
Stainless steel with brushed finish.

Item:
Paper Towel Dispenser
Description:
Recessed, semi-recessed or surface mounted, 14" (356 mm) wide X 28" (711 mm) high X 4" (102 mm) deep. (A combination paper towel/waste receptacle is an appropriate option and can be recessed, semi-recessed or surface mounted.)
Material / Finish:
Stainless steel with brushed finish.

Item:
Waste Receptacle
Description:
Fully recessed 14" (356 mm) wide X 28" (711 mm) high X 4" (102 mm) deep. (If recessed unit cannot be installed, use similar surface mounted model.)
Material / Finish:
Stainless steel with brushed finish.

Item:
Partition Mounted Napkin Disposal
Description:
Surface mounted on toilet partition. 10-11/16" (271 mm) wide X 15-1/8" (384 mm) high X 4-3/16" (106 mm) deep. Disposable liners.
Material / Finish:
Stainless steel with brushed finish.

Item:
Toilet Paper Dispenser
Description:
Surface mounted two roll, side by side, dispenser, similar to Bobrick Model B-686. Provide tumbler lock. 5-7/8" (149 mm) wide X 10-1/2" (267 mm) high X 5-5/8" (143 mm) deep.
Material / Finish:
Stainless steel with brushed finish.

12511 – Horizontal Louver Blinds

Item:
Horizontal Louver Blinds
Description:
Operation: Manual
Handrail: Channel-shaped section fabricated from minimum 0.025" (1 mm) thick sheet steel with rolled edges at top, equipped with end braces. All hardware required for operation of blind at headrail to be enclosed in metal head. Finish of rail to be in same color as slats unless otherwise indicated.
Bottom Rail: Fabricated from steel with rolled edges. Contour section to match slat curvature. Provide metal or plastic end closure caps, same color as rail. Finish rail in same color as slats unless otherwise indicated. Slats: Spring-tempered aluminum slats, alloyed for maximum strength, with forming burrs removed. Slat thickness and ladder support distances adequate to preclude visible sag or bow after continued use. 1" (25 mm) wide, lengths as required, not to exceed 142" (3,607 mm) other components sized to suit.
Ladders: Construction design to support and maintain slat at proper spacing and alignment in open or closed position.
Braided Polyester Cord: Fabricated of not less than 0.045" (1 mm) nor more than 0.068" (1.73 mm) diameter. Integrally braided ladder rungs of not less than 4 threads; space ladders no further than 24" (610 mm) apart and no more than 7" (178 mm) from ends of slats.
Tilting Mechanism: Provide low friction gear tilter, drum and cradle at each ladder, tilt rod, tape clips and grommet guides to prevent wear on ladder and cords. Mechanism designed to hold slats at any angle and prevent movement of slats due to vibration.
Wand Operation: Detachable, clear plastic wand of appropriate length to suit blind installation and to provide convenient operation.
Lifting Mechanism: Crash-proof cord locks with cord separators, braided polyester cords fitted with pulls. Include cord equalizers of self-aligning type designed to maintain horizontal blind position.
Installation Brackets: Provide pre-finished metal mounting brackets designed to facilitate removal of headrail. Provide intermediate brackets at spacing recommended by manufacturer. Include hardware necessary for secure attachment of brackets to adjoining construction and headrails. Provide brackets adequate to support the weight of blind assemblies plus force applied to operate blinds, with mounting holes located to accommodate either horizontal or vertical mounting.
Finish: provide standard factory applied finish system; chemical conversion coating followed by baked-on synthetic resin enamel finish coat. Color shall be as selected by the Contracting Officer.
Fabrication: Prior to fabrication, verify actual opening dimensions by site measurements. Do not proceed with fabrication until unsatisfactory conditions have been resolved. Adjust dimensions for proper fit at openings. Cooperate with other trades for securing headrails to substrates and other finished surfaces.

Fabricate horizontal louver blind components from noncorrosive materials which do not require lubrication during the normal expected life.

Fabricate blind units to completely fill the opening from head to sill and jamb to jamb. For continuous installations, fabricate blind units so that breaks between units occur only at mullions or other defined vertical separation.

Space blind slats to provide overlap for light exclusion when in fully closed position. Equip horizontal louver blind units with the following operations: Full-tilting operations with slats rotating approximately180 degrees. Place tilt-operating controls on left side of blind when facing blind unit. Exceptions may occur due to unique location of window, etc. Height raising, with lifting cord locks for holding blind at any point of travel. Place pull cords on right side of blind when facing it.

12910 – Artwork

Item:
Artwork Frames
Material / Finish:
Frames to be aluminum extrusions with gloss black anodized finish. Frames to be standard for all buildings.
All poster pieces to be dry mounted on foam core and wired for hanging. Alternate methods for hanging are not permitted.

15540 – Plumbing Fixtures

Item:
Standard Faucet
Description:
Supply with swing spout, water economy aerator with maximum 2.2 gpm flow, single lever handle; chrome plated brass P-trap and arm with escutcheon. *Material/Finish:*
Chrome plated brass

Item:
Standard Sink
Description:
Single compartment oval approximately 17" x 11", homogenous solid surface sink integral with countertop with 1, 2 or 3 holes to match selected faucet
Support:
Plastic laminate vanity or metal framing refer to DPW for framework details.
Material / Finish:
Solid surface of polyester/acrylic alloys

Item:
Break Area Faucet
Description:

Goose neck design with paddle wrist handles or single lever mixing valve. Aerator with 2.5 GPM (15.8 cu m/sec) flow. 8" (203 mm) centers.
Material / Finish:
Chrome

Item:
Break Area Sink
Description:
Single compartment stainless steel sink with three holes at 4" (102 mm) centers (verify with faucet selection); 25" (635 mm) wide X 22" (559 mm) deep X 6-1/2" (165 mm) high.
Material / Finish:
Brushed Stainless Steel.

15942 – Air Diffusers

Item:
Air Diffusers
Description:
Air devises shall be steel, square diffusers, flush core, fixed pattern, lay in type for use with a "T" bar suspended or framed ceiling. Coordinate for type of ceiling construction and location. Spline ceiling construction surface mounted air devised shall be used in ceilings, and use sidewall bar type registers in the case of vertical surfaces. All air device supply ducts shall incorporate a lockable balancing damper where the diffuser/register run out interfaces with the zone truck duct, for balancing purposes. In spline ceilings, provide accessible ceiling tile access at the location of these balancing dampers
Material / Finish:
Steel construction, baked white enamel finish.

16515 – Light Fixtures

Item:
Retro-Fit Diffuser
Description:
2" (51 mm) squares parabolic diffuser conversion kit. For use in converting existing 2'X4' (610X1,219 mm) prismatic lenses.
Material / Finish:
Chrome finish.

Item:
Retro-Fit Diffuser
Description:
2" (51 mm) squares parabolic diffuser conversion kit. For use in converting existing 2'X2' (610X610 mm) prismatic lenses.
Material / Finish:
Chrome finish.

Item:
2'X2' (610X610 mm) Fluorescent Lay-in Fixture
Description:
2" (51 mm) squares parabolic fluorescent fixture with semi-specular lens. Provide 90 min. emergency battery pack as required for emergency lighting.
Material / Finish:
Chrome finish.

Item:
2'X4' (610X1,219 mm) Fluorescent Lay-in Fixture
Description:
2" (51 mm) squares parabolic fluorescent fixture with semi-specular lens. Provide 90 min. emergency batter pack as required for emergency lighting.
Material / Finish:
Chrome finish.

Item:
2'X4' (610X1,219 mm) Fluorescent Surface Mounted Fixture
Description:
Surface mounted, 2" (51 mm) squares parabolic fluorescent fixture.
Material / Finish:
Housing to be white baked enamel steel. Lens to be semi-specular clear anodized aluminum.

Item:
Linear Fluorescent Cove Light
Description:
Continuous linear parabolic fluorescent lighting constructed of die formed, 19 gauge steel with factory applied enamel finish. Prefabricated extensions and corner boxes for uninterrupted runs. No holes or knockouts on exposed surfaces. Continuous appearance of louver. Mitered louver at corners 6-1/4"X6" (159X152 mm) housing. At all cove lighting direct lamps to provide light on wall and/or ceiling surfaces above the cove location.
Material/Finish:
White baked enamel steel.

Item:
Compact Fluorescent Downlight
Application:
For use in lobbies, corridors, and other public spaces.
Description:
8" (203 mm) diameter recessed downlight with semi-specular clear alzak reflector and a minimum lamp size of 2-26 watt quad compact fluorescent lamp.
Material/Finish:
White trim ring with clear alzak reflector.

Item:
Compact Fluorescent Wallwasher
Application:
For use to highlight artwork and to lighten walls of small spaces. Optional incandescent fixture when required for color rendition.
Description:
8" (203 mm) diameter recessed wallwasher with semispecular clear alzak reflector and a minimum lamp size of 1-26 watt quad compact fluorescent lamp.
Material/Finish:
White trim ring with clear alzak reflector.

Part 3 – The follow ing is an excerpt fr om the Fort Leonard Wood Installation Design Guide concerning the Interior Furnishing Standards.

J.1 FINISH STANDARDS

Each building needs to have its own identity, which will orient visitors to the installation. Standardized finishes provide a unifying element and are important for administrative and financial reasons. They provide flexibility, are easier to manage and are more cost effective.

Since it is not possible to change to new standards all at once, it is important to at least try to maintain a certain standard for each building. When small projects are completed within a building, the new materials or furnishings must still work with the existing space. If the newer standards will not coordinate with the existing finishes and furniture, a different selection may be required. For example, if the carpet is worn and needs to be replaced, a carpet should be selected that is similar to the new standard but that will coordinate with the existing colors and materials. Whenever possible, projects should be planned for a larger contiguous area of work so that the new standards may be installed. Changing only a small portion of the finishes can be unsuccessful if the end result is obvious. The durability, maintenance and quality of the finishes should be based on the particular image and function of the space and the building.

J.2 Common Finish Recommendations

All door hardware to be a consistent finish – satin finished stainless steel.

All outlet and switch cover plates to be ivory to blend with the neutral color scheme.

All toilet accessories to be brushed stainless steel.

Acoustical ceiling grid to be white. All ceiling mounted accessories: grilles, speakers, smoke detectors, etc. to be white to match ceiling. (Exceptions: sprinkler heads)

All doors within a building to be finished the same –either painted or stained.

All artwork to have black metal frames.

Refer to specifications for additional detail for all fixtures, furnishings and finishes.

Color selections, when not indicated for finishes, to be approved by Department of Public Works (DPW).

J.3 Administrative Finish Recommendations

Administration buildings on the Post are typically

masonry with multiple penetrations to allow daylight into the space. There are more architectural elements on the exterior and interior to create focal points and add interest. The interiors are typically warm, comfortable, inviting and professional.

The individual finish selections are referenced by the alphanumeric code which is used in the index and specifications.

CPT-1 Carpet

CPT-2 Accent Carpet

PT-1 Wall Paint

PT-2 Accent Paint

PT-3 Ceiling Paint

PT-4 Multi-color Paint

PL-1 Plastic Laminate

PL-2 Plastic Laminate VCT-1 Vinyl Floor Tile

VCT-2 Vinyl Floor Tile — Slip Resistant

VS-1 Rubber Stair Tread VB-1 Rubber Base

WO-1 Walk-off Mat

VWC-1 Vinyl Wallcovering VWC-2Vinyl Wallcovering

FWC-1 Fabric Textile Wallcovering

CT-1 Ceramic Floor Tile

CT-2 Ceramic Floor Tile — Accent

CT-3 Ceramic Wall Tile

CT-4 Ceramic Wall Tile — Accent

ACT-1 Acoustic Ceiling Tile WD-1 Wood Finish

J.4 Specifications

08710 — Hardware

Item:

Locksets / Latchsets

Item code:

HW-1

Description:

Heavy duty mortise lock with lever handle conforming to Federal Specification FFH-106C/GEN 7-19-74 and ANSI A156.13. Ensure it meets ADA Standards

Material Finish:

Satin Finish Stainless Steel

Item:

Door Closers

Description:

Surface mounted closer with sliding track arm. Provide hold open on all doors except fire doors. Mount closers inside rooms. Avoid mounting closers in corridors. Do not mount closers on door head.

Material/Finish:

Painted-aluminum color (BHMA 689)

09300 –Ceramic Tile

Item:

Ceramic Floor Tile

Item code:

CT-1, CT-2

Description:

2"X2" (51X51 mm) unglazed ceramic mosaic tile for restroom floors.

Color/Pattern:

Color and finish per DPW.

Item:

Ceramic Wall Tile

Item code:

CT-3, CT-4

Description:

4-1/4"X4-1/4" (108X108 mm) glazed ceramic tile scored

to look like 2"X2" (51X51 mm) tile for restroom walls. *Color/Pattern:*

Color and finish per DPW.

09511 –Ceiling Materials

Item:

Acoustical Ceiling Tile *Item code:*

ACT-1

Description:

Standard for all new installations is 24"X24" (610X610 mm) system. Acoustical fissured 24"X48" (614X1219 mm) ceiling panels scored in the center to give appearance of 24"X24" (610X610 mm) panels for existing ceiling grid system only. Use scored tile in retrofit areas to match existing 24"X24" (610X610 mm) tiles.

24"X24" (610X610 mm)

Material/Finish:

Mineral base panels with white painted finish. Use black tile for specialty applications such as audio/visual rooms that require blackout and use only with black grid.

Item:

Ceiling Suspension System

Description:

15/16" (24 mm) exposed tee suspension grid.

Material/Finish:

Steel with baked white enamel finish. Use backed enamel black finish for specialty applications such as audio/visual rooms that require blackout and use only with black tile.

09660 – Resilient Tile Flooring

Item:

Vinyl Composition Tile

Item code:

VCT-1

Description:

Class 2 through pattern, smooth surface, 1/8"X12"X12" (3X305X305 mm) vinyl tile.

Color/Pattern:

Color and pattern per DPW.

Adhesives:

Water resistant type recommended by manufacturer suitable for the substrate.

Item:

Slip Resistant Vinyl Composition Tile

Item code:

VCT-2

Description:

For use at building entries. Class 2 through pattern, abrasive mineral coating factory applied to surface of tile in a grid pattern, 1/8"X12"X12" (3X305X305 mm) vinyl tile.

Color/Pattern:

Color and pattern per DPW.

Adhesives:

Water resistant type recommended by manufacturer suitable for the substrate.

Item:

Rubber Stair Tread

Item code:

V S - 1 *Description:*

Johnsonite or equal. Conform to ASTM F-1344-93, Standard specification for rubber floor tile. Treads: 131/4" (33.66 cm) overall depth, 1/4" (6 mm) gauge, Heavy duty Safe-T-Grip (G), Square Nose Risers: Smooth, 1/4" (6 mm) gauge.

Color/Pattern:

Color and pattern per DPW.

09660 – Resilient Base

Item:

Rubber Base

Item code: VB-1

Description:

4"X1/8" (63X3 mm) rubber wall base. Cove profile at all flooring surfaces. Provide in polls for seamless installation *Color/Pattern:*

Color and pattern per DPW.

09680 – Carpet

Item:

Office and General Use Carpet

Item code:

CPT-1, CPT-2,

Description:

Carpet for office and general commercial uses to meet the following minimum requirements.

Face Construction: Tufted or woven level loop, multilevel loop, cut and loop or woven. Fully cut pile is not acceptable.

Face Fiber: 100% branded nylon – either Antron, Ultron or Zeftron nylon with anti-stain treatment. Type 6, 6 or 6 branded by fiber manufacturer.

Gau^{g}e: Minimum 1/10 inch (3 mm)

Stitches: 13.5 per inch (25 mm) for woven and cut and loop. 10.3 per inch (25 mm) for loop.

Pile Height: Minimum 9/32" (7 mm) for cut and loop. (.281) Minimum 5/32" (4 mm) for loop (.156) Minimum 7/32" (6 mm) for loop (.219)

Pile Weight: Minimum 79 oz. (2.2 kg) for cut and loop.

[30 oz. (0.8 kg) for cut and loop] Minimum 64 oz. (1.8 kg) for loop. [28 oz. (0..79 kg) for bonded] Minimum 70 oz. (2.0 kg) for woven. [28 oz. (0.79 g) loop pile]

Average Density: 6000 minimum

Primary Backing: Polypropylene

Static Control: Built into the fiber; less than 3.5 Kv., for normal office environments; less than 2.0 Kv. for computer/technical rooms.

Fire Characteristics: Radiant flux - .45 or greater; Smoke density: -450 or less

Wear Classification: Severe

Color/Pattern:

Color and pattern per DPW. Multiple colors (3 or greater

in open areas.)

Item:

Carpet Tile

Description:

Carpet to meet the following minimum requirements. Weave: Tufted

Surface Texture: Cut pile.

Face Yarn: 100% branded nylon – either Antron, Ultron or Zeftron nylon with anti-stain treatment. Type 6, 6 or 6 branded by fiber manufacturer.

Dve Method: Solution or approved yarn dye

Gauge: Minimum 1/8 inch (3 mm)

Stitches: 9 per inch (25 mm)

Pile Height: .177" (5 mm) to .203" (5 mm)

Face Weight: 28 oz. (0.79 kg) per sq. yd. (1 sq. yd. = 0.836 sm)

Total Weight: 138.4 oz. (3.9 kg) per sq. yd. (1 sq. yd. = 0.836 sm)

Average Density: 6000 minimum

Standard Backing: to be equal to Milliken PVC-Free Comfort Plus® cushion

Static Control: Built into the fiber; less than 3.5 Kv., for normal office environments; less than 2.0 Kv. for computer/technical rooms.

Fire Characteristics: Radiant flux - .45 or greater; Smoke density: -450 or less

Wear Classification: Severe

Color/Pattern:

Color and pattern per DPW. Color and material to match the color scheme for the building.

09920 – Painting

Item:

Interior Solid Color Paint *Item code:*

PT-1, PT-2, PT-3

Application:

All interior wall surfaces and gypsum board ceilings. *Color/Quality:*

Color per DPW. Provide manufacturer's first quality materials.

Paint Schedule:

Eggshell Finish: Gypsum board, plaster and cementitious surface.

Semi-gloss: Wood trim, doors, door frames, and metal surfaces.

Item:

Interior Multi-Color Paint

Item code:

PT-4

Application:

Office environments, commercial spaces, and smooth textured walls.

Color:

Color per DPW.

Material:

Spray applied polychromatic, polymer paint consisting of discrete beads of pigment coated with resin and suspended in an aqueous solution. Use materials recommended by manufacturer for substrate to be applied.

Material Compatibility:

Provide block fillers, primers, finish coat materials and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

Material Quality: Provide the best-quality grade of multicolored coatings. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.

09950 — Wallcoverings

Item:

Vinyl Walicovering

Item code:

VWC-1, VWC-2

Application:

For use in conference rooms, offices, break rooms, corridors and other high use areas. (Also for installation over concrete block.)

Color/Pattern:

Color per DPW.

Description:

Federal Spec: CCC-W-408, Type II

Fire Characteristics:

ASTM E84 Flame spread not more than 25. Smoke developed not more than 50.

Backing:

Sheeting

Item:

Textile Wallcovering

Item code:

FWC-1 *Application:*

For use in executive offices and conference rooms for 0-6 officers and above.

Color/Pattern:

Color per DPW.

Description:

Federal Spec: CCC-W-408

Fire Characteristics:

ASTM E84 Flame spread not more than 25. Smoke

developed not more than 50.

Fiber Content:

100% Olefin

Backing: Acrylic

10100 – Visual Display Boards

Item:

Marker / Tack Boards

Description:

Porcelain enamel marker boards and plastic impregnated cork tack boards.

Material / Finish:

Design: match design of systems furniture or related building finish standard, for a coordinated system.

Marker Boards: Provide balanced, high pressure-laminated porcelain enamel boards of 3-ply construction consisting of face sheet, core material, and backing. Provide writing surface with gloss finish for use with liquid felt-tipped markers.

Tack boards: Provide seamless sheet, 1/4" (6 mm) thick hardboard backing.

Accessories: Provide chalk tray for marker boards. Provide four markers (red, green, brown and black) and an eraser for each unit.

Item:

Bulletin Board Cabinet

Application:

For use in lobbies and common areas for display *Material / Finish:*

Black anodized aluminum, square profile frame with

double doors. 3" (76 mm) depth with black hook fabric.

Item:

Trophy Display Case

Application:

For use in lobbies and common areas for display. *Material / Finish:*

Black anodized aluminum frame with clear tempered glass on 4" (102 mm) solid base.

10800 — Washroom Accessories

Item:

Soap Dispenser

Description:

Recessed drawer-type soap vessel. 9-1/2" (241 mm) wide X 5-1/2" (140 mm) high X 4" (102 mm) deep. (If recessed unit cannot be installed, use similar surface mounted model.)

Material / Finish:

Stainless steel with brushed finish.

Item:

Paper Towel Dispenser

Description:

Recessed, semi-recessed or surface mounted, 14" (356

mm) wide X 28" (711 mm) high X 4" (102 mm) deep. (A combination paper towel/waste receptacle is an appropriate option and can be recessed, semi-recessed or surface mounted.)

Material / Finish:

Stainless steel with brushed finish.

Item:

Waste Receptacle

Description:

Fully recessed 14" (356 mm) wide X 28" (711 mm) high X 4" (102 mm) deep. (If recessed unit cannot be installed, use similar surface mounted model.)

Material / Finish:

Stainless steel with brushed finish.

Item:

Partition Mounted Napkin Disposal

Description:

Surface mounted on toilet partition. 10-11/16" (271 mm) wide X 15-1/8" (384 mm) high X 4-3/16" (106 mm) deep. Disposable liners.

Material / Finish:

Stainless steel with brushed finish.

Item:

Toilet Paper Dispenser

Description:

Surface mounted two roll, side by side, dispenser, similar to Bobrick Model B-686. Provide tumbler lock. 5-7/8" (149 mm) wide X 10-1/2" (267 mm) high X 5-5/8" (143 mm) deep.

Material / Finish:

Stainless steel with brushed finish.

12511 – Horizontal Louver Blinds

Item:

Horizontal Louver Blinds

Description:

<u>Operation:</u> Manual

<u>Handrail:</u> Channel-shaped section fabricated from minimum 0.025" (1 mm) thick sheet steel with rolled edges at top, equipped with end braces. All hardware required for operation of blind at headrail to be enclosed in metal head. Finish of rail to be in same color as slats unless otherwise indicated.

<u>Bottom Rail:</u> Fabricated from steel with rolled edges. Contour section to match slat curvature. Provide metal or plastic end closure caps, same color as rail. Finish rail in same color as slats unless otherwise indicated. <u>Slats</u>: Spring-tempered aluminum slats, alloyed for maximum strength, with forming burrs removed. Slat thickness and ladder support distances adequate to preclude visible sag or bow after continued use. 1" (25 mm) wide, lengths as required, not to exceed 142" (3,607 mm) other components sized to suit.

<u>Ladders:</u> Construction design to support and maintain slat at proper spacing and alignment in open or closed position.

Braided Polyester Cord: Fabricated of not less than 0.045" (1 mm) nor more than 0.068" (1.73 mm) diameter. Integrally braided ladder rungs of not less than 4 threads; space ladders no further than 24" (610 mm) apart and no more than 7" (178 mm) from ends of slats.

Tilting Mechanism: Provide low friction gear tilter, drum and cradle at each ladder, tilt rod, tape clips and grommet guides to prevent wear on ladder and cords. Mechanism designed to hold slats at any angle and prevent movement of slats due to vibration.

Wand Operation: Detachable, clear plastic wand of appropriate length to suit blind installation and to provide convenient operation.

Lifting Mechanism: Crash-proof cord locks with cord separators, braided polyester cords fitted with pulls. Include cord equalizers of self-aligning type designed to maintain horizontal blind position.

Installation Brackets: Provide pre-finished metal mounting brackets designed to facilitate removal of headrail. Provide intermediate brackets at spacing recommended by manufacturer. Include hardware necessary for secure attachment of brackets to adjoining construction and headrails. Provide brackets adequate to support the weight of blind assemblies plus force applied to operate blinds, with mounting holes located to accommodate either horizontal or vertical mounting.

Finish: provide standard factory applied finish system; chemical conversion coating followed by baked-on synthetic resin enamel finish coat. Color shall be as selected by the Contracting Officer.

Fabrication: Prior to fabrication, verify actual opening dimensions by site measurements. Do not proceed with fabrication until unsatisfactory conditions have been resolved. Adjust dimensions for proper fit at openings. Cooperate with other trades for securing headrails to substrates and other finished surfaces.

Fabricate horizontal louver blind components from noncorrosive materials which do not require lubrication during the normal expected life.

Fabricate blind units to completely fill the opening from head to sill and jamb to jamb. For continuous installations, fabricate blind units so that breaks between units occur only at mullions or other defined vertical separation.

Space blind slats to provide overlap for light exclusion when in fully closed position. Equip horizontal louver blind units with the following operations:

Full-tilting operations with slats rotating approximately180 degrees. Place tilt-operating controls on left side of blind when facing blind unit. Exceptions may occur due to unique location of window, etc. Height raising, with lifting cord locks for holding blind at any point of travel. Place pull cords on right side of blind when facing it.

12910 – Artwork

Item:

Artwork Frames

Material / Finish:

Frames to be aluminum extrusions with gloss black anodized finish. Frames to be standard for all buildings.

All poster pieces to be dry mounted on foam core and wired for hanging. Alternate methods for hanging are not permitted.

15540 – Plumbing Fixtures

Item.

Standard Faucet

Description:

Supply with swing spout, water economy aerator with maximum 2.2 gpm flow, single lever handle; chrome plated brass P-trap and arm with escutcheon. *Material/Finish:*

Chrome plated brass

Item:

Standard Sink

Description:

Single compartment oval approximately 17" x 11", homogenous solid surface sink integral with countertop with 1, 2 or 3 holes to match selected faucet

Support:

Plastic laminate vanity or metal framing refer to DPW for framework details.

Material / Finish:

Solid surface of polyester/acrylic alloys

Item:

Break Area Faucet

Description:

Goose neck design with paddle wrist handles or single lever mixing valve. Aerator with 2.5 GPM (15.8 cu m/sec) flow. 8" (203 mm) centers.

Material / Finish:

Chrome

Item:

Break Area Sink

Description:

Single compartment stainless steel sink with three holes at 4" (102 mm) centers (verify with faucet selection); 25" (635 mm) wide X 22" (559 mm) deep X 6-1/2" (165 mm) high.

Material / Finish:

Brushed Stainless Steel.

15942 – Air Diffusers

Item:

Air Diffusers

Description:

Air devises shall be steel, square diffusers, flush core, fixed pattern, lay in type for use with a "T" bar suspended or framed ceiling. Coordinate for type of ceiling construction and location. Spline ceiling construction surface mounted air devised shall be used in ceilings, and use sidewall bar type registers in the case of vertical surfaces. All air device supply ducts shall incorporate a lockable balancing damper where the diffuser/register run out interfaces with the zone truck duct, for balancing purposes. In spline ceilings, provide accessible ceiling tile access at the location of these balancing dampers

Material / Finish:

Steel construction, baked white enamel finish.

16515 – Light Fixtures

Item:

Retro-Fit Diffuser

Description:

2" (51 mm) squares parabolic diffuser conversion kit. For use in converting existing 2'X4' (610X1,219 mm) prismatic lenses.

Material / Finish:

Chrome finish.

Item:

Retro-Fit Diffuser

Description:

2" (51 mm) squares parabolic diffuser conversion kit. For use in converting existing 2'X2' (610X610 mm) prismatic lenses.

Material / Finish:

Chrome finish.

Item:

2'X2' (610X610 mm) Fluorescent Lay-in Fixture *Description:*

2" (51 mm) squares parabolic fluorescent fixture with semi-specular lens. Provide 90 min. emergency battery pack as required for emergency lighting.

Material / Finish:

Chrome finish.

Item:

2'X4' (610X1,219 mm) Fluorescent Lay-in Fixture *Description:*

2" (51 mm) squares parabolic fluorescent fixture with

semi-specular lens. Provide 90 min. emergency batter

pack as required for emergency lighting.

Material / Finish:

Chrome finish.

Item:

2'X4' (610X1,219 mm) Fluorescent Surface Mounted Fixture

Description:

Surface mounted, 2" (51 mm) squares parabolic fluorescent fixture.

Material / Finish:

Housing to be white baked enamel steel. Lens to be semi-specular clear anodized aluminum.

Item:

Linear Fluorescent Cove Light

Description:

Continuous linear parabolic fluorescent lighting constructed of die formed, 19 gauge steel with factory applied enamel finish. Prefabricated extensions and corner boxes for uninterrupted runs. No holes or knockouts on exposed surfaces. Continuous appearance of louver. Mitered louver at corners 6-1/4"X6" (159X152 mm) housing. At all cove lighting direct lamps to provide light on wall and/or ceiling surfaces above the cove location.

Material/Finish:

White baked enamel steel.

Item:

Compact Fluorescent Downlight

Application:

For use in lobbies, corridors, and other public spaces.

Description:

8" (203 mm) diameter recessed downlight with semi-

specular clear alzak reflector and a minimum lamp size

of 2-26 watt quad compact fluorescent lamp.

Material/Finish:

White trim ring with clear alzak reflector.

Item:

Compact Fluorescent Wallwasher *Application:*

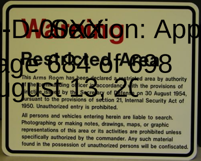
For use to highlight artwork and to lighten walls of small spaces. Optional incandescent fixture when required for color rendition.

Description:

8" (203 mm) diameter recessed wallwasher with semispecular clear alzak reflector and a minimum lamp size of 1-26 watt quad compact fluorescent lamp.

Material/Finish:

White trim ring with clear alzak reflector.


Warning
Restricted Area
This Arms Room has been declared a restricted area by authority
pursuant to the provisions of section 21, Internal Security Act of 1950. Unauthorized entry is prohibited.
All persons and vehicles entering herein are liable to search. Photographing or making notes, drawings, maps, or graphic representations of this area or its activities are prohibited unless specifically authorized by the commander. Any such material found in the possession of unauthorized persons will be confiscated.


4


PROTECTED BY AN
ALARM SYSTEM
Unauthorized entry is prohibited. Violators will be prosecuted under the provisions of the UCMJ or other applicable laws.

APPENDIX FF

Demarcation Matrix

BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
#	**Demarcation Item**	**Privatized Utility Scope/Limit of Work**	**(B/COF RFP) Scope/Limit of Work**	**(BNHQ RFP) Scope/Limit of Work**
	Site Layout	Coordination	Provide a comprehensive site layout for the BCT III-South Complex including building pads and finished floor elevations. For Phase 1 B/COF facilities, provide foundations, floor slab systems (ground or structurally-supported), and select backfill (non-expansive) required per geotechnical recommendations. Contractor will be responsible for ensuring proper subsurface conditions at the building pads meet or exceed the recommendations provided by Contractor's Geotechnical consultant. B/COF Contractor is responsible for the design and construction of the BCT III-South Complex site including horizontal and vertical construction for Phase 1 which includes 2-BCOFs, associated running track and PT pits, parking lots, sidewalks, access roads, dumpster pads, utilities, and any other features required in this contract. The B/COF Contractor will also provide horizontal site preparation for the Phase 2 facilities which include: 1 BNHQ, 3 B/COFs, 1 PT Pit(s), and DFAC. B/COF Contractor shall design and construct utilities for all buildings within the Complex up to the designated point defined in this demarcation matrix. Coordinate associated construction activities with the BNHQ Contractor the BNHQ Contractor.	Provide foundations, floor slab systems (ground or structurally-supported), and select backfill (nonexpansive) required per geotechnical recommendations. Contractor will be responsible for ensuring proper subsurface conditions at the building pad meet or exceed the recommendations provided by Contractor's Geotechnical consultant. BNHQ Contractor shall design and construct utilities from the utility provider termination points provided by the B/COF Contractor or privatized utility, to the BNHQ. BNHQ Contractor will be required to coordinate construction activities with the B/COF Contractor. (BNHQ Contractor is responsible for design and construction of items within the BNHQ Project Limits shown on the Conceptual Site Plan in the Appendix J).

BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
#	**Demarcation Item**	**Privatized Utility Scope/Limit of Work**	**(B/COF RFP) Scope/Limit of Work**	**(BNHQ RFP) Scope/Limit of Work**
2	Demolition	NA	Provide all demolition required for entire BCT III-South Complex	NA
3	Clearing and Grubbing	NA	Provide all clearing and grubbing required for the BCT III-South Complex site. Topsoil should be stockpiled for finish grading activities associated with the BNHQ Contract and subsequent Phase 2 construction. Coordinate topsoil storage quantity and location for the BNHQ Contract with the BNHQ Contractor.	Building pad and subsurface preparation to be provided by B/COF Contractor. Coordinate required topsoil quantities and access with the B/COF Contractor.
4	Site Grading	NA	Provide site grading in accordance with BCT III-South Complex site design for all buildings shown on conceptual drawings. This includes site features required to provide overall site/pad elevations for all primary buildings in the BCT III-South Complex. Positive drainage should be provided for the site to prevent ponding or standing water.	BNHQ Contractor shall complete fine grading within the BNHQ Project Limits.
5	Permits	NA	Provide all permits required for the construction of the BCT III-South Complex site, B/COF and LEB facilities. This includes but is not limited to earthwork, environmental, debris removal, utility extensions/ connections, NPDES, etc.	Provide all permits required for construction of BNHQ facility including but not limited to the building, final grading, NPDES and utility connections.

BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
#	**Demarcation Item**	**Privatized Utility Scope/Limit of Work**	**(B/COF RFP) Scope/Limit of Work**	**(BNHQ RFP) Scope/Limit of Work**
6	Storm Water	NA	B/COF Contractor shall provide all storm water management systems required for the BCT III-South Complex in accordance with specifications and all federal, state and local regulations. B/COF Contractor shall provide storm service connection stubs for every building site proposed in the Complex. Temporarily cap service between 5 and 15 feet from building (location to be approved by the Contracting Officer) and mark location of cap above ground with post. B/COF Contractor shall provide storm sewer collection/system for all other site related items listed, but not limited to, PT Pits, Track, Sidewalks, Access Roads, etc. Coordinate locations of storm water connection point with BNHQ Contractor. Roof drains from each facility shall be collected in a storm water management system. Storm water management areas should be integrated into the overall landscape design.	Provide roof drains and associated piping to storm sewer installed by B/COF contractor. Provide design flows and preferred location of connection point to B/COF contractor.

BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
#	**Demarcation Item**	**Privatized Utility Scope/Limit of Work**	**(B/COF RFP) Scope/Limit of Work**	**(BNHQ RFP) Scope/Limit of Work**
7	Domestic Water	NA	Contractor is responsible for the design and coordination with FLW PW regarding size and location of the existing BCT I pumping and storage facility and service connections which will serve the BCT III-South Complex. B/COF Contractor shall provide a looped distribution system and services for the entire BCT III-South Complex including, but not limited to isolation valve(s), service stub(s) with cap and marked with post, per scope of contract. B/COF Contractor shall install a FLW Public Works approved back flow preventer (BFP) inside Phase 1, B/COF facilities.	BNHQ Contractor is responsible for coordination with the B/COF Contractor and FLW Public Works regarding the size and location of domestic water service. BNHQ Contractor will connect at the meter and take the service the remaining distance to the building. BNHQ Contractor install a FLW Public Works approved BFP inside proposed building.
8	Fire Water	NA	B/COF Contractor is responsible for design and coordination with FLW PW regarding size and location of the existing BCT I pumping and storage facility for water service. The B/COF Contractor shall provide the service loop and service stub outs to all facilities in the BCT III-South Complex. Fire department connection (FDC) is the Contractors responsibility. The Contractor is responsible for the alarm system back to the Fire Department.	Contractor is responsible for coordination with the B/COF Contractor and FLW Public Works regarding size and location of required service. BNHQ Contractor will connect at the temporary capped service location, from the PIV to the BNHQ. Fire department connection (FDC) is the BNHQ Contractors responsibility. The BNHQ Contractor is responsible for the alarm system back to the Fire Department.

#	Demarcation Item	Privatized Utility Scope/Limit of Work	(B/COF RFP) Scope/Limit of Work	(BNHQ RFP) Scope/Limit of Work
BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
9	Sanitary Sewer	NA	B/COF Contractor is responsible for constructing the sanitary system for the entire BCT III-South Complex. Coordinate location of connection point/manhole with BNHQ Contractor. Provide connection points for all Phase 2 facilities. Coordinate design and coordination with FLW Public Works regarding size and location of service. Contractor shall provide service to BCOFs 1 and 2 and a stub out(s) for all other buildings include in the BCT III-South Complex. The stub out(s) shall be between 5 and 15 feet from a building (location to be approved by Contracting Officer) and marked above ground with a post. Contractor will connect the Complex to the FLW Public Works approved service.	BNHQ Contractor is responsible for design and coordination with FLW PW regarding size and location of service. Contractor will connect to the stub out first sanitary sewer manhole outside of building provided by B/COF Contractor and provide any sanitary sewer element required from the temporary stub out to the BNHQ.
10	Gas service	Omega shall provide gas to meter	B/COF Contractor shall provide gas line from meter to Phase 1 BCOFs. Contractor shall coordinate with FLW Public Works and Omega for service. B/COF Contractor shall provide gas line, stub outs, valves, and caps to a location between 5 and 15 feet from the BNHQ and Phase 2 facilities (location to be approved by Contracting Officer). The location of cap shall be marked above ground with post.	BNHQ Contractor shall connect to the Natural Gas at a temporary cap and provide piping and service to the BNHQ as required per RFP. Provide gas meter for the BNHQ facility. Coordinate with B/COF Contractor for service location.

#	Demarcation Item	Privatized Utility Scope/Limit of Work	(B/COF RFP) Scope/Limit of Work	(BNHQ RFP) Scope/Limit of Work
BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
11	Building Identification	NA	B/COF Contractor shall furnish and install all site signage for the BCT III-South Complex and building mounted signage for the B/COF facilities.	BNHQ Contractor shall furnish and install building mounted signage for the BNHQ facility.
12	Sidewalks	NA	B/COF Contractor shall design and construct all sidewalks connecting access roads, BCOFs, Track/PT Pits for the BCT III-South Complex (except those within BNHQ and Phase 2 Project Limits which will be completed in a separate contract). Reference Conceptual Site Plan located in Appendix J.	BNHQ Contractor shall design and construct all sidewalks within BNHQ Project Limits. Coordinate with the B/COF Contractor to ensure sidewalk system is integrated with the BCT III-South Complex design.
13	Parking Lots	NA	Construct all parking lots for BCT III-South Complex per RFP documents.	Not included in contract.
14	Landscaping	NA	Contractor will provide all landscaping (including seeding and entrance plantings) for the BCT III-South Complex, with the exception of the areas within the BNHQ Project Limits. B/COF Contractor shall coordinate adjacent landscape features with the BNHQ Contractor.	BNHQ Contractor shall provide all landscaping within the BNHQ Project Limits. Repair/replace damaged landscaping “in-kind” for any landscaping installed by B/COF Contractor that is destroyed during construction.
15	Turf	NA	Install turf in all disturbed areas outside of planters for all areas within the loop road of the BCT III-South Complex. Native grasses may be utilized in the areas located outside the loop road and not adjacent to other BCT facilities.	Install turf in all disturbed areas outside of planters. Replace turf “in-kind” for any landscaping installed by B/COF Contractor that is destroyed during construction.

BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
#	**Demarcation Item**	**Privatized Utility Scope/Limit of Work**	**(B/COF RFP) Scope/Limit of Work**	**(BNHQ RFP) Scope/Limit of Work**
16	Trash Dumpsters	NA	B/COF Contractor shall construct dumpster pads and enclosures for Phase 1 facilities. Coordinate pad location with BNHQ Contractor.	Coordinate dumpster pad/enclosure location with B/COF Contractor.
17	Site AT/FP	NA	B/COF Contractor shall provide any site AT/FP elements for the entire BCT III-Complex site.	BNHQ Contractor shall provide any AT/FP elements within the BNHQ Project Limits.
18	Bldg HVAC/ Mech Equipment Pad	NA	B/COF Contractor shall construct concrete pads for mechanical equipment for Phase 1 facilities with the exception of the BNHQ. Coordinate with BNHQ Contractor for siting requirements.	Provide all equipment pads required to serve the BNHQ facility. Coordinate with B/COF Contractor for siting.
19	Electrical Service	Laclede Electric to provide electrical service up to and including the transformer pad.	Coordinate primary service upgrades, transformer location and secondary connection with FLW DPW and Laclede Electric.	Secondary & DDC conduit empty duct bank will be extended from the building foundation to the transformer. Provide building service feeders to transformer with 15 feet of slack for termination by others. Coordinate with B/COF Contractor, DPW and Laclede Electric.
20	Electrical & Telecommunication General Note		Construct underground duct banks for the BCT III-South Complex. Coordinate with Laclede, COE and BNHQ Contractor for connection point locations. Seamless transitions of conduits between the site and buildings are preferred.	Coordinate with B/COF Contractor for location of underground raceways. Seamless transitions of conduits between the site and buildings are preferred.

BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
#	**Demarcation Item**	**Privatized Utility Scope/Limit of Work**	**(B/COF RFP) Scope/Limit of Work**	**(BNHQ RFP) Scope/Limit of Work**
21	Site Lighting	Laclede will provide street lighting as required.	B/COF Contractor shall provide all general area, parking, security, and pedestrian lighting outside for the BCT III-South Complex beyond the BNHQ and Phase 2 facilities construction limits.	BNHQ Contractor shall provide building mounted lights and exterior lighting for areas within the BNHQ facility project limits. BNHQ Contractor shall provide the time, override switch, and branch circuit allocation for site lighting which will be controlled from the BNHQ.
22	Telecomm OSP Cabling and Duct Bank		B/COF Contractor shall construct the conduit system, including the last manhole, to a point adjacent to the Phase 1 B/COF's and BNHQ. Phase 2 facilities to a distance of 5 ft from the building foundation. The B/COF Contractor shall run cables; copper and FO from the ADN to the Comm Room of the BNHQ and constr. Coordinate with FLW-DPW, Contracting Officer and the BNHQ Contractor.	OPS empty duct bank will be extended 5 ft past the building foundation for both incoming and outgoing OSP. Coordinate with B/COF Contractor.
23	Cable Television Services	NA	Provide duct bank to a hand hole a distance of approximately 5 ft from each building foundation with the exception of the LEB. Coordinate location with BNHQ Contractor, Contracting Officer and local cable provider.	Connect empty duct bank to the duck bank constructed by the B/COF Contractor. Coordinate location with B/COF Contractor and Contracting Officer.
24	LEED Building/Site	NA	Contractor is responsible for the registration of the B/COF contract project with USGBC. B/COF Contractor shall provide detailed documentation of LEED Credits to the CO. B/COF Contractor is responsible for the site related portion of the B/COF LEED Credits. A minimum rating of Silver is required.	Contractor is responsible for the registration of the BNHQ facility with USGBC. BNHQ Contractor shall provide detailed documentation of LEED Credits to the CO.

BCT III-SOUTH, B/COF CONTRACT DEMARCATION MATRIX				
#	**Demarcation Item**	**Privatized Utility Scope/Limit of Work**	**(B/COF RFP) Scope/Limit of Work**	**(BNHQ RFP) Scope/Limit of Work**
25	Gates and Controls	NA	B/COF Contractor to provide gates within the BCT III-South Project Limits as required by the Contracting Officer.	BNHQ Contractor to provide gates within the BNHQ Project Limits as required by the Contracting Officer.
26	Chilled Water	NA	B/COF Contractor to provide chilled water to the B/COF facilities as required.	BNHQ Contractor to provide chilled water to the BNHQ facility as required.

APPENDIX GG

Closed System Water Treatment Without Glycol

(Ft Leonard Wood - 2 June 2010)

HEATING WATER SYSTEM FLUSHING (NO GLYCOL). System is approximately xxxx gallons.

Contractor shall flush the heating water system in B-xxxx to include dead/no flow points 24 hours prior to adding chemical.

The Contractor shall add 1 gallon per 1000 system gallons of AC-7112 and 1 gallon per 100 system gallons of AC-6160 and allow to circulate for a minimum of 96 to 120 hours prior to any additional treatment added. After circulating for the 96 to 120 hours, Contractor shall flush the system for 24 hours to include all strainers and blow down all dead/no flow points.

The Contractor shall then add 10 ounces of AC-250 and one gallon of AC-7112 to system and allow circulating for 24 hours prior to any additional being added.

The Contractor shall then add 1 gallon per 1000 system gallons of AC-530 to system and allow circulating for 5 days.

After 5 days the Contractor shall flush the system and dead/no flow points.

After chemicals have been flushed from system Contractor shall clean all strainers again to ensure there is flow through all heating coils.

After 3 days of flushing the Contractor can perform there own test on water characteristics prior to having a certified Water Treatment Personal test characteristics of water.

After 0.5 ppm iron levels are reached, Contractor shall contact and schedule a certified Water Treatment Personnel (Rich Colclasure with AquaComp @ 314-705-1393) to verify water characteristics test. Water characteristics shall be at 0.5 ppm or less of Iron if not Contractor shall continue flushing until iron levels are reached. **DPW inspector shall verify the 0.5 ppm or less before proceeding.**

After iron levels have been reach Contractor shall add Nitrites (Aqua Comp AC 301) within 24 hours to a level of 500 to 700 ppm.

APPENDIX HH

Closed System Water Treatment With Glycol (Ft Leonard Wood - 2 June 2010)

Chilled Water and Hot Water Heating System Flushing and Treatment.

The Contractor shall open all system water valves, clean strainers and provide flexible hoses on fan coil units and air handlers prior to flushing the chilled water system. System is approximately xxxx gallons.

Contractor shall flush the water system in to include dead/no flow points 24 hours prior to adding chemical.

The Contractor shall add 1 gallon per 1000 system gallons of AC-7112 and 1 gallon per 100 system gallons of AC-6160 and allow to circulate for a minimum of 96 to 120 hours prior to any additional treatment added. After circulating for the 96 to 120 hours, Contractor shall flush the system for 24 hours to include all strainers and blow down all dead/no flow points.

The Contractor shall then add ½ gallon of AC-250 to system and allow circulating for 24 hours prior to any additional treatment be added.

The Contractor shall then add 1 gallon per 1000 system gallons of AC-530 to system and allow circulating for 5 days.

After 5 days the Contractor shall flush the system and dead/no flow points.

After chemicals have been flushed from system Contractor shall clean all strainers again and ensure there is flow through all fan coils and air handlers.

After 3 days of flushing the Contractor can perform there own test on water characteristics prior to having a certified Water Treatment Personal test characteristics of water.

After 0.5 ppm iron levels are reached, Contractor shall contact and schedule a certified Water Treatment Personal (AquaComp @ 314-705-1393) to verify water characteristics test. Water characteristics shall be at 0.5 ppm or less of Iron, if not Contractor shall continue flushing until iron levels are reached. **DPW inspector shall verify the 0.5 ppm or less before proceeding.**

Once iron levels and water cleanliness within the closed system are accepted by the Government Inspector. The Contractor shall immediately **(Within 24 Hours)** add DOW DOWFROST Inhibited Propylene Glycol or PRODUCTS PLUS INC Inhibited Propylene Glycol with phosphoric acid and dipotassium salt and blue dye and anti-foaming agents to reach a plus 5 to minus 5 degrees Fahrenheit freeze protection; Contractor shall insure freeze protection is not below minus 5 degree Fahrenheit. POC for DOWFROST Glycol is UNIVAR in Springfield, Mo. is Bill Bowler cell # 417-838-8871. POC for PRODUCTS PLUS INC Inhibited Propylene Glycol with phosphoric acid and dipotassium salt is Ron Zorn in Ozark, Mo. is 877-581-3755.

Contractor shall install aluminum metal signage at water chemical feeders to read DOW DOWFROST Inhibited Propylene Glycol or PRODUCTS PLUS INC Inhibited Propylene Glycol with phosphoric acid and dipotassium salt, do not add chemicals or any other type Glycol.

NOTE: Contractor shall provide documentation for DOWFROST inhibited propylene glycol or PRODUCTS PLUS INC inhibited propylene glycol with phosphoric acid and dipotassium salt to include:

1 **The amount used in system**
2 **Building #**
3 **Chilled water system or heating system**
4 **Date added to system**
5 **Copy of Purchase Order**
6 **% of solution in system**
7 **Freeze protection.**