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eProjects
Work Order Numbers:
1257274

Appropriation: UMC

P-1353 Landfill, Phase IV

at

MCB Camp Lejeune, NC

PREPARED BY:

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(A/E Contract N40085-10-D-5304)

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Date: November 12, 2013

SPECIFICATION APPROVED BY:

For Commander, NAVFAC MID-ATLANTIC:
Date:

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SECTION 01 11 00

SUMMARY OF WORK
05/13

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.

ASTM INTERNATIONAL (ASTM)

ASTM E2114	(2008) Standard Terminology for Sustainability Relative to the Performance of Buildings

1.2 DEFINITIONS

Definitions pertaining to sustainable development are as defined in ASTM E2114 and as specified.

a. "Environmentally preferable products" have a lesser or reduced effect on the environment in comparison to conventional products and services. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product.

b. "Indoor environmental quality" is the physical characteristics of the building interior that impact occupants, including air quality, illumination, acoustics, occupant control, thermal comfort, daylighting, and views.

c. "Operational performance" is the functional behavior of the building as a whole or of the building components.

d. "Sustainability" is the balance of environmental, economic, and societal considerations.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1.3.1 Project Description

The work includes construction of three new cells of the existing landfill, providing Portland cement concrete pavement for the Recycling Facility, and incidental related work.

1.3.2 Location

The work shall be located at the Marine Corps Base, Camp Lejeune, NC, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.4 PROJECT ENVIRONMENTAL GOALS

Contractor shall distribute copies of the Environmental Goals to each

subcontractor and the Contracting Officer. The overall goal for design, construction, and operation is to produce a building that meets the functional program needs and incorporates the principles of sustainability. Specifically:

a. Preserve and restore the site ecosystem and biodiversity; avoid site degradation and erosion. Minimize offsite environmental impact.

b. Use the minimum amount of energy, water, and materials feasible to meet the design intent. Select energy and water efficient equipment and strategies.

c. Use environmentally preferable products and decrease toxicity level of materials used.

d. Use renewable energy and material resources.

e. Optimize operational performance (through commissioning efforts) in order to ensure energy efficient equipment operates as intended. Consider the durability, maintainability, and flexibility of building systems.

f. Manage construction site and storage of materials to ensure no negative impact on the indoor environmental quality of the building.

g. Reduce construction waste through reuse, recycling, and supplier take-back.

1.5 OCCUPANCY OF PREMISES

Building(s) will be occupied during performance of work under this Contract.

Before work is started, the Contractor shall arrange with the Contracting Officer a sequence of procedure, means of access and space for storage of materials and equipment.

1.6 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.7 LOCATION OF UNDERGROUND FACILITIES

Obtain digging permits prior to start of excavation by contacting the Contracting Officer 15 calendar days in advance. The Contracting Officer does not issue the digging permits, but will direct the Contractor to the proper point of contact. Scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing underground utilities are discovered. Verify the elevations of existing piping, utilities,and any type of underground obstruction not indicated to

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be specified or removed but indicated or discovered during scanning in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

1.7.1 Notification Prior to Excavation

Notify the Contracting Officer at least 15 days prior to starting excavation work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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SECTION 01 14 00

WORK RESTRICTIONS
05/13

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel; G

1.2 SPECIAL SCHEDULING REQUIREMENTS

A. The Contractor shall provide a Traffic Control Plan. Traffic control shall be the responsibility of the Contractor. Work shall be accomplished with landfill operations continuing on Phase III during construction of new cells for Phase IV. Work shall also be accomplished with recycling operations continuing at the Recycling Facility.

B. UXO Area:

(1) Intrusive activities are restricted in the UXO area identified. Prior to start of field work, a Determination Request (DR) for the use of on-site UXO technician support in accordance with NOSSAINST 8020.15 must be submitted to Marine Corps Systems Command for approval. The DR should be submitted through the Installations Environmental Restoration Program Manager. Assume 30 days will be required to receive appropriate approvals. UXO technical support is required during clearing and excavating activity.

(2) All UXO technicians will be qualified and certified in accordance with Marine Corps Order (MCO) 8023.3B, "Personnel Qualification and Certification Program for Class V Ammunition and Explosives," terms outlined by United States Department of Labor in "Employment Standards Administration Wage Hour Division for UXO Personnel," and DDESB TP-18 "Minimum Qualifications for UXO Technicians and Personnel."

(3) Contractor's site personnel shall have 3R munitions awareness training and 40 hour HAZWOPER training prior to starting any field work. A metal drum containing paint thinner has been found on site and other such materials could exist in the project area. If a drum of liquid, stained soil, petroleum or other alarming odors are encountered, notify the Contracting Officer who will notify EMD (910-451-9385).

(4) If UXO is discovered in the UXO area indicated on the drawings, the Contractor shall continue working in other areas of the project site outside clearances identified by the Contracting

Officer.

C. Have materials, equipment, and personnel required to perform the work at the site prior to the commencement of the work.

D. The nearby buildings and utilities will remain in operation during the entire construction period. The Contractor shall conduct his operations so as to cause the least possible interference with normal operations of the activity and MCB Camp Lejeune (the Base).

E. Permission to interrupt any Activity roads, railroads, and/or utility service shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.

F. The work under this contract requires special attention to the scheduling and conduct of the work in connection with existing facility and base operations. Identify on the construction schedule each factor which constitutes a potential interruption to facility or base operations.

The following conditions apply:

(1) For the Landfill Facility -

(a) Contractor/Construction vehicle access shall be via Old Bear Creek Road from Piney Green Road.

(b) The access road(s) to the Landfill shall be ready for operation and approved by the Contracting Officer before any work is started on the Landfill cells which could interfere with normal operations.

(c) Access to the Phase III portion of the Landfill by trash hauling and landfill operating equipment via the Loop Haul Road or Direct Haul Road shall be maintained throughout construction.

(2) For the Recycling Facility -

(a) Work shall be sequenced, with work performed in two stages and corresponding work areas as indicated.

(b) Work in Work Area 1 shall be accomplished prior to Work Area 2.

(c) Work in Work Area 2 shall not commence until 10 calendar days after completion of work in Work Area I. Completion of work includes time for concrete to achieve required strength and receive any required sealer. The 10 calendar day period allows for the Recycling Facility operations to move from Work Area 2 to Work Area 1.

(d) Work Areas shall be accessed only via the temporary access gates within the specific work area.

1.3 CONTRACTOR ACCESS AND USE OF PREMISES

1.3.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar

with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

1.3.1.1 Subcontractors and Personnel Contacts

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.3.1.2 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installations under the cognizance of NAVFAC except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.3.2 Working Hours

Regular working hours shall consist of an 8 1/2 hour period established by the Contracting Officer, Monday through Friday, excluding Government holidays.

1.3.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer.

1.3.4 Occupied and Existing Buildings

The Contractor shall be working around existing buildings which are occupied. Do not enter the buildings without prior approval of the Contracting Officer.

1.3.5 Utility Cutovers and Interruptions

a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."

b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

c. Interruption to water, sanitary sewer, storm sewer, telephone service, and electric service shall be considered utility cutovers pursuant to the paragraph entitled "Work Outside Regular Hours."

d. Operation of Station Utilities: The Contractor shall not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, and electrical

services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Contracting Officer giving reasonable advance notice when such operation is required.

1.4 SECURITY REQUIREMENTS

Contract Clause "FAR 52.204-2, Security Requirements and Alternate II," "FAC 5252.236-9301, Special Working Conditions and Entry to Work Area," and the following apply:

1.4.1 Business Access Security Requirements, Camp Lejeune, NC

1.4.1.1 Business Access Definition

Contractor/subcontractor employees requiring installation access to MCB, Camp Lejeune or MCAS New River, N.C. must obtain a Business Access Identification Badge for that particular installation. Regularly scheduled delivery personnel, to include FEDEX, UPS, pick-up and deliveries, should also follow the Business Access guidelines described below. Personnel requiring Business Access Identification Badges shall submit all documentation listed below. Badges are not required if the contracted position requires the employee to obtain a Common Access Card (CAC) which will be identified separately within the Government contract.

1.4.1.2 Installation Security Access Requirements

Contractor shall accomplish the security requirements below within 10 days after award or prior to performance under the contract.

1.4.1.3 Business Access Identification Badge Requirement

In order to obtain a Business Access Identification Badge for access to MCB, Camp Lejeune, and satellite activities, or MCAS New River, NC, all personnel providing services under this contract shall be required to present the documentation below to the following offices, as applicable:

a. MCB, Camp Lejeune, NC and its satellite activities. Report as follows:

1. Identification Card Center, 60 Molly Pitcher Road for badge (910-451-8444).

b. MCAS New River, NC. Report as follows:

1. S-4 (Facilities Office), Bldg AS-211 (1st Deck) for registration on contractor's list (910-449-6310).

2. Pass and Identification Office, Bldg AS-187 (1st Deck) for badge and vehicle decal (910-449-7695).

1.4.1.4 Documentation

a. Photo ID:

Valid state or federal issued picture identification card. Acceptable documents include state drivers license, DMV issued photo identification, or alien registration card.

b. Proof of Employee Citizenship or Legal Alien Status:

Acceptable documents include birth certificate, Social Security Cards, Immigration and Naturalization Service (INS) forms and passports.

c. Proof of Criminal Records Check:

Proof of a criminal records check from the county or state where the employee has resided for the previous two years (or length of legal residence for foreign nationals in the U.S. for less than two years). Criminal background records checks must be from a credible source. Many credible sources exist, but some examples include the County Courthouse, Infolink Screening Services, Inc. (www.infolinkscreening.com), IntegraScan Criminal Records Checks (www.integrascan.com), Intelius Employee Screening (www.Intelius.com), and Castle Branch www.castlebranch.com). Subsequent to the initial criminal background records checks, local criminal records checks shall be conducted annually prior to renewal of badges for reevaluation.

d. Letter Provided By Contracting Officer Indicating Contract:

Letter provided by Contracting Officer indicating contract, contract period and prime contractor. Proof of employment on a valid Government contract (e.g., a letter on company letterhead from the prime contractor including contract number and term).

1.4.1.5 Denial of Access

Installation access shall be denied if it is determined that an employee:

a. Is on the National Terrorist Watch List

b. Is illegally present in the United States.

c. Is subject to an outstanding warrant.

d. Has knowingly submitted an employment questionnaire with false or fraudulent information.

e. Has been issued a debarment order and is currently banned from military installations.

f. Is a Registered Sexual Offender, or has any Felony Conviction within the past two years.

1.4.1.6 Appeal Process

All appeals should be directed to the Base Inspector's Office for any individual that has been denied access to the Base.

1.4.1.7 Display and Disposition of Badges

Contractors/subcontractors shall prominently display their badges on their person at all times. Upon completion/termination of this contract or an individual's employment, the Contractor shall collect and turn in to the Pass & ID Office all badges. If the Contractor fails to obtain the employee's badge, the Pass & ID Office shall be notified within 24 hours. During the contract performance period contractors will immediately report

instances of lost or stolen badges to the issuing pass and identification office.

1.4.1.8 Contractor and Subcontractor Vehicle Requirements

Each vehicle to be used in contract performance shall show the Contractor's or subcontractor's name so that it is clearly visible and shall always display a valid state license plate and safety inspection sticker. To obtain a vehicle decal, which will be valid for one year or contract period, whichever is shorter, Contractor or subcontractor vehicle operators shall provide to the Vehicle Registration Office, 60 Molly Pitcher Road for vehicle decal (910-451-1158):

a. An installation sponsor request forwarded to provost Marshall office.

b. A valid form of Federal or state government I.D.

c. If driving a motor vehicle, a valid driver's license, vehicle registration and proof of insurance.

Upon completion/termination of this contract or an individual's employment, the Contractor shall collect and turn in to Vehicle Registration all Government vehicle decals. If any are not collected, the Contractor shall notify the Vehicle Registration Office within 24 hours.

1.4.1.9 Security Checks

Contractor personnel and vehicles shall only be present in locations relevant to contract performance. All Contractor personnel entering the base shall conform to all Government regulations and are subject to such checks as may be deemed necessary to ensure that violations do not occur. Employees shall not be permitted on base when such a check reveals that their presence would be detrimental to the security of the base. Subject to security regulations, the Government will allow access to an area for servicing equipment and/or performing required services. Upon request, the Contractor shall submit to the Contracting Officer questionnaires and other forms as may be required for security purposes.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 20 00.00 20

PRICE AND PAYMENT PROCEDURES
05/13

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.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP-1110-1-8	(2009) Construction Equipment Ownership and Operating Expense Schedule

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

EARNED VALUE REPORT; G

1.3 EARNED VALUE REPORT

1.3.1 Data Required

This contract requires the use of a cost-loaded Network Analysis Schedule (NAS). The information required for the Schedule of Prices will be entered as an integral part of the Network Analysis Schedule. Within 15 calendar days of notice of award, prepare and deliver to the Contracting Officer an Earned Value Report (construction contract) as directed by the Contracting Officer. Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices. Costs shall be summarized and totals provided for each construction category.

1.3.2 Schedule Instructions

Payments will not be made until the Earned Value Report from the cost-loaded NAS has been submitted to and accepted by the Contracting Officer. Identify the cost for site work.

1.3.3 Real Property Assets

Real Property Assets identified in Section 01 78 00 CLOSEOUT SUBMITTALS, Paragraph "REAL PROPERTY RECORD" apply to work covered by this specification.

Cost data accumulated under this section are required in the preparation of DD Form 1354. Coordinate with Section 01 78 00 CLOSEOUT SUBMITTALS paragraph "REAL PROPERTY RECORD".

NOTE: Real Property Unique Identifiers (RPUID's) will be provided by the Government but may not be available until later in the project schedule. Coordinate receipt of the RPUID's with the Contracting Officer and the Real Property Accounting Officer. Temporary RPUID's may be required until the actual RPUID's can be provided.

The Government will provide the Draft DD Form 1354, Transfer and Acceptance of Military Real Property filled in with the appropriate construction Category Codes to summarize the designed real property assets that apply to this contract. The Contractor shall meet with the Contracting Officer and the Real Property Accounting Officer during the Pre Construction Meeting and the Project Closeout Meetings to modify and include any necessary changes to the DD Form 1354. The Contractor shall obtain related Real Property Unique Identifiers (RPUID's) from the Real Property Accounting Officer during or following the Pre Construction Meeting. The Contractor shall provide the Interim DD Form 1354 that uses the appropriate division of the RPUID's/ Category Codes to represent the final constructed facility and include all associated cost. Coordinate the Contractor's Price and Payment structure with the structure of the RPUID's/ Category Codes.

Divide detailed asset breakdown into the RPUID's and related construction Category Codes and populate associated costs which represent all aspects of the work. Where assets diverge into multiple RPUID's/ Category Codes, divide the asset and provide the proportion of the assets in each Facility Number/ Category Code. Assets and related RPUID's/ Category Codes may be modified by the Contracting Officer as necessary during course of the work. Coordinate identification and proportion of these assets with the Government Real Property Accounting Officer.

1.4 CONTRACT MODIFICATIONS

In conjunction with the Contract Clause "DFARS 252.236-7000, Modification Proposals-Price Breakdown," and where actual ownership and operating costs of construction equipment cannot be determined from Contractor accounting records, equipment use rates shall be based upon the applicable provisions of the EP-1110-1-8.

1.5 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

1.5.1 Content of Invoice

Requests for payment will be processed in accordance with the Contract Clause FAR 52.232-27, Prompt Payment Construction Contracts and FAR 52.232-5, Payments Under Fixed-Price Construction Contracts. The requests for payment shall include the documents listed below.

a. The Contractor's invoice.

b. The Earned Value Report from the cost-loaded NAS, showing in detail: the estimated cost, percentage of completion, and value of completed performance for each of the construction categories stated in this contract.

c. Updated Project NAS and reports required by the contract.

d. Contractor Safety Self Evaluation Checklist.

e. Other supporting documents as requested.

f. Updated copy of submittal register.

g. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies.

h. Affidavit to accompany invoice (LANTDIV NORVA Form 4-4235/4 (Rev.5/81)).

i. Materials on Site.

1.5.2 Submission of Invoices

If NFAS Clause 5252.232-9301 is included in the contract, the listed documents shall be provided as attachments in Wide Area Work Flow (WAWF). The maximum size of each WAWF attachment is two megabytes, but there are no limits on the number of attachments. If a document cannot be attached in WAWF due to system or size restriction it shall be provided as instructed by the Contracting Officer.

Monthly invoices and supporting forms for work performed through the anniversary award date of the contract shall be submitted to the Contracting Officer within 5 calendar days of the date of invoice. For example, contract award date is the 7th of the month, the date of each monthly invoice shall be the 7th and the invoice shall be submitted by the 12th of the month.

1.5.3 Final Invoice

a. A final invoice shall be accompanied by the Contractor's Final Release. If the Contractor is incorporated, the Final Release shall contain the corporate seal. An officer of the corporation shall sign and the corporate secretary shall certify the Final Release.

b. For final invoices being submitted via WAWF, the original Contractor's Final Release Form must be provided directly to the respective Contracting Officer prior to submission of the final invoice. Once receipt of the original Final Release Form has been confirmed by the Contracting Officer, the Contractor shall then submit final invoice and attach a copy of the Final Release Form in WAWF.

c. Final invoices not accompanied by the Contractor's Final Release will be considered incomplete and will be returned to the Contractor.

1.6 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of itemized requests by the Contractor which comply with the requirements of this section, and will be subject to reduction for overpayments or increase for underpayments made on previous payments to the Contractor.

1.6.1 Obligation of Government Payments

The obligation of the Government to make payments required under the provisions of this contract will, at the discretion of the Contracting Officer, be subject to reductions and/or suspensions permitted under the FAR and agency regulations including the following in accordance with "FAR 32.503-6:

a. Reasonable deductions due to defects in material or workmanship;

b. Claims which the Government may have against the Contractor under or in connection with this contract;

c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor; and

d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings."

1.6.2 Payment for Onsite and Offsite Materials

Progress payments may be made to the contractor for materials delivered on the site, for materials stored off construction sites, or materials that are in transit to the construction sites under the following conditions:

a. FAR 52.232-5(b) Payments Under Fixed Price Construction Contracts.

b. Materials delivered on the site but not installed, including completed preparatory work, and off-site materials to be considered for progress payment shall be major high cost, long lead, special order, or specialty items, not susceptible to deterioration or physical damage in storage or in transit to the construction site. Examples of materials acceptable for payment consideration include, but are not limited to, structural steel, non-magnetic steel, non-magnetic aggregate, equipment, machinery, large pipe and fittings,precast/prestressed concrete products, plastic lumber (e.g., fender piles/curbs), and high-voltage electrical cable. Materials not acceptable for payment include consumable materials such as nails, fasteners, conduits, gypsum board, glass, insulation, and wall coverings.

c. Materials to be considered for progress payment prior to installation shall be specifically and separately identified in the Contractor's estimates of work submitted for the Contracting Officer's approval in accordance with Earned Value Report requirement of this contract. Requests for progress payment consideration for such items shall be supported by documents establishing their value and that the title requirements of the clause at FAR 52.232-5 have been met.

d. Materials are adequately insured and protected from theft and exposure.

e. Provide a written consent from the surety company with each payment request for offsite materials.

f. Materials to be considered for progress payments prior to installation shall be stored in the Continental United States.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS
05/13

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

View location map; G

Progress and completion pictures; G

1.2 VIEW LOCATION MAP

Submit to the Contracting Officer, prior to or with the first digital photograph submittals, a sketch or drawing indicating the required photographic locations. Update as required if the locations are moved.

1.3 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of 20 digital photographs each week throughout the entire project from a minimum of ten views from points located by the Contracting Officer. Submit a view location sketch indicating points of view. Submit with the monthly invoice two sets of digital photographs each set on a separate CD-R, cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Photographs for each month shall be in a separate monthly directory and each file shall be named to indicate its location on the view location sketch. The view location sketch shall also be provided on the CD as digital file. All file names shall include a date designator. Cross reference submittals in the appropriate daily report. Photographs shall be provided for unrestricted use by the Government.

1.4 MINIMUM INSURANCE REQUIREMENTS

Procure and maintain during the entire period of performance under this contract the following minimum insurance coverage:

a. Comprehensive general liability: $500,000 per occurrence

b. Automobile liability: $200,000 per person, $500,000 per occurrence for bodily injury, $20,000 per occurrence for property damage

c. Workmen's compensation as required by Federal and State workers' compensation and occupational disease laws.

d. Employer's liability coverage of $100,000, except in States where workers compensation may not be written by private carriers,

e. Others as required by State law.

1.5 CONTRACTOR SPECIAL REQUIREMENTS

1.5.1 Apparatus Inspection

All contract requirements of Section 26 08 00 APPARATUS INSPECTION AND TESTING shall be accomplished directly by a first tier subcontractor, including the Commissioning Agent. No work required by Section 26 08 00 shall be accomplished by a second tier subcontractor.

1.6 SUPERVISION

Have at least one qualified supervisor capable of reading, writing, and conversing fluently in the English language on the job site during working hours. In addition, if a Quality Control (QC) representative is required on the contract, then that individual shall also have fluent English communication skills.

1.7 PRECONSTRUCTION CONFERENCE

After award of the contract but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the value engineering and safety program, preparation of the schedule prices, shop drawings, and other submittals, scheduling programming, prosecution of the work, and clear expectations for the DD Form 1354 submittals. Major subcontractors who will engage in the work shall also attend.

1.8 FACILITY TURNOVER PLANNING MEETINGS (NAVFAC Red Zone - NRZ)

Key personnel will meet to identify strategies to ensure the project is carried to expeditious closure and turnover to the Client. Start the turnover process at the Pre Construction Conference meeting and convene at the Facility Turnover Meetings once the project has reached approximately 75 percent completion or three to six months prior to Beneficial Occupancy Date (BOD), whichever comes first. The Contracting Officer's Representative will lead the meetings and guide discussions based on an agenda provided by the Government. See attached NAVFAC Red Zone Facility Turnover Planning Meeting AGENDA for typical meeting agenda. The facility Turnover effort shall include the following:

a. Pre Construction Meeting - Contracting Officer's Technical Representative (COTR) will provide the Facility Turnover Checklist and the Contractor, Client, and NAVFAC Representatives will compare Contractor's schedule to Facility Turnover Checklist to ensure all Contractor Checklist Items are included in the schedule and to discuss the scheduling impact of Client and NAVFAC Checklist Items.

b. Facility Turnover Meetings

1. Fill in the Facility Turnover Checklist including Contractor, Client, and NAVFAC Checklist Items and assign a person to be responsible for each item and a due date. The Contractor's Representative will facilitate the assignment of responsibilities, fill out the Facility Turnover Checklist, and discuss DD Form 1354

requirements. See attached Facility Turnover Checklist Items.

2. Review the Contractor's updated schedule. The Contractor shall develop a POAM for the completion of all Contractor, Client, and NAVFAC Checklist items.

3. Confirm that all Facility Turnover Checklist items will be completed on time for the scheduled Facility Turnover.

1.8.1 Facility Turnover Meeting Attendees

The following key personnel shall attend the Facility Turnover Meetings: Contractor QC Manager, Superintendent, Major Subcontractors, Designer-of-Record, Contracting Officer's Representative, Representative(s) of NAVFAC, the Facility Owner, and the Client.

1.9 PARTNERING

To most effectively accomplish this contract, the Government requires the formation of a cohesive partnership within the Project Team whose members are from the Government, the Contractor and Subcontractors. Key personnel representing Base Facilities, the Designer of Record (DOR), principal individuals from NAVFAC MIDLANT and from the Officer in Charge of Construction (OICC) office, the project sponsor, and representative(s) of the facility user will be invited to participate in the partnering process. Key members of the Contractor and subcontractor teams, including senior management, must participate.

The partnership will draw on the strengths of each organization in an effort to achieve a quality project done right the first time, within budget, on schedule, and without any safety mishaps.

1.9.1 Formal Partnering

Provide and host the Partnering sessions with key personnel of the Project Team, including Contractor personnel and Government personnel. The Contractor shall pay all costs associated with the partnering effort including the Facilitator, the meeting room, and other incidental items. In exception, participants shall bear their own costs for meals, lodging, and transportation associated with the Partnering sessions.

Before a Partnering session, coordinate with the Facilitator all requirements for incidental items (such as audio-visual equipment, easels, flipchart paper, colored markers, note paper, pens/pencils, colored flash cards, etc.), and have these items available at the Partnering session. Provide copies of documents for distribution to all attendees.

The Facilitator shall be experienced in conducting Partnering Workshops, and shall be acceptable to both the Government and the Contractor. The Facilitator is responsible for leading the team in a timely manner and making sure that issues are identified and resolved. A list of Partnering Facilitators is available from the Contracting Officer.

1.9.1.1 Initial Partnering Session

a. Shall be a duration of one day minimum.

b. Will include participants as listed under paragraph "Facility Turnover Meeting Attendees".

c. Should be held at a location off base as agreed to by the partners.

e. May take place with the Preconstruction Conference.

1.9.1.2 Follow-on Partnering Session(s)

a. Shall be held quarterly or as agreed to by the partners.

b. May be held concurrently with other scheduled meetings such as QC or scheduling.

c. May be held at a location off base, the project site, or in government facilities on base.

d. May include only participants required to resolve current issues.

e. Will generally last a half day or less and may utilize electronic means if mutually acceptable to all parties.

f. Will not require a facilitator unless desired by the partners.

1.10 AVAILABILITY OF CADD DRAWING FILES

After award and upon request, the electronic "Computer-Aided Drafting and Design (CADD)" drawing files will only be made available to the Contractor for use in preparation of construction data related to the referenced contract subject to the following terms and conditions. Request specific drawing numbers of files required; the entire set of drawing files will not be provided.

Data contained on these electronic files shall not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor shall make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor shall, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic CADD drawing files are not construction documents. Differences may exist between the CADD files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic CADD files, nor does it make representation to the compatibility of these files with the Contractors hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished CADD files, the signed and sealed construction documents shall govern. The Contractor is responsible for determining if any conflict exists. Use of these CADD files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project.

If the Contractor uses, duplicates and/or modifies these electronic CADD

files for use in producing construction data related to this contract, all previous indicia of ownership (seals, logos, signatures, initials and dates) shall be removed.

1.11 ELECTRONIC MAIL (E-MAIL) ADDRESS

The Contractor shall establish and maintain electronic mail (e-mail) capability along with the capability to open various electronic attachments in Microsoft, Adobe Acrobat, and other similar formats. Within 10 days after contract award, the Contractor shall provide the Contracting Officer a single (only one) e-mail address for electronic communications from the Contracting Officer related to this contract including, but not limited to contract documents, invoice information, request for proposals, and other correspondence. The Contracting Officer may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes, terrorist threats, etc. Multiple email addresses will not be allowed.

It is the Contractor's responsibility to make timely distribution of all Contracting Officer initiated e-mail with its own organization including field office(s). The Contractor shall promptly notify the Contracting Officer, in writing, of any changes to this email address.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

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NAVFAC Red Zone
Facility Turnover Planning Meeting

AGENDA

I. Introduction and Overview – Purpose CM

The purpose of the Facility Turnover Planning Meeting is to address elements within the project team's purview – schedule management, assure completed facility complies with contract requirements, and other contractual issues. Each member of the project delivery team (Client, NAVFAC, and the contractor) has critical responsibilities to ensure timely completion and turnover of the new facility and each member should execute the NRZ process to achieve this end. The NRZ process provides a final re-focusing of attention to details of those key elements critical for a successful construction contract completion. In implementing NRZ processes, the NAVFAC/Contractor/Client team take a collective "snapshot" of contract status, identifying remaining actions to be accomplished, and confirm required resources needed for successful contract completion and turnover to the Client.

The Facility Turnover Planning Meeting is a collaborative effort between the Client, NAVFAC, and the contractor and results in a completed "NRZ Checklist/POAM Items" list that identifies the major items (and their due dates) that must be completed by the Contractor, the Client and the NAVFAC team to ensure timely completion of the contract.

II. Attendees

NAVFAC Echelon IV (PM); NAVFAC FEAD/ROICC Team (AROICC, CM, ET/QA, Contracting Officer); Client Team (Project Manager, Program Coordinator, User/Tenant); Contractor Team (Project Manager, Project Superintendent, CQC Manager)

III. Schedule to Completion (POAM)	Contractor
IV. Schedule of Final Outfitting and Occupancy (POAM)	Client
V. Critical feature(s) of project (POAM)	CM
VI. Transfer of Maintenance Responsibility	CM
VII. Systems training & O&M Manuals (POAM)	CQC Manager
VIII. Other Items to include on NRZ checklists	All
IX. Summary of Required Actions and Responsibility	CM

Guidelines for conducting Facility Turnover Planning Meeting are as follows:

a. Meeting is held at approximately 75% construction contract completion or three to six months prior to BOD. NAVFAC representatives will include the Project Manager, Construction Manager/AROICC (CM) and Design Manager (DM), as appropriate. The contractor representatives include applicable prime contractor staff and decision-makers from major subcontractors. Design-Build contractors will have A-E representatives attending. The Client should include representatives from Public Works Officer (PWO) staff, a Client scope and financial decision maker, a user tenant representative, a facility start-up person, and others such as SPAWAR, NMCI, telephone, and furniture contractor, etc.

b. The purpose of the meeting is to plan the remaining work, identify critical project features that still need to be completed (such as “soft” construction contract requirements as shown on the NRZ Checklist/POAM Items), and to complete the filling out of the “NRZ Checklist/POAM Items”.

c. The contractor, client and NAVFAC provide a POC and due date for each item on their checklist. The team fills in the checklists by selecting items applicable to the project, selects due dates on each item, and appoints a person who has responsibility to ensure the item gets completed by the due date. The CM will be responsible to monitor the milestones.

NRZ Checklist/POAM Items

The tables below provide typical NRZ checklist items for contractor, Client, and NAVFAC actions (Tables 1, 2, and 3, respectively). Items listed on the checklists are required to remain on the checklists if they are part of the project/contract or required by construction convention. Items not listed on the checklists, but required in the contract or by construction convention, must be added to the checklists by the contractor, Client and NAVFAC. Checklists are applicable to all contracts no matter what Category of Work.

The Point of Contact and due date shall initially be determined during the Facility Turnover Planning Meeting by the NAVFAC, client and contractor leads. During execution of the NRZ process, for each item on the entire list, the Construction Manager (CM) shall indicate date completed and initial to indicate completion of the item. If a party fails to complete an item by the due date, this should be noted on the checklist and new due date established and indicated. The completed NRZ Checklist/POAM shall be placed in the contract file.

Table 1

Contractor Checklist Items	Point of Contact	Due Date	Actual Complete Date	CM Initials	Notes
a. Construction Completion Schedule					
b. Facility Delivery Closeout:					
Duct Air Leakage Testing					
HVAC System Test & Balance					
ACATS Controls Testing					
Conduct Second Seasons TAB					
Electrical Systems Testing					
Final utility systems connections (power, water, etc.)					
Superchlorination of potable water systems					
Plumbing / Other Mechanical Testing					
Elevator Certification(s)					
Specialized Equipment & Systems Inspections (Boilers, UPV, etc.)					
Fire Protection Systems Inspections and Performance Verification					
Communications / IT Systems Testing					
Security Systems Testing					
Other Specified Building Performance Requirements					
c. Other Contractor Items:					
Delivery of O&M Manuals					
Delivery of Equipment/Product Warranty List/Tag					
O&M/OMSI Training of Navy Personnel					
Site Restoration, if applicable					

Contractor Checklist Items	Point of Contact	Due Date	Actual Complete Date	CM Initials	Notes
Landscaping Complete					
Pre-Final Inspection					
Final Inspection and Acceptance					
Delivery of Spare Parts, Extra Stock, Special Tools, etc					
Delivery of As-Built Drawings					
Delivery of Utility Record Drawings (if applicable)					
Delivery of Utility As-Built Drawings (if applicable)					
Beneficial Occupancy Date (BOD)					
Final Demobilization and Clean-up Completed					
Remove Construction Fence & Associated Coordination					
Pre-warranty Conference					
Project Close-out Meeting					
Coordination and Delivery of Facility Signage					
Final Cleaning					
Replace Construction Lock Cores and Re-keying					
Punch List Completion					
Provide DD1354 to Government CM					

Table 2

Client Checklist Items	**Point of Contact**	**Due Date**	**Actual Complete Date**	**CM Initials**	**Notes**
Modification to FSC or BOSC to maintain/service new facility -Telephone service contract -Utilities service contract -Custodial service contract					
Installation of communications for phones and computers					
NMCI Installations or other networks					
Delivery and installation of client furnished furniture					
Delivery and installation of client furnished equipment					
User move-in					
GFE status/delivery schedule (GFCI, GFGI)					
Coordination of Intrusion Detection Systems and Physical Security Equipment					
Process operating permits					
Recycled/recovered materials report					
Coordination of IT and Communication Infrastructure and Devices (incl. CAT IV)					
Ribbon-cutting ceremony					

Table 3

NAVFAC Checklist Items	Point of Contact	Due Date	Actual Complete Date	CM Initials	Notes
Client walk-thru prior to pre-final inspections, if appropriate					
Schedule client satisfaction post BOD follow-up					
Schedule Government inspections of specialized equipment (e.g., Boiler/pressure vessels, elevators, UPS, SCIF shielding requirements, medical certifications, generators/switchgear)					
Provide keying plan to contractor					
Confirm utilities availability for final connections by contractor					
Startup utilities					
Mechanical Acceptance					
Resolve contract modifications & requests for equitable adjustment					
Contractor final release					
Return unobligated funds					
Process final payment					
Process recycled/recovered materials report					
Closeout actions on construction permits (e.g., NPDES)					
A-E and Construction Contractor Evaluations (ACASS/CCASS)					
Contractor QC Evaluation					
Complete Installed Property List and DD 1354					
Sign & provide Interim DD1354 to activity Real Property Accountability Officer NLT BOD					

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Performance Assessment Plan
MONTHLY EVALUATION

MONTH: _____YEAR:_____

Evaluation Factor	Yes	No	N/A	Comments
Experience of Personnel 1. Did the team identified in the proposal actively participate in the project? 2. If personnel substitutions were needed, was the degree of technical competence maintained?				
Working Relationships 1. Did the Construction team participate in the design process (i.e. attend meetings, provide insight, etc.)? Were the coordination meetings between Construction and Design team personnel documented? 2. Did the Design team participate in the construction process (i.e. attend CQC meetings, perform field oversight, etc.)? Were coordination meetings between Construction and Design team personnel documented? 3. Did the collaboration between the Construction and Design Team deliver a high value innovative facility? - Were Total Operating Cost minimized - What LEED points can be obtained - Was energy efficiency optimized, and the energy goals exceeded. 4. Was the budget management process clear; was an estimate submitted on time with each design submittal. Was the estimate updated to reflect the changes in the design submittal? 5. Did the Contractor's team effectively manage the project budget and the User's requirements to meet the customer's needs? Was project budget and emphasis in cost control exhibited in the estimate? (Contractor to document in comments block				

materials/systems innovations and provision of higher quality than required in the RFP Part 4) *Additional factors to be developed during Partnering.*				
Quality Control 1. Were re-submittals of design deliverables or construction rework required this month? 2. Were as built redlines updated this month? *Additional factors to be developed during Partnering.*				
Timely Performance 1. Is the Contractor on schedule? 2. Is the Contractor maintaining the schedule? (Can the Government confirm the project is on schedule?) 3. Is the Contractor following his schedule? *Additional factors to be developed during Partnering.*				
Effectiveness of Management 1. Did the Government need to intercede in resolving a subcontractor issue? *Additional factors to be developed during Partnering.*				
Compliance with Labor Standards 1. Did payrolls have to be resubmitted this month due to inaccuracies or errors? *Additional factors to be developed during Partnering.*				
Compliance with Safety Standards 1. Were there any lost time accidents this month?				

Additional factors to be developed during Partnering.				

GENERAL PERFORMANCE COMMENTS THIS MONTH:

Concurrence:

CM/ROICC Representative _____Date_____.

Project Manager _____Date_____.

Contractor Representative _____Date_____.

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SECTION 01 32 17.00 20

NETWORK ANALYSIS SCHEDULES (NAS)
05/13

PART 1 GENERAL

1.1 DESCRIPTION

The Contractor is responsible for scheduling procurement, Contractor quality control and construction, acceptance testing and training. Refer to Specification Section 01 33 00 SUBMITTAL PROCEDURES to determine if any items require Government approval prior to construction; If any are required, that submittal review time shall be included in the schedule.

The schedule is a tool to manage the project, both for Contractor and Government activities. It will also be used to report progress and evaluate time extensions. If cost-loaded, it will provide the basis for progress payments.

The Contractor shall use the Critical Path Method (CPM) and the Precedence Diagram Method (PDM) to satisfy time and cost applications. For consistency, when scheduling software terminology is used in this specification, the terms in Primavera's scheduling programs are used.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualifications; G

Baseline Network Analysis Schedule (NAS); G

SD-07 Certificates

Monthly Network Analysis Schedule Update; G

SD-11 Closeout Submittals

As-Built Schedule; G

1.3 SCHEDULE ACCEPTANCE PRIOR TO START OF WORK

The Contracting Officer and Contractor shall participate in a preliminary meeting(s) to discuss the proposed schedule and requirements of this section prior to the Contractor preparing the Project Baseline Schedule.

Government review comments on the Contractor's schedule(s) shall not relieve the Contractor from compliance with requirements of the Contract Documents.

Only bonds shall be paid prior to acceptance of the Baseline Network Analysis Schedule (NAS).

The acceptance of a Baseline NAS is a condition precedent to:

a. The Contractor starting work on the demolition or construction stage(s) of the contract.

b. Processing Contractor's pay request(s) for construction activities/items of work.

c. Review of any schedule updates.

Submittal of the Baseline Network Analysis Schedule, and subsequent schedule updates, shall be understood to be the Contractor's certification that the submitted schedule meets all of the requirements of the Contract Documents, represents the Contractor's plan on how the work shall be accomplished, and accurately reflects the work that has been accomplished and how it was sequenced (as-built logic).

1.4 SOFTWARE

Project schedules must be prepared and maintained using Primavera P3, Primavera SureTrak or current mandated scheduling program. Save files in Concentric P3 or current mandated scheduling program file format, compatible with the Governments version of the scheduling program. Importing data into P3/SureTrak/current mandated scheduling program using data conversion techniques or third party software will be cause for rejection of the submitted schedule.

1.5 QUALIFICATIONS

The designated Scheduler for the project shall have prepared and maintained at least 3 previous schedules of similar size and complexity of this contract using SureTrak/P3 or current mandated scheduling program. A resume outlining the qualifications of the Scheduler shall be submitted for acceptance to the Contracting Officer. Payment will not be processed until an acceptable Scheduler is provided.

1.6 NETWORK SYSTEM FORMAT

The system shall include time scaled logic diagrams and specified reports.

1.6.1 Diagrams

Provide Time-scaled Logic Diagram printed in color on ANSI D size sheets. The diagram shall clearly show activities on the critical path. Critical path items must be red in color. Include the following information for each activity:

a. Activity ID

b. Activity Description

c. Original Duration in Work Days

d. Remaining duration

e. Percent Complete

f. Early Start Date

g. Early Finish Date

h. Total Float

1.6.2 Schedule Activity Properties and Level of Detail

The NAS shall identify all Government, Construction Quality Management (CQM), Construction activities planned for the project and all other activities that could impact project completion if delayed. Separate activities shall be created for each Phase, Area, Floor Level and Location the activity is occurring. Activity categories included in the schedule are specified below.

With the exception of the Contract Award and Contract Completion Date (CCD) milestone activities, no activity shall be open-ended; each activity shall have predecessor and successor ties. Once an activity exists on the schedule it may not be deleted or renamed to change the scope of the activity and shall not be removed from the schedule logic without approval from the Contracting Officer. The ID number for a deleted activity shall not be re-used for another activity. No more than 20 percent of the activities shall be critical or near critical. Critical is defined as having zero days of Total Float. "Near Critical" is defined as having Total Float of 1 to 14 days. Contractor activities shall be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days.

1.6.2.1 Activity Categories

a. Procurement Activities: Examples of procurement activities include, but are not limited to; Material/equipment submittal preparation, submittal and approval of material/equipment; material/equipment fabrication and delivery, and material/equipment on-site. As a minimum, separate procurement activities will be provided for critical items, long lead items, items requiring government approval and material/equipment procurement for which payment will be requested in advance of installation. The Contractor shall show each delivery with relationship tie to the Construction Activity specifically for the delivery.

b. Government Activities: Government and other agency activities that could impact progress shall be clearly identified. Government activities include, but are not limited to; Government approved submittal reviews, Government conducted inspections/tests, environmental permit approvals by State regulators, utility outages, Design Start, Construction Start, (including Design/Construction Start for each Fast-Track Phase, and delivery of Government Furnished Material/Equipment.

c. Construction Quality Management (CQM) Activities: CQM Activities shall identify the Preparatory Phase and Initial Phase for each Definable Feature of Work identified in the Contractor's Quality Control Plan. These activities shall be added to each Three-Week Look Ahead Schedule referenced in the paragraph entitled "THREE-WEEK LOOK AHEAD SCHEDULE" and will also be included in each monthly update. The Follow-up Phase will be represented by the Construction Activities in the Baseline Schedule and in the schedule updates.

d. Construction Activities: No on-site construction activity shall have a duration in excess of 20 working days. Separate construction activities

shall be created for each Phase, Area, Floor Level and Location the activity is occurring. Contractor activities will be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days, unless otherwise defined in this contract.

e. Turnover and Closeout Activities: Include a separate section with all items on the Facility Turnover Checklist that are applicable to this project. The checklist will be provided at the Preconstruction Meeting. As a minimum, this will include all testing, specialized inspection activities, Pre-Final inspection, Punch List Completion, Final Inspection and Acceptance. Add a milestone for the Facility Turnover Planning Meeting at approximately 75 percent construction contract completion or three to six months prior to BOD, whichever is sooner.

1.6.2.2 Contract Milestones and Constraints

a. Project Start Date Milestones: The Contractor shall include as the first activity on the schedule a start milestone titled "Contract Award", which shall have a Mandatory Start constraint equal to the Contract Award Date.

b. Projected Completion Milestone: The Contractor shall include an unconstrained finish milestone on the schedule titled "Projected Completion". Projected Completion is defined as the point in time the Government would consider the project complete and ready for its intended use. This milestone shall have the Contract Completion (CCD) milestone as its only successor.

c. Contract Completion Date (CCD) Milestone: The Contractor shall include as the last activity on the schedule a finish milestone titled "Contract Completion (CCD)", which shall have a Mandatory Finish constraint equal to the current Contract Completion Date. Calculation of schedule updates shall be such that if the finish of the "Projected Completion" milestone falls after the contract completion date, then negative float will be calculated on the longest path and if the finish of the "Projected Completion" milestone falls before the contract completion date, the float calculation shall reflect positive float on the longest path. The only predecessor to the Contract Completion Date Milestone shall be the Projected Completion milestone.

1.6.2.3 Activity Code

At a minimum, the Contractor shall establish activity codes identified in this specification and 3 additional activity codes identified by the Contracting Officer. Once established, activity codes and values cannot be changed without approval by the Contracting Officer.

a. Phase: All activities shall be assigned a 4-digit code value based on the contract phase it occurs in.

b. Area Code: All activities shall be assigned an area code value identifying the Area in which the activity occurs. Activities shall not belong to more than one area. Area is defined as a distinct space, function or activity category; such as, separate structure(s), sitework, project summary, construction quality management, material/equipment procurement, etc.

c. Work Item: All activities in the project schedule shall be assigned a

4-digit Work Item code value. Examples of Work Item code values include but are not limited to water lines, drain lines, building pad and foundation, slab on grade, walls and columns, suspended slab, roof structure, roofing, exterior finish systems, interior rough-in, and finishes, etc.

d. Location 1: Assign a 4-digit Location 1 code value to activities associated with multistory structures. Code values are used to identify the floor level where an activity is occurring.

e. Location 2: Assign a 4-digit Location 2 code value to all activities to identify the location within an Area, Work Item or Building Level that an activity is occurring.

f. Responsibility Code: All activities in the project schedule shall be identified with the party responsible for completing the task. Activities shall not belong to more than one responsible party.

1.6.2.4 Anticipated Weather Delays

The Contractor shall use the National Oceanic and Atmospheric Administration's (NOAA) historical monthly averages for the NOAA location closest to the project site as the basis for establishing a "Weather Calendar" showing the number of anticipated non-workdays for each month due to adverse weather, Saturdays, Sundays and all Federal Holidays as non-work days.

Assign the Weather Calendar to any activity that could be impacted by adverse weather. The Contracting Officer will issue a modification in accordance with the contract clauses, giving the Contractor a time extension for the difference of days between the anticipated and actual adverse weather delay if the number of actual adverse weather delay days exceeds the number of days anticipated for the month in which the delay occurs and the adverse weather delayed activities critical to contract completion. A lost workday due to weather conditions is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity.

1.6.2.5 Cost Loading

a. Cost Loading Activities: Material and Equipment Costs for which payment will be requested in advance of installation shall be assigned to their respective procurement activity (i.e., the material/equipment on-site activity). All other construction costs shall be assigned to their respective Construction Activities. The value of inspection/testing activities will not be less than 10 percent of the total costs for Procurement and Construction Activities. Evenly disperse overhead and profit to each activity over the duration of the project.

b. Quantities and Units of Measure: Each cost loaded activity shall have a detailed quantity breakdown and unit of measure.

1.6.3 Schedule Software Settings and Restrictions

a. Activity Constraints: Date/time constraint(s), other than those required by the contract, will not be allowed unless accepted by the Contracting Officer. Identify any constraints proposed and provide an explanation for the purpose of the constraint in the Narrative Report.

b. Default Progress Data Disallowed: Actual Start and Actual Finish dates on the CPM schedule shall match the dates on the Contractor Quality Control and Production Reports.

c. Software Settings: Schedule calculations and Out-of-Sequence progress (if applicable) shall be handled through Retained Logic, not Progress Override. All activity durations and float values will be shown in days. Activity progress will be shown using Remaining Duration. Default activity type will be set to "Task". The project "Must Finish By" date shall be left blank.

1.6.4 Required Tabular Reports

The following reports shall be included with the schedule submittal:

a. Log Report: Listing of all changes made between the previous schedule and current updated schedule.

b. Narrative Report: Identify and justify; 1) Progress made in each area of the project; 2) Critical Path; 3) Date/time constraint(s), other than those required by the contract 3) Changes in the following; added or deleted activities, original and remaining durations for activities that have not started, logic, milestones, planned sequence of operations, critical path, and cost loading; 4) Any decrease in previously reported activity Earned Amount; 5) Pending items and status thereof, including permits, changes orders, and time extensions; 6) Status of Contract Completion Date and interim milestones; 7) Current and anticipated delays (describe cause of delay and corrective actions(s)); and 8) Description of current and future schedule problem areas. Each entry in the narrative report will cite the respective Activity ID and Activity Description, the date and reason for the change, and description of the change.

c. Earned Value Report: Listing all activities having a budget amount cost loaded. Compilation of total earnings on the project from notice to proceed to current progress payment request. Group and sort activities as directed by the Contracting Officer. Show current budget, previous physical percent complete, to-date physical percent complete, previous earned value, to-date earned value and cost to complete on the report for each activity:

d. Schedule Variance Control (SVC) Diagram: With each schedule submission, provide a SVC diagram showing 1) Cash Flow S-Curves indicating planned project cost based on projected early and late activity finish dates and 2) Earned Value to-date. Revise Cash Flow S-Curves when the contract is modified, or as directed by the Contracting Officer.

1.7 SUBMISSION AND ACCEPTANCE

1.7.1 Monthly Network Analysis Updates

Contractor and Government representatives shall meet at monthly intervals to review and agree on the information presented in the updated project schedule. The submission of an acceptable, updated schedule to the Government is a condition precedent to the processing of the Contractor's pay request. If a Schedule of Prices is the basis for progress payments, it shall be consistent with the logic and activity breakdowns on the

progress schedule. If progress payments are based on a cost-loaded schedule, the Contractor and Government shall agree on percentage of payment for each activity progressed during the update period.

Provide the following with each Schedule submittal:

a. Time Scaled Logic Diagram.

b. Reports listed in paragraph entitled "Required Tabular Reports."

c. Data disks containing the project schedule. Include the back-up native .prx/current mandated schedule program files.

1.7.2 As-Built Schedule

As a condition precedent to the release of retention and making final payment, submit an "As-Built Schedule," as the last schedule update showing all activities at 100 percent completion. This schedule shall reflect the exact manner in which the project was actually constructed.

1.8 CONTRACT MODIFICATION

Submit a Time Impact Analysis with each cost and time proposal for a proposed change. Time Impact Analysis (TIA) shall illustrate the influence of each change or delay on the Contract Completion Date or milestones. No time extensions will be granted nor delay damages paid unless a delay occurs which consumes all available Project Float, and extends the Projected Finish beyond the Contract Completion Date.

a. Each TIA shall be in both narrative and schedule form demonstrating the delay impact. The TIA shall identify the predecessors to the new activities and demonstrate the impacts to successor activities. The Contractor shall run the schedule calculations and submit the impacted schedule with the proposal or claim.

b. The TIA schedule submitted with the proposal shall show all activity progress as of the date of the proposal. If the impact to the schedule occurs prior to the proposal submission, the TIA schedule shall be updated to show all activity progress as of the time of the impact. If the proposed change does not impact the CCD, no TIA shall be required.

c. Submit Data disks containing the TIA schedule. Include the back-up native .prx/current mandated schedule program files.

d. Unless the Contracting Officer requests otherwise, only conformed contract modifications shall be added into the Project NAS.

1.9 PROJECT FLOAT

Project Float is the length of time between the Contractor's Projected Finish Milestone and the Contract Completion Date Milestone. Project Float available in the schedule, at any time shall not be for the exclusive use of either the Government or the Contractor.

1.10 THREE-WEEK LOOK AHEAD SCHEDULE

The Contractor shall prepare and issue a 3-Week Look Ahead schedule to provide a more detailed day-to-day plan of upcoming work identified on the Project Network Analysis Schedule. The work plans shall be keyed to NAS

activity numbers and updated each week to show the planned work for the current and following two-week period. Additionally, include upcoming outages, closures, preparatory meetings, and initial meetings. Identify critical path activities on the Three-Week Look Ahead Schedule. The detail work plans are to be bar chart type schedules, maintained separately from the Project NAS on an electronic spreadsheet program and printed on 8 ½ by 11 sheets as directed by the Contracting Officer. Activities shall not exceed 5 working days in duration and have sufficient level of detail to assign crews, tools and equipment required to complete the work. Three hard copies and one electronic file of the 3-Week Look Ahead Schedule shall be delivered to the Contracting Officer no later than 8 a.m. each Monday and reviewed during the weekly CQC Coordination Meeting.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES
05/13

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to commencing work on site.

Certificates of insurance

Surety bonds

List of proposed Subcontractors

List of proposed products

Construction Progress Schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of prices

Health and safety plan

Work plan

Quality control(QC) plan

Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts,

instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier,

installer or Subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (MSDS)concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

Interim "DD Form 1354" with cost breakout for all assets 30 days prior to facility turnover.

1.1.2 Approving Authority

Office or designated person authorized to approve submittal.

1.1.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor QC approval. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal register; G

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved G

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled, "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.3.1.1 Information Only

Submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.4.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of fabrication, forward to Architect-Engineer: C. Allan Bamforth, Jr., Engineer-Surveyor, Ltd., 2207 Hampton Boulevard, Norfolk, Virginia 23517 submittals required in the technical sections of this specification, including shop drawings, product data and samples. One copy of the transmittal form for all submittals shall be forwarded to the Officer in Charge of Construction.

The Architect-Engineer for this project will review and approve for the Contracting Officer those submittals reserved for Contracting Officer approval to verify submittals comply with the contract requirements.

1.4.1.1 O&M Data

The Architect-Engineer for this project will review and approve for the Contracting Officer O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

a. In the event the Contractor fails to deliver O&M Data within the time

limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.4.1.2 Submittals Reserved for Marine Corps North Carolina IPT Approval

As an exception to the standard submittal procedure specified above, submit the following to Tim Osborne, Code OPQC15, Marine Corps North Carolina IPT, 9742 Maryland Avenue, Norfolk, Virginia, 23511-3095:

a. Section 26 12 19.10 THREE-PHASE PAD-MOUNTED TRANSFORMERS: All submittals

b. Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION: Transformer submittals

1.4.1.3 Submittals Not Requiring Government Approval Or Surveillance

Construction submittals not requiring Government approval or surveillance shall be submitted for information.

1.5 PREPARATION

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled, "Identifying Submittals," of this section. Process transmittal forms to record actions regarding sample installations or panels.

1.5.2 Identifying Submittals

When submittals are provided by a subcontractor, the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location.

b. Construction contract number.

c. Date of the drawings and revisions.

d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other subcontractor associated with the submittal.

e. Section number of the specification section by which submittal is required.

f. Submittal description (SD) number of each component of submittal.

g. When a resubmission, add alphabetic suffix on submittal description,

for example, submittal 18 would become 18A, to indicate resubmission.

h. Product identification and location in project.

1.5.3 Electronic Submittals

Construction Submittals for this project shall be made electronically utilizing software provided by the Contractor and approved by the Government and the DOR. Electronic Working and Record Drawings shall be submitted in accordance with specification section 01 78 00 CLOSEOUT SUBMITTALS. Provide eOMSI submittals in accordance with specification section 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI).

1.5.3.1 Identification and Information

Identify and incorporate information in each electronic submittal file as follows:

a. Assemble complete submittal package into a single indexed electronic file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

b. Name file with the project identifier and Specification Section number, and submittal number, including revision identifier if required as follows:

File name shall use project P-number followed by a dash, the six or ten digit Specification Section number followed by a dash, and then a sequential number (e.g., P601-04 20 00-001 or P601-07 21 00.00 20-001). Resubmittals shall include an alphabetic suffix after the sequential number (e.g., P601-04 20 00-001A or P601-07 21 00.00 20-001A).

1.5.3.2 General Electronic Submittal Procedure Requests

Post electronic submittals as PDF electronic files directly to Contractor's project electronic site specifically established for the Project.

a. DOR will post electronic annotated files.

b. Contractor shall annotate and retain one copy of file as an electronic Project record document file.

c. Contractor shall maintain three (3) hard copies of all submittals: one copy to be maintained in the field during construction, one for the Construction Management Engineer (CME) office, and one for the contract files.

d. Contractor shall provide upon completion of the project, CDs which have all reviewed and marked up submittals for the project.

1.5.4 Format for SD-02 Shop Drawings

a. Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a

quality to produce clear, distinct lines and letters with dark lines on a white background.

b. Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."

d. Number drawings in a logical sequence. Contractors may use their own number system. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

e. Reserve a blank space, no smaller than 4 inches x 4 inches on the right hand side of each sheet for the Government disposition stamp.

f. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

g. Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

1.5.5 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates.

d. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

e. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from

an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

f. Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of construction effort.

g. Submit manufacturer's instructions prior to installation.

1.5.6 Format of SD-04 Samples

a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

(1) Sample of Equipment or Device: Full size.

(2) Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

(3) Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

(4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

(5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

(6) Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

(7) Sample Panel: 4 by 4 feet.

(8) Sample Installation: 100 square feet.

b. Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.7 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inch paper. Provide a bound volume for submittals containing numerous pages.

1.5.8 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

a. Provide reports on 8 1/2 by 11 inch paper in a complete bound volume.

b. Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.5.9 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.10 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies of SD-02 Shop Drawings

Submit six copies of submittals of shop drawings requiring review and approval only by QC organization and seven copies of shop drawings requiring review and approval by Contracting Officer.

1.6.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.3 Number of Samples SD-04 Samples

a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of non-solid materials.

1.6.4 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.6.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.6 Number of Copies of SD-10 Operation and Maintenance Data

Submit Five copies of O&M Data to the Contracting Officer for review and approval.

1.6.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit two sets of administrative submittals.

1.6.8 Quantity of Submittals for Information

Submit two copies of submittals for information to the Contracting Officer.

1.7 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.

1.8 VARIATIONS

Variations from contract requirements require Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.8.1 Considering Variations

Discussion with Contracting Officer prior to submission will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.8.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.8.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.8.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.9 SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of equipment and materials for which submittals are required by the specifications is provided as an attachment. This list may not be all inclusive and additional submittals may be required. The Government will provide the initial submittal register with the following fields completed, to the extent that will be required by the Government during subsequent usage. The Government provided submittal register will be in the form of a pdf file.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g. SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

1.9.1 Use of Submittal Register

Submit submittal register. Submit with QC plan and project schedule. Verify that all submittals required for project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.9.2 Contractor Use of Submittal Register

Update the following fields with each submittal throughout contract.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.9.3 Approving Authority Use of Submittal Register

Update the following fields.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (l) List date of submittal receipt.

Column (m) through (p)List Date related to review actions.

Column (q) List date returned to Contractor.

1.9.4 Action Codes

Entries for columns (j) and (o), are to be used are as follows (others may be prescribed by Transmittal Form):

1.9.4.1 Contractor Action Codes

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.9.5 Copies Delivered to the Government

Deliver one copy of submittal register updated by Contractor to Government with each invoice request.

1.10 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.

b. Submittals called for by the contract documents will be listed on the register. If a submittal is called for but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the register or marked "N/A."

c. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.

d. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

e. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days for submittals for QC Manager approval and 20 working days for submittals for Contracting Officer approval. Period of review for submittals with Contracting Officer approval begins when Government receives submittal from QC organization.

f. For submittals requiring review by fire protection engineer, allow review period, beginning when Government receives submittal from QC organization, of 30 working days for return of submittal to the Contractor.

g. Period of review for each resubmittal is the same as for initial submittal.

1.10.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is QC Manager unless otherwise specified for specific submittal. At each "Submittal" paragraph in individual specification sections, a notation "G," following a submittal item, indicates Contracting Officer is approving authority for that submittal item.

1.10.2 Constraints

a. Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.

b. Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a

system.

c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.10.3 QC Organization Responsibilities

a. Note date on which submittal was received from Contractor on each submittal.

b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.

c. Review submittals for conformance with project design concepts and compliance with contract documents.

d. Act on submittals, determining appropriate action based on QC organization's review of submittal.

(1) When QC Manager is approving authority, take appropriate action on submittal from the possible actions defined in paragraph entitled, "Approved/Accepted Submittals," of the section."

(2) When Contracting Officer is approving authority or when variation has been proposed, forward submittal to Government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of submittal determines appropriate action.

e. Ensure that material is clearly legible.

f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is Contracting Officer, QC organization will certify submittals forwarded to Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number (insert contract number here), is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Certified by QC Manager _____, Date _____"
(Signature)

(2) When approving authority is QC Manager, QC Manager will use the following approval statement when returning submittals to Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with contract Number (insert contract number here), is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Approved by QC Manager _____, Date _____"
(Signature)

g. Sign certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.

h. Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Contracting Officer.

i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

1.11 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

a. Note date on which submittal was received from QC Manager.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph entitled "Review Notations" of this section and with markings appropriate for action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date approved submittals. Two copies of the approved submittal will be retained by the Contracting Officer and 5 copies of the submittal will be returned to the Contractor.

1.11.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize the Contractor to proceed with the work covered.

b. Submittals marked "approved as noted" "or approved except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.

c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until

resubmittal is approved.

d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required , does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.12 DISAPPROVED SUBMITTALS

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes," is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, the Contractor to assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient

cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Contracting Officer does not relieve the Contractor of his responsibilities under the contract.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

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		01 14 00	SD-01 Preconstruction Submittals															
			List of Contact Personnel	1.3.1.1	G													
		01 20 00.00 20	SD-01 Preconstruction Submittals															
			EARNED VALUE REPORT	1.3	G													
		01 30 00	SD-01 Preconstruction Submittals															
			View location map	1.2	G													
			Progress and completion pictures	1.3	G													
		01 32 17.00 20	SD-01 Preconstruction Submittals															
			Qualifications	1.5	G													
			Baseline Network Analysis	1.3	G													
			Schedule															
			SD-07 Certificates															
			Monthly Network Analysis	1.7.1	G													
			SD-11 Closeout Submittals															
			As-Built Schedule	1.7.2	G													
		01 33 00	SD-01 Preconstruction Submittals															
			Submittal register	1.9	G													
		01 35 26	SD-01 Preconstruction Submittals															
			Accident Prevention Plan (APP)	1.7	G	A												
			Activity Hazard Analysis (AHA)	1.8	G	A												
			Crane Critical Lift Plan	1.7.1	G	A												
			Crane Operators	1.6.1.3	G	A												
			Traffic Control Plan	1.17.1	G	A												
			Standard Hand Signals	1.17.2.1	G	A												
			SD-06 Test Reports															
			Notifications and Reports	1.12														

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		01 35 26	Accident Reports	1.12.2														
			Crane Reports	1.12.3														
			Arc Flash Risk/Hazard Analysis	3.7.1	G													
			SD-07 Certificates															
			Confined Space Entry Permit	1.9														
			Hot work permit	1.9														
			Arc Flash Risk/Hazard Analysis	3.7.2	G													
			Qualifications															
			Contractor Electrical Energized	3.7.3	G													
			Work Permit															
			Contractor Safety Self-Evaluation	1.4	G	A												
			Checklist															
			Certificate of Compliance	1.12.4														
		01 45 00.00 20	SD-01 Preconstruction Submittals															
			Construction Quality Control (QC)	1.6.1	G													
			Plan															
		01 50 00	SD-01 Preconstruction Submittals															
			Traffic control plan	3.3.1	G													
			Construction site plan	1.4	G													
			SD-06 Test Reports															
			Backflow Preventer Tests	2.2.5	G													
			SD-07 Certificates															
			Backflow Tester	1.5.1	G													
			Backflow Preventers	1.5														
		01 57 13.00 22	SD-01 Preconstruction Submittals															
			Construction Sequence Schedule	1.4	G													

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		01 57 13.00 22	SD-03 Product Data															
			Sediment Fence	2.1														
			Dust Suppressors	2.4														
			Erosion Control Matting	2.6														
			Temporary Channel Liner	2.7														
			Filter Fabric	2.3.1.2														
		01 57 19.00 20	SD-01 Preconstruction Submittals															
			Preconstruction Survey	1.5.1	G													
			Solid Waste Management Plan	3.4	G													
			and Permit															
			Regulatory Notifications	1.5.2	G													
			Environmental Management Plan	3.1	G													
			Storm Water Pollution Prevention	3.2.1.1	G													
			Plan															
			Air Emissions Source	3.2.4	G													
			Specification Data															
			Dirt and Dust Control Plan	3.14.1														
			Contractor Hazardous Material	3.6	G													
			Inventory Log															
			SD-06 Test Reports															
			Laboratory Analysis	3.13.2.2														
			Erosion and Sediment Control	3.2.1														
			Inspection Reports															
			Storm Water Inspection Reports	3.2.1														
			for General Permit															

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		01 57 19.00 20	Contractor 40 CFR employee	1.5.5														
			training records															
			Solid Waste Management Report	3.4.1	G													
			SD-11 Closeout Submittals															
			Storm Water Pollution Prevention	3.2.1.2	G													
			Plan compliance notebook															
			Waste Determination	3.5														
			Documentation															
			Disposal Documentation for	3.6.1														
			Hazardous and Regulated Waste															
			Contractor 40 CFR Employee	1.5.5														
			Training Records															
			Solid Waste Management Permit	3.4														
			Solid Waste Management Report	3.4.1														
			Contractor Hazardous Material	3.6	G													
			Inventory Log															
			Hazardous Waste/Debris	3.13.2														
			Management															
			Regulatory Notifications	1.5.2														
		01 58 00	SD-02 Shop Drawings															
			preliminary drawing indicating	1.3.1	G													
			layout and text content															
		01 60 00.00 22	SD-07 Certificates															
			Certificate of North Carolina	1.2.1														
			Licensed Applicator															
			SD-11 Closeout Submittals															

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		01 60 00.00 22	Field Pesticide/Herbicide	3.2														
			Management Record Form															
		01 74 19	SD-01 Preconstruction Submittals															
			Waste Management Plan	1.5	G													
			SD-11 Closeout Submittals															
			Records	1.6														
		01 78 00	SD-03 Product Data															
			As-Built Record of Equipment	1.3.2														
			and Materials															
			Warranty Management Plan	1.7.1														
			Warranty Tags	1.7.4														
			Final Cleaning	1.9														
			Spare Parts Data	1.4														
			SD-08 Manufacturer's Instructions															
			Preventative Maintenance	1.5														
			Condition Monitoring (Predictive	1.5														
			Testing)															
			Inspection	1.5														
			Instructions	1.7.1														
			SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	1.8														
			Manuals															
			SD-11 Closeout Submittals															
			Record Drawings	1.3.1														

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		01 78 00	NAVFAC Sustainable & Energy	1.12	G													
			Data Record Card															
			Certification of EPA Designated	1.6	G													
			Items															
			Preliminary Interim DD Form	1.10	G													
			1354															
			Updated Interim DD Form 1354	1.10	G													
		01 78 24.00 20	SD-07 Certificates															
			Qualifications of eOMSI Preparer	1.6	G													
			Qualifications of eOMSI Preparer	1.6	G													
			SD-11 Closeout Submittals															
			eOMSI, 100 percent, Prefinal	1.9.1	G													
			Submittal															
			eOMSI, Final Submittal	1.9.2	G													
		01 78 30.00 22	SD-11 Closeout Submittals															
			GIS Data Deliverables	1.3.13	G													
		02 41 00	SD-01 Preconstruction Submittals															
			Existing Conditions	1.9	G													
			SD-07 Certificates															
			Demolition Plan	1.2.1	G													
		02 56 13	SD-02 Shop Drawings															
			Geomembrane Panel Layout,	1.2	G													
			Seam Location and Detail															
			Drawings															
			Penetrations	3.8	G													
			As-Built Drawings	1.2	G													

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		02 56 13	SD-03 Product Data															
			Sheet Materials	2.1.2	G													
			Warranty	1.7	G													
			Tests, Inspections, and	2.2	G													
			Verifications															
			Field Seaming	3.3	G													
			Qualifications	1.4	G													
			SD-04 Samples															
			Samples	3.4														
			SD-06 Test Reports															
			Materials	2.1	G													
			Surface Preparation	3.1.1	G													
			Geomembrane Seam Testing	3.2	G													
			Log															
			Geomembrane Panel Placement	3.2	G													
			Log															
			Geomembrane Seaming Record	3.2	G													
			Log															
			Geomembrane Seam Destructive	3.5.2	G													
			Sample Log															
			Non-Destructive Field Seam	3.5.1	G													
			Continuity Testing															
			Destructive Field Seam Testing	3.5.2	G													
			Geomembrane Repair Log	3.2	G													
			Geomembrane Repair Log	3.6.1	G													
			Destructive Seam Test Repairs	3.6.1	G													

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		02 56 13	Tests	3.5	G													
			SD-07 Certificates															
			QC Laboratory Accreditation	1.4.5														
			Samples	3.4														
			Materials	2.1	G													
			Surface Preparation	3.1.1	G													
			Destructive Field Seam Testing	3.5.2	G													
			Destructive Seam Test Repairs	3.6.1	G													
			Completed test logs with a	3.5	G													
			statement certifying compliance															
			with specified requirements herein															
		02 56 14	SD-03 Product Data															
			Equipment	2.2														
			Commercial Testing Laboratory	3.1.4														
			SD-04 Samples															
			Clay	2.1														
			Quality Assurance Samples	3.6.4														
			SD-06 Test Reports															
			Borrow Source Assessment	3.1	G													
			Assessment Tests	3.1	G													
			Clay Material Properties Tests	3.6.1	G													
			Moisture Content and Density	3.6.2	G													
			Tests of In-Place Clay															
			Hydraulic Conductivity Tests of	3.6.3	G													
			In-Place Clay															
			SD-07 Certificates															

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		02 56 14	Completed test logs with a	3.6	G													
			statement certifying compliance															
			with specified requirements herein															
		02 56 15	SD-02 Shop Drawings															
			GCL Panel Layout and Detail	1.2	G													
			Drawings															
			As Built GCL Panel Layout and	3.5	G													
			Detail Drawings															
			SD-03 Product Data															
			GCL Properties	2.1	G													
			Warranty	1.6	G													
			Tests, Inspections, and	2.2	G													
			Verifications															
			Qualifications	1.4	G													
			SD-04 Samples															
			Samples	3.1.1														
			SD-06 Test Reports															
			Daily QC Checklist	3.2.2	G													
			Tests, Inspections, and	2.2	G													
			Verifications															
			Conformance Tests	3.1.2	G													
			Clay Liner Preparation	3.2.1														
			GCL Repair Log	3.3	G													
			SD-07 Certificates															

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		02 56 15	Completed test logs with a	3.1	G													
			statement certifying compliance															
			with specified requirements herein															
		26 08 00	SD-06 Test Reports															
			Acceptance tests and inspections	3.1	G													
			SD-07 Certificates															
			Qualifications	1.4.1	G													
			Acceptance test and inspections	1.4.3	G													
			procedure															
		26 12 19.10	SD-02 Shop Drawings															
			Pad-mounted transformer	1.5.1	G													
			drawings															
			SD-03 Product Data															
			Pad-mounted transformers	2.2	G													
			SD-06 Test Reports															
			Acceptance checks and tests	3.7.1	G													
			SD-07 Certificates															
			Transformer Efficiencies	2.2.2.1	G													
			SD-09 Manufacturer's Field															
			Reports															
			design tests	2.7.2	G													
			routine and other tests	2.7.3	G													
			SD-10 Operation and Maintenance															
			Data															
			Transformer(s)	1.6.1	G													
			SD-11 Closeout Submittals															

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		26 12 19.10	Transformer test schedule	2.7.1	G														
		26 20 00	SD-02 Shop Drawings																
			Panelboards	2.7	G														
			Marking strips	3.1.6.1	G														
			SD-03 Product Data																
			Circuit breakers	2.7.3	G														
			Switches	2.5	G														
			Enclosed circuit breakers	2.8	G														
			Motor controllers	2.10	G														
			SD-06 Test Reports																
			600-volt wiring test	3.5.2	G														
			Grounding system test	3.5.3	G														
			SD-07 Certificates																
			Fuses	2.6	G														
		26 32 13.00 20	SD-02 Shop Drawings																
			Engine-Generator set and	1.5.1.1	G														
			auxiliary equipment																
			SD-03 Product Data																
			Engine-generator set data	1.3.1	G														
			Engine-generator set efficiencies	1.3.2	G														
			Diesel engine data	1.3.3	G														
			Generator and exciter data	1.3.4	G														
			Diesel engine-generator set	2.1	G														
			SD-05 Design Data																
			Capacity calculations for	1.3.5	G														
			engine-generator set																

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		26 32 13.00 20	Calculations for brake mean	1.3.6	G													
			effective pressure															
			Torsional vibration stress	1.3.7	G													
			analysis computations															
			Capacity calculations for batteries	1.3.8	G													
			SD-06 Test Reports															
			Acceptance checks and tests	3.5.1	G													
			Functional acceptance tests	3.5.2	G													
			Functional acceptance test	3.4.4	G													
			procedure															
			SD-07 Certificates															
			Vibration isolation system	1.5.2	G													
			Fuel system	1.5.3	G													
			Start-up engineer	3.3	G													
			Instructor's	3.6.1	G													
			SD-09 Manufacturer’s Field															
			Reports															
			Engine tests	2.5.1	G													
			Generator tests	2.5.2	G													
			Assembled engine-generator set	2.5.3	G													
			tests															
			SD-10 Operation and Maintenance															
			Data															
			Diesel engine-generator set	2.1	G													
			Preliminary assembled operation	3.4.3	G													
			and maintenance manuals															

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		26 32 13.00 20	SD-11 Closeout Submittals															
			Posted operating instructions	1.8.2	G													
			Training plan	3.6.2	G													
		26 36 23.00 20	SD-02 Shop Drawings															
			Automatic Transfer Switch	1.4.2	G													
			Drawings															
			SD-03 Product Data															
			Automatic Transfer Switches	2.1	G													
			SD-06 Test Reports															
			Acceptance Checks and Tests	3.3.1	G													
			Functional Acceptance Tests	3.3.2	G													
			SD-07 Certificates															
			Proof of Listing	1.4.1	G													
			SD-10 Operation and Maintenance															
			Data															
			Automatic Transfer Switches	2.1	G													
		26 56 00.00 22	SD-01 Preconstruction Submittals															
			Photometric Plan	1.4.2	G													
			Warranty	1.7	G													
			LED Luminaire Warranty	1.7.1	G													
			SD-02 Shop Drawings															
			Luminaire drawings	1.4.1.1	G													
			Poles	1.4.1.2	G													
			SD-03 Product Data															
			Local/Regional Materials	1.6.1														
			Energy Efficiency	1.6.2														

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		26 56 00.00 22	LED Luminaires	2.2	G													
			LED Luminaire Photocell Switch	2.2.6	G													
			Concrete poles	2.3.1	G													
			Brackets	2.4														
			SD-05 Design Data															
			Design Data for luminaires	1.4.2	G													
			Wind Loading Calculations	2.2.1	G													
			SD-06 Test Reports															
			LED Luminaire IESNA LM-79	2.2.1	G													
			Report															
			LED Luminaire IESNA LM-80	2.2.1	G													
			Report															
			Operating test	3.2														
			SD-07 Certificates															
			Fixture Useful Life Certificate	1.7.1	G													
			SD-08 Manufacturer's Instructions															
			Concrete poles	2.3.1														
			SD-10 Operation and Maintenance															
			Data															
			Operational Service	1.8														
		31 05 19	SD-03 Product Data															
			Thread	2.1.2														
			Manufacturing Quality Control	2.2														
			Sampling and Testing															
			SD-04 Samples															

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		31 05 19	Quality Assurance Samples and	3.1														
			Tests															
			SD-07 Certificates															
			Geotextile	2.1.1	G													
		31 05 20	SD-03 Product Data															
			Sampling and Testing	2.2														
			Seams and Overlaps	3.1.3	G													
			Penetrations	3.1.6														
			Construction Quality Control (QC)	1.3.3														
			Laboratory															
			SD-04 Samples															
			Geocomposite	2.1														
			Seams and Overlaps	3.1.3														
			SD-06 Test Reports															
			Sampling and Testing	2.2														
			Geocomposite	2.1														
			Geocomposite Membrane Repair	3.2.1	G													
			Log															
			SD-07 Certificates															
			Completed test logs with a	2.2	G													
			statement certifying compliance															
			with specified requirements herein															
		31 23 00.00 20	SD-01 Preconstruction Submittals															
			Dewatering work plan	1.7.1														
			SD-06 Test Reports															
			Borrow Site Testing	1.6														

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		31 23 00.00 20	Common Fill, Fill and Backfill	3.14.2.1														
			Materials Testing															
			Select material	3.14.2.2														
			Density tests	3.14.2.3														
		32 01 19	SD-03 Product Data															
			Manufacturer's	1.4	G													
			Recommendations															
			Equipment	1.2														
			SD-04 Samples															
			Materials	1.4.2														
			SD-06 Test Reports															
			Certified copies of the test reports	1.4.2	G													
			SD-07 Certificates															
			Compatibility of Sealant and	1.4.2														
			Backup Material															
		32 05 33	SD-01 Preconstruction Submittals															
			Integrated Pest Management	2.2	G													
			Plan															
			SD-03 Product Data															
			Fertilizer	2.1	G													
			SD-07 Certificates															
			Maintenance inspection report	3.4.1														
		32 10 00	SD-06 Test Reports															
			Mix design	1.3.3														
			Density	3.3.2.1														
			Thickness	3.3.2.1														

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		32 10 00	Straightedge test	3.3.2.1														
			SD-07 Certificates															
			Aggregate base course	2.2														
			Asphalt or Bituminous concrete	2.1														
			mix design	1.3.3														
		32 13 13.06	SD-03 Product Data															
			Curing materials	2.1.8														
			Admixtures	2.1.4														
			Dowel	2.1.6														
			Reinforcement	2.1.5														
			Sodium Silicate Surface Sealer	2.1.10														
			SD-04 Samples															
			Field-Constructed Mockup	1.4.7	G													
			SD-05 Design Data															
			mix design	2.3	G													
			SD-06 Test Reports															
			Aggregate	2.1.3														
			Concrete slump tests	3.9.2														
			Air content tests	3.9.4														
			Compressive strength tests	3.9.3	G													
			SD-07 Certificates															
			Ready-mixed concrete plant	1.4.1														
			Batch tickets	1.4.6														
			Cementitious materials	2.1.1														
		32 17 23.00 20	SD-03 Product Data															
			Paints for roads and streets	2.1.1														

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		32 17 23.00 20	Equipment	1.5														
			SD-07 Certificates															
			Paints for roads and streets	2.1.1														
			Qualifications	1.7														
			SD-08 Manufacturer's Instructions															
			Paints for roads and streets	2.1.1														
		32 31 13	SD-02 Shop Drawings															
			Fence Assembly	1.3	G													
			Location of Gate, Corner, End,	3.15.1	G													
			and Pull Posts															
			Gate Assembly	1.3	G													
			Gate Hardware and Accessories	2.14	G													
			Erection/Installation Drawings	1.3	G													
			SD-03 Product Data															
			Fence Assembly	1.3	G													
			Gate Assembly	1.3	G													
			Gate Hardware and Accessories	2.14	G													
			Zinc Coating	2.2	G													
			Fabric	2.3	G													
			Stretcher Bars	2.9	G													
			Concrete	2.17	G													
			SD-07 Certificates															
			Certificates of Compliance	1.5.2	G													
			SD-08 Manufacturer's Instructions															
			Fence Assembly	1.3	G													
			Gate Assembly	1.3	G													

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		32 31 13	Hardware Assembly	1.3	G													
			Accessories	1.3	G													
		32 92 19	SD-03 Product Data															
			Wood cellulose fiber mulch	2.4.3														
			SD-06 Test Reports															
			Topsoil composition tests	2.2.3														
			SD-07 Certificates															
			seed	2.1														
			SD-08 Manufacturer's Instructions															
			Erosion Control Materials	2.6														
		32 92 23	SD-03 Product Data															
			Fertilizer	2.4														
			SD-06 Test Reports															
			Topsoil composition tests	2.2.3														
			SD-07 Certificates															
			sods	2.1														
		33 31 16	SD-02 Shop Drawings															
			Drawings	1.4.2														
			Precast concrete manhole	2.5.1														
			Metal items	2.5.3														
			Frames and covers	2.5.3.1														
			Leachate Extraction Pumping	2.2	G													
			System															
			Leachate Extraction Pumping	3.1.3	G													
			System															
			SD-03 Product Data															

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		33 31 16	Pipeline materials	2.1														
			SD-06 Test Reports															
			Reports	2.6														
			SD-07 Certificates															
			Aggregates	2.3.1	G													
			SD-09 Manufacturer's Field															
			Reports															
			Leachate Extraction Pumping	2.2	G													
			System															
			Leachate Extraction Pumping	3.1.3	G													
			System															
			SD-10 Operation and Maintenance															
			Data															
			Leachate Extraction Pumping	2.2	G													
			System															
			Leachate Extraction Pumping	3.1.3	G													
			System															
		33 40 00	SD-03 Product Data															
			Placing Pipe	3.3														
		33 71 01	SD-03 Product Data															
			Conductors	2.6	G													
			Insulators	2.5	G													
			Wood Poles	2.2.1														
			Cutouts	2.9	G													
			Surge arresters	2.8	G													
			Nameplates	2.13	G													

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		33 71 01	SD-06 Test Reports															
			Wood Crossarm Inspection	1.5.5														
			Report															
			Field Test Plan	1.5.5.1	G													
			Field Quality Control	3.4	G													
			Ground resistance test reports	1.5.4	G													
			SD-07 Certificates															
			Public Utility - Electrical	1.5.1	G													
			Contractor's License															
			Wood poles	2.2.1	G													
			Wood crossarms	2.3.1	G													
		33 71 02.00 20	SD-02 Shop Drawings															
			Precast underground structures	1.4.2	G													
			SD-03 Product Data															
			Medium voltage cable	2.5	G													
			Medium voltage cable joints	2.7	G													
			Medium voltage cable	2.6	G													
			terminations															
			Precast concrete structures	2.11.1.1	G													
			Sealing Material	2.11.1.4														
			Handhole frames and covers	2.11.2	G													
			Cable supports	2.12	G													
			Pulling in irons	3.4.2	G													
			SD-06 Test Reports															
			Arc-proofing test	2.13.1	G													
			Arc-proofing test	2.13.1	G													

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		33 71 02.00 20	Medium voltage cable	2.13.2	G													
			qualification and production tests															
			Field Acceptance Checks and	3.16.1	G													
			Tests															
			Cable Installation Plan and	3.3														
			Procedure															
			SD-07 Certificates															
			Public Utility - Electrical	1.4.1	G													
			Contractor's License															
			Cable splicer/terminator	1.4.3	G													
			Cable Installer Qualifications	1.4.4														

SECTION 01 35 26

GOVERNMENTAL SAFETY REQUIREMENTS
06/13

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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) / INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA 107	(2010) American National Standard for High-Visibility Safety Apparel and Headwear

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.32	(2012) Fall Protection
ASSE/SAFE A10.34	(2001; R 2012) Protection of the Public on or Adjacent to Construction Sites
ASSE/SAFE Z359.1	(2007) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

ASME INTERNATIONAL (ASME)

ASME B30.22	(2010) Articulating Boom Cranes
ASME B30.3	(2012) Tower Cranes
ASME B30.5	(2011) Mobile and Locomotive Cranes
ASME B30.8	(2010) Floating Cranes and Floating Derricks

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2012; Errata 2012; INT 1 2012; INT 2 2012; INT 3 2012) National Electrical Safety Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2010) Occupational and Educational Personal Eye and Face Protection Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1	(2012; TIA 11-1) Fire Code
NFPA 10	(2013) Standard for Portable Fire Extinguishers

NFPA 241	(2013) Standard for Safeguarding Construction,Alteration, and Demolition Operations
NFPA 51B	(2009; TIA 09-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2011; Errata 2 2012) National Electrical Code
NFPA 70E	(2012; Errata 1) Standard for Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009) Manual on Uniform Traffic Control Devices

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.1400	Cranes & Derricks in Construction
29 CFR 1926.16	Rules of Construction
29 CFR 1926.500	Fall Protection
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC P-307	(2009; Change 1 Mar 2011; Change 2 Aug 2011)Management of Weight Handling Equipment
ND OPNAVINST 5100.23	(2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual

1.2 DEFINITIONS

a. Competent Person for Fall Protection. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.

b. High Visibility Accident. Any mishap which may generate publicity or high visibility.

c. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

d. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers and crane walkers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

e. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

(1) Death, regardless of the time between the injury and death, or the length of the illness;

(2) Days away from work (any time lost after day of injury/illness onset);

(3) Restricted work;

(4) Transfer to another job;

(5) Medical treatment beyond first aid;

(6) Loss of consciousness; or

(7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

f. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

g. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.) Any mishap meeting the criteria described above shall be documented in both the Contractor Significant Incident Report (CSIR)

and using the NAVFAC prescribed Navy Crane Center (NCC) form submitted within five days both as provided by the Contracting Officer. Comply with additional requirements and procedures for accidents in accordance with NAVFAC P-307, Section 12.

h. Internal Traffic Control Plan (ITCP). Strategies to control the flow of construction workers, vehicles and equipment inside the work zone.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Government acceptance is required for submittals with a "G, A" designation.

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, A

Activity Hazard Analysis (AHA); G, A

Crane Critical Lift Plan; G, A

Proof of qualification for Crane Operators; G, A

Traffic Control Plan; G, A

Standard Hand Signals; G, A

SD-06 Test Reports

Notifications and Reports

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Notifications and Reports."

Accident Reports

Crane Reports

Arc Flash Risk/Hazard Analysis; G

SD-07 Certificates

Confined Space Entry Permit

Hot work permit

Arc Flash Risk/Hazard Analysis Qualifications; G

Contractor Electrical Energized Work Permit; G

Contractor Safety Self-Evaluation Checklist; G, A

Certificate of Compliance (Crane)

Submit one copy of each permit/certificate attached to each Daily Quality Control Report.

1.4 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contracting Officer will provide a "Contractor Safety Self-Evaluation checklist" to the Contractor at the pre-construction conference. Complete the checklist monthly and submit with each request for payment voucher. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90 may result in retention of up to 10 percent of the voucher. Additionally, provide a Monthly Exposure Report and attach to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the voucher. The Contracting Officer will submit a copy of the Contractor Safety Self-Evaluation and Monthly Exposure Report to the local safety and occupational health office.

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, comply with the most recent edition of USACE EM 385-1-1, NFPA 70E, IEEE C2 and federal, state, and local, laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

The SSHO must meet the requirements of EM 385-1-1 section 1 and ensure that the requirements of 29 CFR 1926.16 are met for the project. Provide a Safety oversight team that includes a minimum of one (1) person at each project site to function as the Site Safety and Health Officer (SSHO). The SSHO shall be at the work site at all times to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. The SSHO's training, experience, and qualifications shall be as required by EM 385-1-1 paragraph 01.A.17, entitled SITE SAFETY AND HEALTH OFFICER (SSHO), and all associated sub-paragraphs.

A Competent Person shall be provided for all of the hazards identified in the Contractor's Safety and Health Program in accordance with the accepted Accident Prevention Plan, and shall be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the the Contracting Officer for acceptance in consultation with the Safety Office.

1.6.1.1.1 Contractor Quality Control (QC) Person

The Contractor Quality Control Person cannot be the SSHO on this project, even though the QC has safety inspection responsibilities as part of the QC duties.

1.6.1.2 Competent Person for Confined Space Entry

Provide a "Competent Person" to supervise the entry into each confined space. That individual must meet the requirements and definition of Competent Person as contained in EM 385-1-1.

1.6.1.3 Crane Operators

Meet the crane operators requirements in USACE EM 385-1-1, Section 16 and Appendix I. In addition, for mobile cranes, designate crane operators as qualified by a source that qualifies crane operators (i.e., union, a government agency, or and organization that tests and qualifies crane operators). Provide proof of current qualification. In addition, the Contractor shall comply with Contractor Operated Crane Requirements included in the latest revision of document NAVFAC P-307 Section 1.7.2 "Contractor Operated Cranes," and Appendix P, Figure P-1 and with 29 CFR 1926, Subpart CC.

1.6.2 Personnel Duties

1.6.2.1 Site Safety and Health Officer (SSHO)

The SSHO shall:

a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily quality control report.

b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.

c. Maintain applicable safety reference material on the job site.

d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.

e. Implement and enforce accepted APPS and AHAs.

f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. Post a list of unresolved safety and health deficiencies on the safety bulletin board.

g. Ensure sub-contractor compliance with safety and health requirements.

h. Ensure an approved "Contractor Electrical Energized Work Permit" prior to starting any activity on energized electrical systems.

i. Maintain a list of hazardous chemicals on site and their material safety data sheets.

Failure to perform the above duties will result in dismissal of the superintendent, QC Manager, and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

c. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.6.3.2 Safety Meetings

Conduct and document meetings as required by EM 385-1-1. Attach minutes showing contract title, signatures of attendees and a list of topics discussed to the Contractors' daily quality control report.

1.7 ACCIDENT PREVENTION PLAN (APP)

Use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident Prevention Plan". Specific requirements for some of the APP elements are described below. The APP shall be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer, the Contractor Quality Control Manager, and any designated CSP or CIH.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34,) and the environment.

Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site. Continuously review and amend the APP, as necessary, throughout the life of the contract. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered.

1.7.1 EM 385-1-1 Contents

In addition to the requirements outlined in Appendix A of USACE EM 385-1-1, the following is required:

a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. Specify the duties of each position.

b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.

c. Confined Space Entry Plan. Develop a confined and/or enclosed space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, OSHA Directive CPL 2.100, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

d. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than

one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. Submit 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.H. and the following:

(1) For lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400.

(2) For barge mounted mobile cranes, barge stability calculations identifying barge list and trim based on anticipated loading; and load charts based on calculated list and trim. The amount of list and trim shall be within the crane manufacturer's requirements.

e. Fall Protection and Prevention (FP&P) Program Documentation. The program documentation shall be site specific and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A qualified person for fall protection shall prepare and sign the program documentation. Include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Revise the Fall Protection and Prevention Program Documentation every six months for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted Fall Protection and Prevention Program Documentation at the job site for the duration of the project. Include the Fall Protection and Prevention Program Documentation in the Accident Prevention Plan (APP).

The FP&P Plan shall include a Rescue and Evacuation Plan in accordance with USACE EM 385-1-1, Section 21.M. The plan shall include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan in the Fall Protection and Prevention (FP&P) Plan, and as part of the Accident Prevention Plan (APP).

f. Site Demolition Plan. The safety and health aspects prepared in accordance with Section 02 41 00 DEMOLITION and referenced sources.

g. Excavation Plan. The safety and health aspects prepared in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

1.8 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1, Section 1. NAVFAC Midlant shall follow latest edition authorized by command. Submit the AHA for review at least 7 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

Develop the activity hazard analyses using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

1.9 DISPLAY OF SAFETY INFORMATION

Within 1 calendar day after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, shall be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, section 01.A.06. Additional items required to be posted include:

a. Confined space entry permit.

b. Hot work permit.

c. Contractor Electrical Energized Work Permit.

1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.11 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.12 NOTIFICATIONS AND REPORTS

1.12.1 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $2,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

1.12.2 Accident Reports

a. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, property damage accidents resulting in at least $20,000 in damages, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the Contractor Incident Report (CIR), and electronically file the report in ESAMS within 5 calendar day(s) of the

accident.

b. Near Misses: Complete the applicable documentation in NAVFAC Contractor Incident Reporting System (CIRS), and electronically submit via the NAVFAC Enterprise Safety Applications Management System (ESAMS).

c. Conduct an accident investigation for any weight handling equipment accident (including rigging gear accidents) to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

1.12.3 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix I and as specified herein with Daily Reports of Inspections.

1.12.4 Certificate of Compliance

Provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). State within the certificate that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance comply with 29 CFR 1926 and USACE EM 385-1-1 Section 16 and Appendix I. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. Also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). Post certifications on the crane.

1.13 HOT WORK (Welding And Cutting, Etc.)

Hot work permits will only be issued to the Prime Contractor. Prime Contractor shall notify OICC/ROICC office of issuance of hot work permits and all renewals of hot work permits. Copies of all hot work permits and renewals shall be attached to daily quality control reports.

Submit and obtain a written permit prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, from the Fire Division. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. Provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DIVISION IMMEDIATELY.

1.14 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

1.15 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must:

a. Secure outside equipment and materials and place materials that could be damaged in protected areas.

b. Check surrounding area for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

c. Ensure that temporary erosion controls are adequate.

1.16 CONFINED SPACE ENTRY REQUIREMENTS.

Contractors entering and working in confined spaces performing shipyard industry work are required to follow the requirements of EM 385-1-1 Section 34 Confined Space Entry. Contractors entering and working in confined spaces performing general industry work are required to follow the requirements of OSHA 29 CFR 1910 and EM 385-1-1 Section 34 Confined Space Entry.

NAVFAC personnel entering and working in confined spaces performing non-maritime facility work are required to follow the requirements of ND OPNAVINST 5100.23 Chapter 27.

1.17 TRAFFIC CONTROL

The requirements contained in this paragraph are in addition to the requirements contained in EM 385-1-1. In case of a conflict, the more stringent requirement applies. Traffic Control shall be accomplished in accordance with MUTCD.

1.17.1 Traffic Control Plan

Prior to the commencement of contract operations, the Contractor shall submit for acceptance the complete details of the proposed traffic control plan for the maintenance of traffic and access through the contract work area. The plan shall include durations of time associated with each phase of traffic maintenance including duration of re-routing of traffic.

Include traffic control and traffic control signal systems in each Activity Hazard Analysis as applicable.

1.17.2 Signal Systems, Personnel And Procedures

Signal systems, personnel and procedures shall comply with EM 385-1-1 Section 08.B SIGNAL SYSTEMS, PERSONNEL AND PROCEDURES.

1.17.2.1 Standard Hand Signals

Standard hand signals shall be submitted for acceptance and shall be posted at the operator's position, signal control points and other points as

necessary to inform those concerned.

1.17.3 Road Closings

Traffic control is extremely important on highways, in residential areas, and at construction sites. When traffic may pose a hazard to operations, public roads will be closed. Road closings shall be coordinated in writing with appropriate local agencies. Traffic controls and signage shall comply with MUTCD.

1.17.4 Operating Precautions

When a road cannot be closed, the following precautions shall be taken:

a. “FLAGGER” (MUTCD W-20-7) or “WORKERS AHEAD: (W21-1) or similar appropriate signs shall be placed along the roadway, 1,000 ft (304.8m) and 500 ft (30.5 m) before the work zone, on both sides of the work zone”.

b. Sufficient number of flag persons shall be used to control traffic within the work area.

c. Flag persons shall be used and shall receive instruction in flagging operations before being placed in traffic (training and certification by the National Safety Council (NSC) is recommended).

d. All flag persons shall wear high-visibility apparel in accordance with EM 385-1-1, paragraph 05.F, safety-toed footwear and hard hats.

e. "STOP/SLOW" paddles, preferably mounted on a 6 ft staff, will be used for traffic control.

f. Flag persons shall be able to communicate with each other and with the foreman, and effectively signal/direct the affected public.

g. Two-way radios shall be used whenever visual contact between flaggers is not maintained.

1.17.5 Construction Vehicles

All construction vehicles and all vehicles exceeding 1-1/2 tons (1360.8 kg) shall have a signal person to assist in backing and maneuvering in residential and construction areas.

1.17.6 Internal Traffic Control Plans (ITCP)

Internal traffic control plans (ITCP) (written plans which address separation and safety of personnel and moving equipment) will be attached to all AHA's when interaction between personnel and moving equipment will occur or physical changes occur onsite which could affect personnel or moving equipment.

PART 2 PRODUCTS

2.1 CONFINED SPACE SIGNAGE

Provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a

minimum of one inch in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 5 feet.

PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

Comply with USACE EM 385-1-1, NFPA 1, NFPA 70, NFPA 70E, NFPA 241, IEEE C2, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. In addition to the requirements of EM 385-1-1, Safety Glasses ANSI/ISEA Z87.1 and High-Visibility Apparel (ANSI/ISEA 107 Shirt or Vest) will be worn at all times on construction sites. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

Mandatory PPE on all construction sites includes:

a. Hard Hat

b. Safety Glasses

c. Appropriate Safety Shoes

d. Reflective Vest or High-Visibility Shirt

3.1.1 Hazardous Material Use

Each hazardous material must receive approval from the Contracting Officer or their designated representative prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocynates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the Radiation Safety Officer (RSO) prior to excepted items of radioactive material and devices being brought on base.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos, and other OSHA regulated chemicals (i.e. 29 CFR Part 1910.1000). If material, not indicated, that may be hazardous

to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Ensure that each employee is familiar with and complies with these procedures and USACE EM 385-1-1, Section 12, Control of Hazardous Energy.

3.4 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

Establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

3.4.1 Training

Institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection in accordance with USACE EM 385-1-1, Section 21.B.

3.4.2 Fall Protection Equipment and Systems

Enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, Paragraphs 21.N through 21.N.04. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with

29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ASSE/SAFE A10.32.

3.4.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ASSE/SAFE Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 6 feet. The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

3.4.3 Horizontal Lifelines

Design, install, certify and use under the supervision of a qualified person horizontal lifelines for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.4.4 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

3.4.5 Rescue and Evacuation Procedures

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

3.5 EQUIPMENT

3.5.1 Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions. Additionally, when material handling equipment is used as a crane it must meet NAVFAC P-307 requirements in Sections 1.7.2, "Contractor Operated Cranes," and 12, "Investigation and Reporting of Crane and Rigging Gear Accidents."

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.5.2 Weight Handling Equipment

a. Equip cranes and derricks as specified in EM 385-1-1, section 16.

b. Notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Contractor's operator shall remain with the crane during the spot check.

c. Comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.

d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.

e. Under no circumstance shall a Contractor make a lift at or above 90 percent of the crane's rated capacity in any configuration.

f. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and follow the requirements of USACE EM 385-1-1 Section 11, NAVFAC P-307 Figure 10-3 and ASME B30.5 or ASME B30.22 as applicable.

g. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane.

h. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.

i. All employees must keep clear of loads about to be lifted and of suspended loads.

j. Use cribbing when performing lifts on outriggers.

k. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

l. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

m. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

n. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

o. Certify that all crane operators have been trained in proper use of all

safety devices (e.g. anti-two block devices).

p. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. Prior to conducting lifting operations set a maximum wind speed at which a crane can be safely operated based on the equipment being used, the load being lifted, experience of operators and riggers, and hazards on the work site. This maximum wind speed determination shall be included as part of the activity hazard analysis plan for that operation.

3.5.3 Equipment and Mechanized Equipment

a. Proof of qualifications for operator shall be kept on the project site for review.

b. Manufacturer specifications or owner's manual for the equipment shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

3.5.4 USE OF EXPLOSIVES

Explosives shall not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval shall not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, shall be only where directed and in approved storage facilities. These facilities shall be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

3.6 EXCAVATIONS

Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1. A competent person for excavation must be on site during all excavation work.

3.6.1 Utility Locations

All underground utilities in the work area must be positively identified by a third party, independent, private utility locating company in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

3.6.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system.

3.6.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify.

Whenever contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company shall locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.6.4 Location of Underground Utilities

Location and Protection of underground utilities shall be the responsibility of the Contractor. Where existing-to-remain piping, utilities, and underground obstructions of any type are indicated in locations to be traversed by new piping, ducts, and other evacuations, the elevations of the existing utilities and obstructions shall be determined before the new work is completed.

a. In addition, the Contractor shall be responsible for obtaining the services of a professional utility locator prior to digging. Contractor shall provide documentation that the site has been surveyed and checked for underground utilities. All utilities shall be located, including but not limited to power, water, sewer, storm drains, fiber optics, T.V. cable, telephone, and intrusion detection wiring. A set of known utility drawings will be available in the OICC office for review to assist the locator.

b. It is mandatory that the Contractor also contact the Base Telephone Office at (910) 451-2531 prior to accomplishing any digging at Camp Lejeune. A telephone office representative will assist in locating telephone lines.

c. It is mandatory that the Contractor also contact Charter Communications, cable TV service prior to accomplishing any digging at Camp Lejeune, to ensure that all buried cable lines are identified. Contact Mr. Olin Criswell at (910) 353-8677 for assistance.

d. It is mandatory that the Contractor also contact the North Carolina One-Call Center to coordinate the location of underground natural gas infrastructure. North Carolina 811, Inc. can be reached at 811 on a touch-tone phone in the state of North Carolina or toll-free at 1-800-632-4949 if calling from out of state. Work request may also be submitted online at www.nc811.org.

3.6.4.1 The Locations of Underground Utilities

The locations of underground utilities shown are only approximate and the information provided may be incomplete. Contractor shall attempt to ascertain locations of existing underground utilities prior to and during digging operations.

3.6.4.2 Damage to Underground Utilities

Immediate notice shall be delivered to the Contracting Officer of any damage. The Contractor shall make temporary repairs immediately and shall provide permanent repairs as soon as practicable.

3.7 ELECTRICAL

3.7.1 Arc Flash Risk/Hazard Analysis

Contractor shall provide an Arc Flash Risk/Hazard Analysis in accordance with NFPA 70E for all locations where workers may be exposed to arc flash hazard (work on energized electrical equipment). The Arc Flash Risk/Hazard Analysis shall be sealed and signed by a qualified professional engineer.

In addition to Arc Flash Risk/Hazard Analysis required for safety during construction, provide an Arc Flash Risk/Hazard Analysis for the entire electrical distribution system as constructed. Provide equipment labels as required by NFPA 70E.

3.7.2 Arc Flash Risk/Hazard Analysis Qualifications

Contractor shall engage the services of a qualified organization to provide Arc Flash Risk/Hazard Analysis of the electrical distribution system. Organization shall be independent of the supplier, manufacturer, and installer of the equipment. The organization shall be a first tier subcontractor. This work shall not be performed by a second tier subcontractor.

a. Submit name and qualifications of organization. Organization shall have been regularly engaged in providing Arc Flash Risk/Hazard Analysis for a minimum of 5 years.

b. Submit name and qualifications of the professional engineer performing the analysis. Include a list of three comparable jobs performed by the engineer with specific names and telephone numbers for reference.

3.7.3 Contractor Electrical Energized Work Permit

All work on energized electrical systems must have an approved/signed Contractor Electrical Energized Work Permit. The results of the Arc Flash Risk/Hazard Analysis shall be included in the "Contractor Electrical Energized Work Permit" request. Flame-resistant (FR) clothing and personal protective equipment (PPE) shall be rated for a minimum of 8 calories per square centimeter even if the flash hazard analysis indicates a lower value. A blank copy of the permit request is attached. An editable version may be obtained from the Contracting Officer.

3.7.4 Portable Extension Cords

Size portable extension cords in accordance with manufacturer ratings for the tool to be powered and protected from damage. Immediately remove from service all damaged extension cords. Portable extension cords shall meet the requirements of EM 385-1-1, NFPA 70E and OSHA electrical standards.

3.8 WORK IN CONFINED SPACES

Comply with the requirements in Section 34 of USACE EM 385-1-1, OSHA 29 CFR 1910, OSHA 29 CFR 1910.146, OSHA Directive CPL 2.100 and OSHA 29 CFR 1926. Any potential for a hazard in the confined space requires a permit system to be used.

a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has

conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 34 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.

b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.

c. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

-- End of Section --

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Special Permission Energized Electrical Work Permit

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Permit Number:

Part I: Request for Special Permission

Job Order/Contract Number:

(1) Description of circuit/equipment:

(2) Job Location:

(3) Description of work to be done:

(4) Justification of why the circuit/equipment cannot be de-energized:

(5) Anticipated Duration of Work Requiring Special Permission: (hours/minutes) _____ On (date) _____

(6) Means Employed to Restrict Access of Unqualified Persons:

(7) Shock Hazard Analysis:

Voltage _____ Approach Boundaries: (distance) Limited _____ Restricted_____ Prohibited_____ Flash_____

(8) Flash Hazard Analysis: Calorie PPE required _____ (8 minimum)

Approach Boundaries to be crossed: (Check as applicable) Limited ____ Restricted_____ Prohibited____ Flash Protection _____

(9) PPE to be used: (in addition to required daily wear)

Leather Gloves:	Yes____ No____
Voltage Rated Rubber Gloves with Leather Protectors	Yes____ No____
Safety Glasses	Yes____ No____
Arc Flash Face Shield rated 10-cal/cm sq or more	Yes____ No____
Arc Flash Hood rated 20 cal/cm sq or more	Yes____ No____
Safety Helmet	Yes____ No____
Balaclava (Head Sock)	Yes____ No____
Hearing Protection (single level)	Yes____ No____
Voltage Rated Tools	Yes____ No____
Hazard Risk Category 3 Clothing	Yes____ No____

(10) Source of Lighting: Outside Daylight___ Inside Existing Artificial ___ Temporary Portable Lighting: (AC) ___ Battery___

(11) Name of Employee(s) Assigned to Job and will receive job briefing before beginning work (sign in sheet required):

Requested By_____

Name Typed **Organization (BL / FEAD / PWO)** **Phone #**

_____

Signature

Part II: Recommended Approval

Construction Safety Manager Concurrence: _____ Date: _____

Notification:

Operation Officer:_____Date: _____

Executive Officer:_____Date: _____

Approved by: _____ Date _____

Commanding Officer / Designee

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SECTION 01 45 00.00 20

QUALITY CONTROL
05/13

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 in the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Quality Control (QC) Plan; G

Submit a Construction QC Plan prior to start of construction.

1.3 INFORMATION FOR THE CONTRACTING OFFICER

Prior to commencing work on construction, the Contractor can obtain a single copy set of the current report forms from the Contracting Officer. The report forms will consist of the Contractor Production Report, Contractor Production Report (Continuation Sheet), Contractor Quality Control (CQC) Report, (CQC) Report (Continuation Sheet), Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, and Testing Plan and Log.

Deliver the following to the Contracting Officer during Construction:

a. CQC Report: Mail or hand-carry the original (wet signatures) and one copy by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work.

b. Contractor Production Report: Mail or hand-carry the original (wet signatures) and one copy by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work, attached to the CQC Report.

c. Preparatory Phase Checklist: Original attached to the original CQC Report and one copy attached to each QC Report copy.

d. Initial Phase Checklist: Original attached to the original CQC Report and one copy attached to each QC Report copy.

e. QC Specialist Reports: Mail or hand-carry the original (wet signatures) and one copy by 10:00 AM the next working day after each day that work is performed.

f. Field Test Reports: Mail or hand-carry the original within two working days after the test is performed, attached to the original CQC Report and one copy attached to each QC Report copy.

g. Monthly Summary Report of Tests: Mail or hand-carry the original attached to the last QC Report of the month.

h. Testing Plan and Log: Mail or hand-carry the original attached to the last CQC Report of each month and one copy attached to each CQC Report copy. A copy of the final Testing Plan and Log shall be provided to the OMSI preparer for inclusion into the OMSI documentation.

i. Rework Items List: Mail or hand-carry the original attached to the last CQC Report of each month and one copy attached to each CQC Report copy.

j. CQC Meeting Minutes: Mail or hand-carry the original within two working days after the meeting is held, attached to the original CQC Report and one copy attached to each CQC Report copy.

k. QC Certifications: As required by the paragraph entitled "QC Certifications."

1.4 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and approval, testing, completion inspections, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract. The QC program must cover on-site and off-site work and be keyed to the work sequence. No construction work or testing may be performed unless the QC Manager is on the work site. The QC Manager must report to an officer of the firm and not be subordinate to the Project Superintendent or the Project Manager. The QC Manager, Project Superintendent and Project Manager must work together effectively. Although the QC Manager is the primary individual responsible for quality control, all individuals will be held responsible for the quality of work on the job.

1.4.1 Acceptance of the Construction Quality Control (QC) Plan

Acceptance of the QC Plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications. All QC organization personnel are subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

1.4.2 Preliminary Construction Work Authorized Prior to Acceptance

The only construction work that is authorized to proceed prior to the acceptance of the QC Plan is mobilization of storage and office trailers, temporary utilities, and surveying.

1.4.3 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel, a minimum of 10 work days prior to a proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

1.5 QC ORGANIZATION

1.5.1 CQA Consultant

The Contract Quality Assurance Consultant is an Independent Quality Assurance Individual responsible for independent monitoring of the Landfill construction. The Consultant is hired by the Government to provide review of CQC plans, procedures, and testing results; observe the execution of work; inspect the partial or completed work for acceptance on behalf of the Contracting Officer; recommend or perform independent sampling and testing; and provide documented assurance to the State of North Carolina that the facility has been adequately monitored throughout construction with regard to Quality Control.

The CQA Consultant shall be an integral but independent member of the Contractor's QC Plan. The QC Manager shall be available to the CQA Consultant during normal working hours throughout construction. The CQA Consultant shall have unrestricted access to copies of all CQC Documents at all times, and shall have at least 7 days notice of all CQC meetings in order to attend.

1.5.2 QC Manager

1.5.2.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. The only duties and responsibilities of the QC Manager are to manage and implement the QC program on this Contract. The QC Manager is required to attend the partnering meetings, QC Plan Meetings, Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control except for those phases of control designated to be performed by QC Specialists, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by the QC Specialists, testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

1.5.2.2 Qualifications

An individual with a minimum of 10 years combined experience in the following positions: Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract. The individual must have at least two years experience as a

QC Manager. The individual must be familiar with the requirements of EM 385-1-1, and have experience in the areas of hazard identification, safety compliance, and sustainability.

1.5.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager must have completed the course entitled "Construction Quality Management (CQM) for Contractors." If the QC Manager does not have a current certification, they must obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

1.5.4 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager must be the same as for the QC Manager.

1.5.5 QC Specialists Duties and Qualifications

Provide a separate QC Specialist at the work site for each of the areas of responsibilities, specified in Part 3, Execution, of the technical sections, who shall assist and report to the QC Manager and who will have no duties other than their assigned quality control duties, except the QC Inspector area of responsibility for Geonet Liner, Geomembrane Liner and GCL may be the same individual. QC Specialists are required to attend the QC meetings and be physically present at the construction site to perform the three phases of control and prepare documentation for each definable feature of work in their area of responsibility at the frequency specified below.

Qualification/Experience in Area of Responsibility	Area of Responsibility	Frequency
Pavement Inspector	Potland Cement Concrete Paving	Full Time During Pavement Construction
Wastewater Pump Station Distributor	Wastewater Pump Station	Full Time During Pump Station Installation
Leachate Pump Distributor	Leachate Pump Station	Full Time During Pump Station Installation
Liner Technician QC Specialist (see Section 02 56 13)	Geomembrane Liner	During Entire Liner Installation
Liner Technician QC Specialist (see Section 31 05 20)	Geonet Liner	During Entire Liner Installation
Liner Technician QC Specialist (see Section 02 56 15	Geosynthetic Clay Liner (GCL)	During Entire Liner Installation

1.6 QUALITY CONTROL (QC) PLAN

1.6.1 Construction Quality Control (QC) Plan

1.6.1.1 Requirements

Provide, for acceptance by the Contracting Officer, a Construction QC Plan submitted in a three-ring binder that includes a table of contents, with major sections identified with tabs, and with pages numbered sequentially:

a. QC ORGANIZATION: A chart showing the QC organizational structure.

b. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format, for each person in the QC organization. Include the CQM for Contractors course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs entitled "Construction Quality Management Training" and "Alternate QC Manager Duties and Qualifications".

c. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

d. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

e. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for implementing and managing the QC program as described in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work which is not in compliance with the Contract. Letters of direction are to be issued by the QC Manager to all other QC Specialists outlining their duties, authorities, and responsibilities. Include copies of the letters in the QC Plan.

f. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving, and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval. Provide the initial submittal of the Submittal Register as specified in Section 01 33 00 SUBMITTAL PROCEDURES.

g. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs entitled "Accreditation Requirements", as applicable.

h. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test. Use Government forms to log and track tests.

i. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track, and complete rework items. Use Government forms to record and track rework items.

j. DOCUMENTATION PROCEDURES: Use Government form.

k. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task. A DFOW is identified by different trades or disciplines and is an item or activity on the construction schedule. Include in the list of DFOWs, but not be limited to, all critical path activities on the NAS. Include all activities for which this specification requires QC Specialists or specialty inspection personnel. Provide separate DFOWs in the Network Analysis Schedule for each design development stage and submittal package.

l. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL: Identify procedures used to ensure the three phases of control to manage the quality on this project. For each DFOW, a Preparatory and Initial phase checklist will be filled out during the Preparatory and Initial phase meetings. Conduct the Preparatory and Initial Phases and meetings with a view towards obtaining quality construction by planning ahead and identifying potential problems for each DFOW.

m. PERSONNEL MATRIX: Not Applicable.

n. PROCEDURES FOR COMPLETION INSPECTION: Not Applicable.

o. TRAINING PROCEDURES AND TRAINING LOG: Not Applicable.

p. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications on subcontractors, testing laboratories, suppliers, personnel, etc. QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the contract that the work is being performed.

1.7 QC PLAN MEETINGS

Prior to submission of the QC Plan, the QC Manager will meet with the Contracting Officer to discuss the QC Plan requirements of this Contract. The purpose of this meeting is to develop a mutual understanding of the QC Plan requirements prior to plan development and submission and to agree on the Contractor's list of DFOWs.

1.8 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan, and prior to the start of construction, the QC Manager will meet with the Contracting Officer to present the QC program required by this Contract. When a new QC Manager is appointed, the coordination and mutual understanding meeting shall be repeated.

1.8.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, design intent, environmental requirements and procedures, coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail how three phases of control will be implemented for each DFOW, as well as how each DFOW will be affected by each management plan or requirement as listed below:

a. Waste Management Plan.

b. Procedures for noise management.

c. Environmental Protection Plan.

d. Environmental regulatory requirements.

1.8.2 Coordination of Activities

Coordinate activities included in various sections to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation.

1.8.3 Attendees

As a minimum, the Contractor's personnel required to attend include an officer of the firm, the Project Manager, Project Superintendent, QC Manager, Alternate QC Manager, QC Specialists, Environmental Manager, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities shall have a principal of the firm at the meeting. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor and the Contracting Officer. Provide a copy of the signed minutes to all attendees and shall be included in the QC Plan.

1.9 QC MEETINGS

After the start of construction, conduct QC meetings once every two weeks by the QC Manager at the work site with the Project Superintendent, QC Specialists, and the foremen who are performing the work of the DFOWs. The QC Manager is to prepare the minutes of the meeting and provide a copy to the Contracting Officer within two working days after the meeting. The Contracting Officer may attend these meetings. As a minimum, accomplish the following at each meeting:

a. Review the minutes of the previous meeting.

b. Review the schedule and the status of work and rework.

c. Review the status of submittals.

d. Review the work to be accomplished in the next two weeks and documentation required.

e. Resolve QC and production problems (RFI, etc.).

f. Address items that may require revising the QC Plan.

g. Review Accident Prevention Plan (APP).

h. Review environmental requirements and procedures.

i. Review Waste Management Plan.

j. Review Environmental Management Plan.

k. Review the status of training completion.

1.10 THREE PHASES OF CONTROL

Adequately cover both on-site and off-site work with the Three Phases of Control and include the following for each DFOW.

1.10.1 Preparatory Phase

Notify the Contracting Officer at least two work days in advance of each preparatory phase meeting. The meeting will be conducted by the QC Manager and attended by the QC Specialists, the Project Superintendent, and the foreman responsible for the DFOW. When the DFOW will be accomplished by a subcontractor, that subcontractor's foreman shall attend the preparatory phase meeting. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFOW:

a. Review each paragraph of the applicable specification sections.

b. Review the Contract drawings.

c. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders, in order to minimize waste due to excessive materials.

d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.

e. Review the testing plan and ensure that provisions have been made to provide the required QC testing.

f. Examine the work area to ensure that the required preliminary work has been completed.

g. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

h. Arrange for the return of shipping/packaging materials, such as wood pallets, where economically feasible.

i. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data.

j. Discuss specific controls used and construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW.

k. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted.

1.10.2 Initial Phase

Notify the Contracting Officer at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the QC Specialists, the Project

Superintendent, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each DFOW:

a. Establish the quality of workmanship required.

b. Resolve conflicts.

c. Ensure that testing is performed by the approved laboratory.

d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.

1.10.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report:

a. Ensure the work is in compliance with Contract requirements.

b. Maintain the quality of workmanship required.

c. Ensure that testing is performed by the approved laboratory.

d. Ensure that rework items are being corrected.

e. Assure manufacturers representatives have performed necessary inspections if required and perform safety inspections.

1.10.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

1.10.5 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least two weeks prior to the start of the preparatory and initial phases.

1.11 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES.

1.12 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.12.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a

laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

1.12.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at http://ts.nist.gov/ts/htdocs/210/214/214.htm , the American Association of State Highway and Transportation Officials (AASHTO) program at http://www.transportation.org/aashto/home.nsf/frontpage , International Accreditation Services, Inc. (IAS) at http://www.iasonline.org, U. S. Army Corps of Engineers Materials Testing Center (MTC)at http://www.wes.army.mil/SL/MTC/, the American Association for Laboratory Accreditation (A2LA) program at http://www.a2la.org/, the Washington Association of Building Officials (WABO) at http://www.wabo.org/ (Approval authority for WABO is limited to projects within Washington State), and the Washington Area Council of Engineering Laboratories (WACEL) at http://www.wacel.org/labaccred.html (Approval authority by WACEL is limited to projects within Facilities Engineering Command (FEC) Washington geographical area).

1.12.3 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.12.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results must be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month, per the paragraph entitled "INFORMATION FOR THE CONTRACTING OFFICER".

1.12.5 Test Reports and Monthly Summary Report of Tests

Furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month. Provide a copy of the signed test reports and certifications to the OMSI preparer for inclusion into the OMSI documentation.

1.13 QC CERTIFICATIONS

1.13.1 CQC Report Certification

Contain the following statement within the CQC Report: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.13.2 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current, coordinated and attesting that the work for which payment is requested, including stored material, is in compliance with Contract requirements.

1.13.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract." Provide a copy of this final QC Certification for completion to the OMSI preparer for inclusion into the OMSI documentation.

1.14 COMPLETION INSPECTIONS

1.14.1 Punch-Out Inspection

Near the completion of all work or any increment thereof, established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QC Manager must conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings, specifications and Contract. Include in the punch list any remaining items on the "Rework Items List", which were not corrected prior to the Punch-Out Inspection. Include within the punch list the estimated date by which the deficiencies will be corrected. Provide a copy of the punch list to the Contracting Officer. The QC Manager, or staff, must make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government "Pre-Final Inspection".

1.14.2 Pre-Final Inspection

The Government and QCM will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Pre-Final Punch List" will be documented by the CQM as a result of this inspection. The QC Manager will ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the Client can be scheduled. Any items noted on the "Pre-Final" inspection must be corrected in a timely manner and be accomplished before the contract completion date for the work,or any particular increment thereof, if the project is divided into increments by separate completion dates.

1.14.3 Final Acceptance Inspection

Notify the Contracting Officer at least 14 calendar days prior to the date a final acceptance inspection can be held. State within the notice that all

items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the date of the final acceptance inspection. The Contractor must be represented by the QC Manager, the Project Superintendent, and others deemed necessary. Attendees for the Government will include the Contracting Officer, other FEAD/ROICC personnel, and personnel representing the Client. 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 entitled "Inspection of Construction."

1.15 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

1.15.1 Construction Documentation

Reports are required for each day that work is performed and must be attached to the Contractor Quality Control Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities. The forms identified under the paragraph "INFORMATION FOR THE CONTRACTING OFFICER" will be used. Reports are required for each day work is performed. Account for each calendar day throughout the life of the Contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. The reporting of work must be identified by terminology consistent with the construction schedule. In the "remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.15.2 Quality Control Validation

Establish and maintain the following in a series of three ring binders. Binders shall be divided and tabbed as shown below. These binders must be readily available to the Contracting Officer during all business hours.

a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.

b. All milestone inspections, arranged by Activity Number.

c. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.

d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.

e. An up-to-date copy of the Rework Items List.

f. Maintain up-to-date copies of all punch lists issued by the QC staff to

the Contractor and Sub-Contractors and all punch lists issued by the Government.

1.15.3 Reports from the QC Specialist(s)

Reports are required for each day that work is performed in their area of responsibility. QC Specialist reports shall include the same documentation requirements as the CQC Report for their area of responsibility. QC Specialist reports are to be prepared, signed and dated by the QC Specialists and shall be attached to the CQC Report prepared for the same day.

1.15.4 Testing Plan and Log

As tests are performed, the QC Manager will record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Contracting Officer. Attach a copy of the updated "Testing Plan and Log" to the last daily CQC Report of each month, per the paragraph "INFORMATION FOR THE CONTRACTING OFFICER". Provide a copy of the final "Testing Plan and Log" to the OMSI preparer for inclusion into the OMSI documentation.

1.15.5 Rework Items List

The QC Manager must maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to the last daily CQC Report of each month. The Contractor is responsible for including those items identified by the Contracting Officer.

1.15.6 As-Built Drawings

The QC Manager is required to ensure the as-built drawings, required by Section 01 78 00 CLOSEOUT SUBMITTALS are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. PC No., Modification No., Request for Information No., etc.). The QC Manager or QC Specialist assigned to an area of responsibility must initial each revision. Upon completion of work, the QC Manager will furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.16 NOTIFICATION ON NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected non-compliance with the Contract. 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 will be made the subject of claim for extension of time for excess costs or damages by the Contractor.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

-- End of Section --

CAPITAL IMPROVEMENTS

ENGINEERING & CONSTRUCTION Bulletin

Issue No. 2008-03 **25 September 2008** **Type: Policy**

Subject: **Acceptance Testing of Critical Systems**

Reference: (a) ECB 2007-01 Proper use of Military Construction Funds, 13 October 2006

Enclosure: (1) Roles and Responsibilities (R&R) Matrices

Cancelled: NAVFAC Instruction 12271.1: NAVFAC Total Building Commissioning Policy, dated 23 October 2003

1. Purpose.

To focus NAVFAC's technical oversight of acceptance testing during construction on five critical areas (electrical, fire and life safety, mechanical, roofing, and underwater structures) to ensure the constructed facility performs as intended and meets the needs of the supported commands; to define the use of Post Construction Award Services (PCAS) funding as it applies to the Capital Improvements Business Line (CIBL) in-house acceptance testing and technical support efforts.

2. Background.

NAVFAC has identified five critical areas that have consistently caused problems in facilities delivered to its supported commands. These areas are electrical, fire and life safety, mechanical, roofing systems, and underwater structures. These five critical areas were identified as requiring ongoing, thorough construction technical oversight in support of acceptance testing. A NAVFAC Team of technical experts determined how to apply responsible oversight to these five critical areas using one-half of PCAS funds. Each Team compiled all systems / sub-systems and developed R&R matrices (enclosure (1)). Each matrix identifies responsibilities of each of the contributors to the quality and functionality of the completed project, including the contractor, Facilities Engineering Command's (FEC) Integrated Product Team (IPT) and Facilities Engineering and Acquisition Division (FEAD) technical staff. The matrices served as the basis for determining the level of effort (man hours) to perform the technical support for acceptance testing. The following table shows the format in the R&R matrices. Each heading is provided with a description of each column's intent:

System	Sub-System	Phase	Element	Ktr QC-DOR (Project Req'ts)	FEAD (SIOH)	FEC (PCAS)
Major system grouping	Specific system	Phase of the project where it will occur	The item or task to be accomplished	What actions, if any, need to be taken by the appropriate party? (Indicates funding method)		

The contractor is still responsible for delivering a high quality and properly functioning facility via the Contractor Quality Control (CQC) program and commissioning process (including documentation and training).

3. Policy and Implementation.

The following will apply to the performance of acceptance testing for the five critical areas:

a. This applies to Military Construction (MILCON) and all Special Projects with costs over $750,000 for design-build and design-bid-build contracts.
b. The Project Manager (PM) shall manage, in coordination with the Construction Manager (CM), the project PCAS funds. The PM shall ensure that PCAS funding is used in accordance with reference (a).
c. The average funds available to support the CIBL acceptance testing in-house effort will be one-half the total PCAS funds.
d. Enclosure (1) defines the roles and responsibilities of the contractor, FEC's IPT and FEAD technical staff.
e. While the FEAD will be responsible for managing the overall construction project, the FEC's IPT will be responsible for the technical support for the acceptance testing effort associated with the five critical areas. Technical support from the FEAD can be leveraged as capabilities and resources allow, and must be coordinated between the FEC IPT and FEAD. The support for the five critical areas will be provided by engineers that have been trained and are experienced in that area.
f. The CM will manage the day-to-day coordination with the contractor and coordinate the necessary reach back to the FEC IPT for technical support for acceptance testing.
g. PCAS must be budgeted and included in the project costs. The PCAS costs must be shown in the budget estimate summary sheets (BESS) on the DD 1391.
h. The Public Works Business Line (PWBL) has agreed to designate representatives who are responsible for facility maintenance and sustainment to perform the following:
    i. Participate in the submittal review process by providing comments on submittals for the critical areas.
    ii. Be present for the final inspections and tests.
    iii. Be present for all system training.
    iv. Provide feedback and lessons learned to the FEC CI4.
i. It is recommended that the designated representatives, who are responsible for maintenance and sustainment visit the site during construction to become familiar with the building systems.
j. The efforts in paragraph 3.h above will not be funded using PCAS or supervision, inspection and overhead (SIOH).

JOSEPH E. GOTT, P.E.
Chief Engineer and Director,
Capital Improvements

Note: This ECB has been coordinated with Headquarters, U.S. Marine Corps (Code LFF).

ELECTRICAL ENGINEERING ROLES and RESPONSIBILITIES

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System	Sub-Systems	Phase	Elements	EE QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
All Systems	**Submittals & Plans**	Pre-Construction	Qualifications of Installer, Shop Drawings, Data Sheets, and Calculations (as applicable)	A	C	S
			QC Plan		A	S
			Performance Verification Plan		A	S
	Certificates & Reports	Construction	Functional Acceptance Test Procedure	A	C	S
			Preliminary Test Reports	A	RA	S
			Final Acceptance Test Reports	A	C	S
Power Generators	**Single Operation Generator Sets**	Test Preparation	Perform fuel oil piping tests	V	C	-
			Perform acceptance checks and tests	V	W	C
			Perform preliminary operations	V	W	C
		Final Test	Test all engine protective shutdown devices	V	—	W
			Test all pre-shutdown alarm devices	V	—	W
			Test crank cycle/terminate relay	V	—	W
			Test automatic and manual operations in all possible scenarios involving loss of utility, return of utility, manual starting, and emergency stop	V	—	W
			Perform load test	V	—	W
	Automatic Transfer Switches	Test Preparation	Perform acceptance checks and tests	V	W	C
		Final Test	Simulate loss of normal power	—	—	W
			Simulate return of normal power	V	—	W
			Simulate loss of emergency power	V	—	W
			Simulate all forms of single-phase conditions	V	—	W
			Verify operation of normal power voltage-sensing relays	V	—	W
			Verify engine start sequence	V	—	W
			Verify time delay upon transfer	V	—	W
			Verify operation of alternate power voltage-sensing relays	V	—	W
			Verify automatic transfer operation	V	—	W
			Verify interlocks and limit switch operation	V	—	W
			Verify time delay and retransfer upon normal power restoration	V	—	W
400-Hertz Solid State Frequency Converter	**All**	Test Preparation	Perform acceptance checks and tests	V	W	C
			Verify equipment nameplate information with specifications and approved shop drawings	V	W	—
			Inspect physical and mechanical condition	V	W	—
			Verify correct equipment grounding	V	W	—
			Perform resistance measurements through all bolted connections	V	W	—
			Perform preliminary operations	V	W	C
		Final Test	Test all control devices	V	—	W
			Test all protective shutdown devices	V	—	W
			Perform load test	V	—	W
			Perform transient tests	V	—	W
			Perform harmonic distortion tests	V	—	W
			Perform automatic line drop compensation test	V	—	W

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System	Sub-Systems	Phase	Elements	EE QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Uninterruptible Power Supply (UPS)	All	Test Preparation	Verify ventilation equipment in UPS and battery rooms are operational	V	W	—
			Verify battery cells are filled with electrolyte	V	W	—
			Verify polarity of DC connections and phase rotation of AC connections	V	W	—
			Verify AC power to all equipment	V	W	—
			Verify remote monitors and control wiring	V	W	—
			Verify UPS system and battery system is properly grounded	V	W	—
			Verify operation of emergency shower and eye wash	V	W	—
			Verify control connections between UPS and emergency engine generator signal contacts	V	W	—
			Verify control connections between UPS module and UPS maintenance bypass cabinet	V	W	—
			Perform acceptance checks and tests	V	W	C
		Final Test	Perform load tests	V	—	W
			Perform full-load burn in test	V	—	W
			Perform battery discharge test	V	—	W
			Perform battery performance test	V	—	W
			Perform UPS in conjunction with emergency generator service (if applicable)	V	—	W
Lighting	Interior Lighting	Final Test	Verify electronic dimming ballasts operatation over full range of dimming capability without any visually detectable flicker	V	W	—
			Verify occupancy sensors operation	V	W	—
			Verify lighting controls operation	V	W	—
			Verify lighting output levels	V	W	—
	Exterior Lighting	Final Test	Verify photocell aiming and operation	V	W	—
			Verify lighting controls operation	V	W	—
			Verify lighting output levels	V	W	—
Transformers	Single-Phase Pad-Mounted Transformers	Factory Routine Tests	Perform resistance measurements, polarity, ratio, no-load losses and excitation current, load losses and impedance voltage, dielectric, leak (liquid-filled), and disolved gas analysis (liquid-filled) tests	—	—	W
		Field Tests	Perform acceptance checks and tests	V	W	C
	Three-Phase Pad-Mounted Transformers	Factory Routine Tests	Perform resistance measurements, polarity, ratio, no-load losses and excitation current, load losses and impedance voltage, dielectric, leak (liquid-filled), and disolved gas analysis (liquid-filled) tests	—	—	W
		Field Tests	Perform acceptance checks and tests	V	W	C
	Secondary Unit Substations	Factory Routine Tests	Perform resistance measurements, polarity, ratio, no-load losses and excitation current, load losses and impedance voltage, and dielectric tests	—	—	W
		Field Tests	Perform acceptance checks and tests	V	W	C
	Primary Unit Substations	Factory Routine Tests	Perform resistance measurements, polarity, ratio, no-load losses and excitation current, load losses and impedance voltage, dielectric, leak (liquid-filled), and disolved gas analysis (liquid-filled) tests	—	—	W
		Field Tests	Perform acceptance checks and tests	V	W	C

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System	Sub-Systems	Phase	Elements	EE QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Switchgear/ Switchboards	**Metal-Clad Switchgear / Switchboards and Busway**	Factory Production Tests	60 Hz dielectric, mechanical operation, electrical operation and control wiring, and ground fault sensing equipment tests	—	—	W
		Test Preparation	Perform acceptance checks and tests	V	W	C
Cable	**Medium-Voltage Cable, Terminations, and Splices**	Test Preparation	Perform acceptance checks and tests	V	W	—
		Field Tests	Perform shield continuity and very low frequency (VLF) tests	V	W	—
SF6 Switch - Padmount	**Medium Voltage Pad-mounted Switches**	Factory Production Tests	60 Hz dielectric, mechanical operation, electrical operation and control wiring, and ground fault sensing equipment tests	—	—	W
		Test Preparation	Perform acceptance checks and tests	V	W	C
Airfield Lighting	**Airfield Lighting Circuits**	Field Tests	Airfield lighting circuits low voltage continuity and high voltage insulation resistance tests	V	W	—
		Field Tests	Airfield lighting circuit operating test	V	W	—
	Counterpoise	Field Tests	Counterpoise system test	V	W	—
	Constant	Field Tests	Perform open circuit protector and load tests	V	W	—
	All	Field Tests	Perform airfield lighting system operation test	V	W	—
Cathodic Protection	**Cathodic Protection by Galvanic Anodes**	Field Tests	Perform non-destructive testing of anodes	V	W	—
			Perform destructive testing of anodes	V	W	—
			Perform base potential tests, insulation joint testing, electrical continuity testing, pipe casing testing, anode-to-soil potential tests, anode output tests, protected potential measurement tests, and interference testing.	V	W	—
			Perform field operation tests.	V	—	W
	Cathodic Protection by Impressed Current	Field Tests	Perform non-destructive testing of anodes	V	W	—
			Perform destructive testing of anodes	V	W	—
			Perform base potential tests, permanent reference electrode calibration, insulation joint testing, electrical continuity testing, rectifier system testing, pipe casing testing, protected potential measurement tests, and interference testing.	V	W	—
			Perform field operation tests.	V	—	W

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FIRE PROTECTION ENGINEERING ROLES and RESPONSIBILITIES

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System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
All Systems	Required Submittals		QC Plan	—	A	S
			Performance Verification Plan	—	A	S
		Test Prep & Preliminary Certifications	Field Visit/Construction Surveillance Reports	—	S	QA
		Final Test Reports &	Final Acceptance Test Reports	A	S	QA or A
			Final Life Safety/Fire Protection Certification	—	S	A
Sprinkler Systems	Wet Pipe Sprinkler Systems	Test Preparation	Process/review system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Process/review Preliminary Test Reports & Certifications	—	RA	S
			Witness hydrostatic test.	A	C	—
			Witness flush test.	V	W	—
			Visually inspect system for adherence to plan, completeness, and adequacy of installation.	A	QA	QA
			Visually inspect pipe pentrations	A	QA	QA
			Visually inspect sprinklers for location and that they are not painted / taped.	A	QA	QA
			Visually inspect seismic bracing	A	C	QA
			Operate control valves {Other than main service entrance riser}	A	C	QA
			Visually inspect check valve installation	A	C	QA
			Visually inspect test/drain discharge locations	A	C	QA
			Witness backflow preventer forward-flow test (NFPA 13, §16.2.5).	V	W	W
			Inspect/test alarm valve assembly and water service entrance(pipe sleeves, thrust rods, etc.), including valves, flow switch & tamper switches)	V	C	W
			Inspect/test flow control valve assembly	V	C	W
	Additional requirements for Dry Pipe, Preaction - Deluge		Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Witness hydrostatic test.	A	C	—
			Witness flush test.	V	W	—
		Final Test	Verify Low-point drains are provided	V	—	QA
			Visually inspect air supply and piping	A	S	QA
			Witness backflow preventer test.	V	W	W
			Test high-low pressure air switch operation	V	—	W
			Inspect/Test deluge or dry valve riser assembly (including control valves, alarm switch & tamper switches), and functional operation	A	S	W
			Inspect/test detection and releasing system	See Fire Alarm System		

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System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Water Distribution	**Fire hydrants, distribution piping, & control valves**	Final Test	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	—
			Preliminary Test Reports & Certifications	—	RA	S
			Visually inspect all thrust blocks.	A	QA	—
			Witness hydrostatic test.	A	C	—
			Witness flush testing of hydrant	A	C	QA
			Operate all control/isolation valves (each)	V	S	QA
			Operate fire hydrants and check for proper drainage (each)	V	S	QA
	Water storage	Construction	Preliminary Test Reports & Certifications	—	RA	S
			Verify suction piping w/in tank is installed in accordance with design	A	C	S
Pumps for Fire Protection (Water & Foam)	**Pumps & Controllers**	Test Preparation	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Visually inspect system for adherence to plan, completeness, and adequacy of installation.	A	QA	QA
		Test Preparation	Witness pump controller functional tests (including automatic transfer switch operation & battery transfer as applicable).	A	QA	W
			Witness flow test to generate performance curve (pressure vs discharge, rpms, amps, shaft alignment)	V	QA	W
		Final Test	Witness automatic and manual starts & stops	V	QA	W
			Verify that controller supervisory signals are received by the fire alarm control panel	V	C	W

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System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Fire Alarm Systems	**Evacuation / Notification Detection & Releasing Systems.**	Test Preparation & Final Test	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Visually inspect system for adherence to plan, completeness, and adequacy of installation. (30,000 SQ. FT.)	A	QA	QA
			Test initiating devices for proper operation. (Activate 15% of smoke or heat detectors with no failures {30,000 sq. ft)/(625 sq. ft/ detector)(0.15)=7}	A	QA	QA
			Test initiating circuits for shorts, ground faults, and general operation	A	C	QA
			Test signaling circuits for shorts, ground faults, and general operation	A	C	QA
			Verify audible and visual devices operate properly and audible devices can be heard throughout the facility	A	C	QA
			Test peripheral devices (door hold opens, etc)	A	C	QA
			Witness functional test of the main control panel	V	C	W
			Test interface with other systems (i.e., preaction, gaseous, etc.)	V	C	W
			Test that correct signals are being sent to the base receiving station	V	C	W
			Test recall for elevators - See "Others - Elevators" {Bldg 2 stories or more}	V	S	W
			Test AHU shut down - See "Others - HVAC"	V	S	W
			Test power shut down - See "Others - {Elevators} Electrical"	V	C	W
	Control Panels used for Releasing Service		Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Test releasing circuits for shorts, ground faults, and general operation	V	C	W
			Test power shut down - See "Others - Electrical"	V	S	QA
			Test automatic closing of dampers/doors	V	S	W
	Base-Wide Fire Reporting System		Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Test transmitting devices to ensure the signals are received at the main console **{per bldg}**	V	C	W
			Test the main console for redundancy requirements	V	S	W

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FIRE PROTECTION ENGINEERING ROLES and RESPONSIBILITIES

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System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Miscelaneous Extinguishing Systems	**Gaseous Systems**	Final Test	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Visually inspect system for adherence to plan, completeness, and adequacy of installation.	A	S	QA
			Verify correct nozzles were installed	A	S	W
			Witness room pressurization test	V	S	W
			Witness full functional test to verify cylinder head functions properly and all control/interface functions operate accordingly.	V	S	W
			Inspect/test detection and releasing system	See Fire Alarm System		
	Wet Chemical & Dry Chemical Systems	Test Prep	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Verify piping and nozzles are installed in accordance with manufacturer's listing requirements	A	S	W
			Witness discharge test - ensure nozzles are bagged if discharging water in a wet chemical system	V	S	W
		Final Test	Verify alarm and supervisory signals are sent to the FACP	V	S	W
			Verify power and gas are disconnect when system activates (if applicable)	V	S	W
			Verify exhaust system either continues to run or shuts down depending on listing (if applicable)	V	S	W
	Foam Systems (All types)	Test Preparation	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Review test plan	—	C	QA
			Review the contractor's test plan for environmental and other compliance	—	S	QA
			Inspect/test detection and releasing system	See Fire Alarm System		
			Visually inspect system for adherence to plan, completeness, and adequacy of installation. Conduct functional test of entire system. Submit report.	A	QA	QA
			Verify correct foam generators / discharge devices are installed and properly piped	A	—	QA
			Verify correct size pipe and installed properly	A	—	QA
			Verify riser assembly (deluge valve) is installed properly	A	—	QA
		Final Test	Verify strainer has proper mesh	V	QA	W
		Final Test	Conduct performance test to ensure proper setting and operation of foam control valves and discharge devices. *(multiply by the number of risers)*	V	QA	W
			Conduct functional test of each generator, ratio controller, or proportioner. *(multiply by the number of risers)*	—	QA	W

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FIRE PROTECTION ENGINEERING ROLES and RESPONSIBILITIES

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System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Passive	Fire / Smoke Barriers IBC Inspections (Section 109)	Preliminary and Final Inspections	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Inspect Lath & gypsum board installation	A	QA	QA
			Inspect fire-rated / smoke wall and/or floor penetrations	A	S	QA
			Inspect wall/ceiling/roof joint	A	S	QA
			Inspect/test fire & smoke damper installation and performance	A	S	QA
			Inspect fire doors and frames	A	QA	QA
Life Safety Features	Exit Signs and Emergency Lighting	Preliminary	Verify installed locations of exit signs.	A	S	QA
			Verify installed locations of emergency lighting	A	S	QA
		Final Test	Check performance of emergency lighting systems and battery back-up.	A	S	QA
	Emergency Generators		Check to ensure all life safety features on the emergency generator are provide with power in the required amount of time	A	S	QA
Other Systems	Elevators	Test	Verify elevator re-call to primary floor	A	S	QA
			Verify elevator re-call to alternate floor	A	S	QA
			Test power disconnect upon water flow	V	S	QA
			Verify signal in elevator cab activates	V	S	QA
	Smoke Control / Exhaust Systems	Preliminary Test	Verify smoke exhaust / smoke control system activates via appropriate initiating devices (IBC §1704)	A	S	QA
			Verify location of duct detectors and for proper installation	A	S	QA
		Final Test	Perform operational test to show smoke exhaust / smoke control system functions as designed	V	S	QA
			Special Inspections for smoke control (IBC §1704) (See NFPA 92A & 92B, Chap. 8.)	A	W	W
			Perform operational test to verify detector functions properly and shuts down the correct AHU	V	S	QA
	Electrical	Pre-Test	Verify each detector associated with the electrical equipment disconnects power	A	S	QA
		Final Test	Test power disconnect for associated electronic equipment	V	S	QA

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems	**Fuel Oil - ALL**	Field Visit	**Complete System -** Verify contractor provided complete fuel oil system to the facility, including applications and permits	A	QA	—
			Piping - Verify fuel oil piping meets requirements of International Mechanical Code.	A	QA	—
			Testing - Verify oil system testing meets requirements of NFPA 31.	V	W	—
	Fuel Oil - Exterior	Submittal Process	**Piping -** Verify fuel piping is either ASTM A 53 Type E (electric-resistance welded, Grade A or B) black steel; or ASTM A 53 Type S (seamless, Grade A or B) black steel; or API SPEC 5L, seamless, submerged-arc weld or gas metal-arc weld, Grade B, black ste	A	RA	—
			Fuel Pumps - Verify fuel pumps comply with NEMA MG 1, NFPA 70, and are designed for use with hydrocarbon fuels.	A	RA	—
			Fuel Pumps - Verify fuel pumps have a working pressure of 1896 kilopascals (275 psig) at 38 degrees C (100 degrees F).	A	RA	—
			Fuel Meters - Verify fuel meters are continuous duty, positive displacement type, with electronic thermal compensation capability, suitable for outdoor installation.	A	RA	—
			Fuel Meters - Verify fuel meters are designed for use with hydrocarbon fuels and have a working pressure of 1896 kilopascals (275 psig) at 38 degrees C (100 degrees F).	A	RA	—
		Submittal Process/ Field Visit	**Storage Tanks -** Verify aboveground liquid fuel storage tanks are concrete encased or double wall in accordance with UL 142 and UL 2085 with secondary containment and leak monitoring of a capacity to meet the system requirements. Verify overfill/spill con	A	RA/ QA	S
			Dispensing Tanks - Verify Liquid fuel dispensing tanks are concrete encased or double wall in accordance with UL 142 and UL 2085 with secondary containment and leak monitoring of a capacity to meet the system requirements. Verify overfill/spill containme	A	RA/ QA	S
	Fuel Oil - Interior	Submittal Process	**Pumps -** Verify pumps that are not part of the burner assembly are positive dispacement type	A	RA	—
		Field Visit	**Oil Filter -** Verify an oil filter is provided prior to oil entering appliance or pump.	A	QA	QA
		Field Visit	**Drip Legs -** Verify drip legs are provided and properly installed prior to oil entering appliance or pump.	A	QA	—
		Submittal Process	**Storage Tanks -** Verify all storage tanks meet NFPA 31 requirements.	A	RA	—
	Natural Gas - ALL	Field Visit	**Complete System -** Verify contractor provided complete natural gas system to the facility, including applications and permits	A	QA	—
		Field Visit	**Testing -** Verify system was tested at 1.5 times maximum working pressure, but not less than 350 kPa (50 PSI) per NFPA 54	V	W	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)	**Natural Gas - Exterior (Contractor installed piping)**	Field Visit	**Piping -** Verify exterior gas piping meets requirements of local natural gas utility	A	QA	—
		Submittal Process	**Piping -** Verify piping meets requirements of ASME B31.8, Gas Transmission and Distribution Piping Systems	A	RA	—
		Submittal Process	**Piping -** Verify the natural gas piping is either ASTM A 53, Type E (electric-resistance welded, Grade A or B) black steel piping or ASTM A 53 Type S (seamless, Grade A or B) black steel piping or ASTM D 2513, Grade PE2406 or PE3408 polyethylene piping an	A	RA	—
		Field Visit	**Meter and Pressure Regulator -** Verify meter and pressure regulator are provided in accordance with local utility requirements.	A	QA	—
		Field Visit	**Piping Identification -** Verify polyethylene plastic tape manufactured specifically for warning and identifying buried utility lines are provided for non-metallic undergound piping systems	A	QA	—
	Natural Gas - Interior	Submittal Process	**Piping -** Verify interior gas piping meets requirements of NFPA 54, National Fuel Gas Code	A	RA	—
	Propane - ALL	Field Visit	**Complete System -** Verify contractor provided complete propane system to the facility, including appropriate applications and permits.	A	QA	—
	Propane - Exterior	Submittal Process	**Piping -** If piping is not provided by propane supplier, verify the propane piping is either ASTM A 53, Type E (electric-resistance welded, Grade A or B) black steel piping or ASTM A 53 Type S (seamless, Grade A or B) black steel piping or ASTM D 2513, Gr	A	RA	—
		Submittal Process	**Fittings -** Confirm Polyethylene fittings meet ASTM D 2683 for socket fittings or ASTM D 2513 for molded butt-fusion fittings	A	RA	—
		Field Visit	**Tank -** Verify propane tank capacity conforms to tank capacity submitted in shop drawings.	A	QA	—
		Submittal Process	**Tank -** If tank is not provided by propane supplier, verify propane tank material and installation comply with NFPA 58.	A	RA	—
		Submittal Process	**Tank -** If tank is not provided by propane supplier, verify propane tank is ASME labeled.	A	QA	—
		Field Visit	**Piping Identiication -** Verify polyethylene plastic tape manufactured specifically for warning and identifying buried utility lines are provided for non-metallic undergound piping systems	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)	**Propane - Interior**	Field Visit	Verify the propane installation meets the requirements specified in NFPA 58.	A	QA	—
		Submittal Process	**Piping -** Verify standard pipe dimension ratio is not more than 11.5	A	RA	—
	Steam - Exterior Underground	Submittal Process	Confirm the submission of a Certificate of Satisfactory Operation certifying that at least 3 systems installed by the piping system manufacturer within the previous 10 years have and are operating satisfactorily for not less than 5 years.	A	RA	S
		Submittal Process	Confirm the submission of a written certification by the piping system manufacturer that the distribution system installer is technically qualified and experienced in the installation of the system.	A	RA	S
		Submittal Process/ Field Visit	Verify underground steam and condensate piping in separate conduits is direct buried, factory pre-fabricated, pre-insulated, and consist of a steel service pipe with polyurethane insulation and a high-density polyethylene (HDPE) jacket.	A	RA/ QA	—
		Submittal Process/ Field Visit	Confirm piping system fittings and components are factory fabricated and no field insulated fittings are provided.	A	RA/ QA	—
		Field Visit	Verify asbestos cement or plastic conduit piping is not provided.	A	QA	—
		Field Visit	**Piping Insulation -** Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Submittal Process	**Isolation Valves -** Verify ASME class 150 isolation valves are provided in manholes for system supply and return lines at take-offs for service to each building .	A	QA	—
		Submittal Process/ Field Visit	**Expansion Loops -** Verify expansion loops are utilized to compensate for piping expansion.	A	RA/ QA	S
		Submittal Process/ Field Visit	**Expansion Anchors -** Verify piping expansion anchors are located outside manholes.	A	RA/ QA	—
		Field Visit	**Manholes -** Verify system manholes are constructed of reinforced, 206.8 bar (3000 psi) concrete. Verify manhole floor and sides are watertight and were made in one monolithic pour. Verify manhole top extends a minimum of 300 mm (6 inches) above grade. V	A	QA	—
		Submittal Process	Verify a sump pit and a vertical sump pump designed for an operating temperature design of 93 degrees C (195 degrees F) minimum are provided in each system manhole.	A	RA	—
		Submittal Process	**Sump Pump - Float Control -** Verify a 2-pole float control is provided for each manhole sump pump.	A	RA	—
		Submittal Process/ Field Visit	**Valves -** For system valves located outside of manholes, verify a cast-iron or ductile-iron valve box and cover of a suitable size are provided. Verify the box cover has the word(s) describing the utility cast on the cover.	A	RA/ QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)	**Steam - Exterior Aboveground**	Submittal Process	**Piping -** Verify steam piping is either ASTM A 53 Type E (electric-resistance welded, Grade A or B) black steel pipe or ASTM A 53 Type S (seamless, Grade A or B) black steel pipe or, for pipe sizes through 250 mm (9 inches), ASTM A 106 (Grade A or B) black	A	RA	—
		Submittal Process	**Piping -** Verify condensate piping is either ASTM A 53 Type E (electric-resistance welded, Grade A or B) black steel, Weight Class XS (Extra Strong); or ASTM A 53 Type S (seamless, Grade A or B) black steel, Weight Class XS (Extra Strong); or ASTM A 106, G	A	RA	—
		Field Visit	**Piping Insulation -** Verify piping insulation is either fibrous glass, calcium silicate, or cellular glass as indicated in submitted shop drawings. Verify pipe insulation matches existing or surrounding insulation if applicable.	A	QA	—
		Field Visit	**Piping Insulation -** Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Field Visit	**Insulation -** Verify insulation is covered with an with aluminum jacket painted to conform with the Base Architectural Plan.	A	QA	—
		Submittal Process/ Field Visit	Verify the use of either MSS SP-58 or MSS SP-69 adjustable supports with insulation protection saddles. Verify roller supports utilize stainless steel axles.	A	RA/ QA	—
		Field Visit	**Support Poles -** Verify support poles are installed with guy wires and necessary hardware.	A	QA	—
		Submittal Process/ Field Visit	**Pipe Expansion -** Verify pipe expansion is compensated by utilizing either expansion loops, guided sliexpansion joints, or flexible ball type expansion joints.	A	RA/ QA	S
	Steam - Interior	Submittal Process	**Steam piping** - Verify is ASTM A106 or A53, Grade B, Schedule 40, black steel, electric-resistance welded or seamless	A	RA	—
		Submittal Process/ Field Visit	**Steam piping** - Verify insulated with mineral fiber or cellular glass insulation with all-purpose jacket	A	RA/ QA	—
		Submittal Process	**Condensate return piping** - Verify is ASTM A106 or ASTM A53, Grade B, Schedule 80, black steel, electric-resistance welded or seamless	A	RA	—
		Submittal Process/ Field Visit	**Condensate return piping** - Verify insulated with mineral fiber or cellular glass insulation with all-purpose jacket	A	RA/ QA	—
		Submittal Process	**Steel pipe fittings** - For piping 50 mm (2 inch) and smaller, verify is ANSI/ASME B16.3 malleable iron screwed fittings or ASME B16.11 socket welding (Class 3000) or ASME B16.11 threaded type (Class 2000)	A	RA	—
		Submittal Process	**Steel pipe fittings** - For piping 63 mm (2-1/2 inch) and larger, verify is ANSI/ASME B16.9 butt-welding fittings or ANSI/ASME B16.5 flanged type	A	RA	—
		Field Visit	**Steam pressure reducing station -** Verify provided for each building	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
nergy Supply Systems (continued)		Submittal Process/ Field Visit	**Steam traps** - Verify steam traps and accessories are in accordance with UFC 3-400-10N	A	RA/ QA	—
		Field Visit	Verify all valves, traps, and PRV's are accessible for service & maintenance	A	QA	—
	Hot Water - Exterior Underground	Submittal Process/ Field Visit	**Piping -** Verify underground hot water supply & return piping in separate conduits is direct buried, factory pre-fabricated, pre-insulated, and consist of a steel service pipe with polyurethane insulation and a high-density polyethylene (HDPE) jacket.	A	RA/ QA	—
		Submittal Process/ Field Visit	Confirm piping system fittings and components are factory fabricated and no field insulated fittings are provided.	A	RA/ QA	—
		Field Visit	Verify asbestos cement or plastic conduit piping is not provided.	A	QA	—
		Submittal Process	The UHDS representative shall be certified in writing by the UHDS manufacturer to be technically qualified and experienced in the installation of the system. Provide a Certificate of Satisfactory Operation certifying that at least 3 systems installed by	A	QA	S
		Field Visit	**Piping Insulation -** Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Submittal Process/ Field Visit	**Isolation Valves -** Verify ASME class 150 isolation valves are provided in manholes for system supply and return lines at take-offs for service to each building .	A	RA/ QA	—
		Submittal Process/ Field Visit	**Expansion Loops -** Verify expansion loops are utilized to compensate for piping expansion.	A	RA/ QA	S
		Submittal Process/ Field Visit	**Manholes -** Verify system manholes are constructed of reinforced, 206.8 bar (3000 psi) concrete. Verify manhole floor and sides are watertight and were made in one monolithic pour. Verify manhole top extends a minimum of 300 mm (6 inches) above grade. V	A	RA/ QA	—
		Submittal Process	Verify a sump pit and a vertical sump pump designed for an operating temperature design of 93 degrees C (195 degrees F) minimum are provided in each system manhole.	A	RA	—
		Submittal Process	**Sump Pump - Float Control -** Verify a 2-pole float control is provided for each manhole sump pump.	A	RA	—
		Submittal Process/ Field Visit	**Valves -** For system valves located outside of manholes, verify a cast-iron or ductile-iron valve box and cover of a suitable size are provided. Verify the box cover has the word(s) describing the utility cast on the cover.	A	RA/ QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
En	**Hot Water - Exterior Aboveground**	Submittal Process	**Piping -** Verify hot water piping is either ASTM A 53 Type E (electric-resistance welded, Grade A or B) black steel, Weight Class XS (Extra Strong); or ASTM A 53 Type S (seamless, Grade A or B) black steel, Weight Class XS (Extra Strong); or ASTM A 106, Gr	A	RA	—
		Field Visit	**Piping Insulation -** Verify piping insulation is either fibrous glass, calcium silicate, or cellular glass as indicated in submitted shop drawings.	A	QA	—
		Field Visit	**Piping Insulation -** Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Field Visit	**Insulation -** Verify insulation is covered with an with aluminum jacket painted to conform with the Base Architectural Plan.	A	QA	—
		Submittal Process/ Field Visit	**Pipe Expansion -** Verify pipe expansion is compensated by utilizing either expansion loops, guided slip expansion joints, or flexible ball type expansion joints.	A	RA/ QA	S
		Submittal Process/ Field Visit	Verify the use of either MSS SP-58 or MSS SP-69 adjustable supports with insulation protection saddles. Verify roller supports utilize stainless steel axles.	A	RA/ QA	—
		Field Visit	**Support Poles -** Verify support poles are installed with guy wires and necessary hardware.	A	QA	—
	Hot Water - Interior	Submittal Process	**Piping -** Verify hot water piping is electric resistance, welded or seamless, schedule 40, black steel pipe conforming to ASTM A53. Piping 100mm (4 inch) and smaller may be ASTM B 88 Type K or L copper.	A	RA	—
		Submittal Process	**Steel fittings - For piping 50mm (2 inch) and smaller**, verify provided ANSI/ASME B16.3 malleable iron screwed fittings **OR** ASME B16.11 socket welding (Class 3000) fittings OR ASME B16.11 threaded type (Class 2000)	A	RA	—
		Submittal Process	**Steel fittings - For piping 63 mm (2-1/2 inch) and larger**, verify provided ANSI/ASME B16.9 butt-welding fittings **OR** ANSI/ASME B16.5 flanged type	A	RA	—
		Submittal Process	**Copper fittings -** Verify ANSI B16.18 cast bronze solder joint type or ASME/ANSI B16.22 wrought copper solder joint type	A	RA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)		Submittal Process/ Field Visit	**Insulation -** Verify hot water piping insulated with mineral fiber insulation with factory-applied all-purpose jacket	A	RA/ QA	—
		Field Visit	**Isolation valves** - Verify equipment provided with isolation valves for service and repairs	A	QA	—
		Submittal Process/ Field Visit	**Valves -** Verify appropriately sized	A	RA/ QA	—
		Submittal Process/ Field Visit	**Balancing valves -** Verify provided and appropriately sized to balance water flow	A	RA/ QA	QA
		Field Visit	**Appurtenances -** Verify provided (such as air separators, expansion tanks, suction diffusers, strainers, etc)	A	QA	—
		Field Visit	**Test ports -** Verify provided in piping at inlet and outlet of all major system components including boilers, pumps, etc)	A	QA	QA
		Field Visit	Verify all valves and test ports are accessible for service and maintenance	A	QA	—
	Chilled Water & Condenser Water - Exterior Underground	Submittal Process	Verify system provided is direct buried, factory-prefabricated, pre-insulated, chilled water piping systems. Verify all fittings and accessories are designed and factory-fabricated to prevent moisture from entering into the system by manufacturer.	A	RA	S
		Field Visit	Verify backfill and overall installation meets the requirements of the piping system manufacturer.	A	QA	—
		Field Visit	**Isolation Valves -** Verify supply and return line isolation valves are provided at take-offs for service to each building in valve boxes.	A	QA	—
		Submittal Process/ Field Visit	Verify expansion loops are provided to compensate for piping expansion. Verify anchors are provided outside manholes.	A	RA/ QA	S
	Chilled Water & Condenser Water - Exterior Aboveground	Submittal Process	**Piping -** Verify chilled and condenser water piping are either electric resistance welded or seamless Schedule 40 black steel pipe conforming to ASTM A 53 or, for piping 100 mm (4 inch) and smaller, ASTM B 88 Type K or L copper.	A	RA	—
		Submittal Process	If steel piping is used, verify for piping 50 mm (2 inch) and smaller, ANSI/ASME B16.3 malleable iron screwed fittings or ASME B16.11 socket welding (Class 3000) or threaded type (Class 2000) fittings are provided. For piping 63 mm (2-1/2 inch) and large	A	RA	—
		Submittal Process	If copper piping is used, verify ANSI B16.18 cast bronze solder joint fittings or ASME/ANSI B16.22 wrought copper solder joint fittings are provided.	A	RA	—
		Submittal Process/ Field Visit	**Piping Insulation -** Verify piping insulation is either Mineral fiber, Urethane, cellular glass, Faced Phenolic Foam, or Flexible Cellular pipe insulation as indicated in submitted shop drawings.	A	RA/ QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)		Field Visit	**Piping Insulation -** Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Field Visit	**Piping Insulation -** Verify piping insulation is covered with an aluminum jacket.	A	QA	—
		Submittal Process/ Field Visit	Verify the use of either MSS SP-58 or MSS SP-69 adjustable supports with insulation protection saddles. Verify roller supports utilize stainless steel axles.	A	RA/ QA	—
		Field Visit	**Support Poles -** Verify support poles are installed with guy wires and necessary hardware.	A	QA	—
		Submittal Process/ Field Visit	**Pipe Expansion -** Verify pipe expansion is compensated by utilizing either expansion loops, guided slip expansion joints, or flexible ball type expansion joints.	A	RA/ QA	S
	Chilled Water & Condenser Water - Interior	Submittal Process	**Aboveground chilled & condenser water piping -** Verify aboveground chilled water piping is electric resistance welded or seamless schedule 40 black steel pipe conforming to ASTM A 53. Piping 100mm (4 inch) and smaller may be ASTM B 88 Type K or L copper.	A	RA	—
		Submittal Process	**Steel pipe fittings - For piping 50mm (2 inch) and smaller -** Verify provided ANSI/ASME B16.3 malleable iron screwed fittings or ASME B16.11 socket welding (Class 3000) or threaded type (Class 2000).	A	RA	—
		Submittal Process	**Steel pipe fittings - For piping 63mm (2-1/2 inch) and larger -** Verify provided ASME/ANSI B16.9 butt-welding fittings or ASME/ANSI B16.5 flanged type.	A	RA	—
		Submittal Process	**Steel pipe fittings -** Grooved joint pipe coupling systems of appropriate pressure rating are acceptable in lieu of welded or screwed fittings	A	RA	—
		Submittal Process	**Copper fittings -** Verify provided ANSI B16.18 cast bronze solder joint type or ASME/ANSI B16.22 wrought copper solder joint type	A	RA	—
		Field Visit	**Isolation valves -** Verify isolation valves provided on supply and return lines at take-offs for service to each building	A	QA	—
		Field Visit	**Isolation valves -** Verify isolation valves located in valve boxes	A	QA	—
		Submittal Process/ Field Visit	**Insulation -** Verify above-ground chilled water piping insulated with cellular glass insulation. Flexible unicellular insulation may be used on small piping runouts.	A	RA/ QA	—
		Submittal Process/ Field Visit	**Insulation -** Verify above-ground condenser water piping insulated with mineral fiber insulation	A	RA/ QA	—
		Submittal Process/ Field Visit	**Insulation -** Verify all-purpose jacket with vapor retarder provided for above-ground chilled water and condenser piping	A	RA/ QA	—
		Submittal Process/ Field Visit	**Valves -** Verify appropriately sized	A	RA/ QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (conti		Submittal Process/ Field Visit	**Balancing valves -** Verify provided and appropriately sized to balance water flow	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Relief valves -** Verify provided and appropriately sized	A	RA/ QA	—
		Field Visit	**Test ports -** Verify test ports provided inpiping at inlet and outlet of all major system components including chillers, pumps, etc	A	QA	QA
		Field Visit	Verify all valves and test ports are accessible for service and maintenance	A	QA	—
	AHU's - ALL	Field Visit	**DDC Sensors -** Confirm location of DDC sensors (temp, SP, Freeze, High pressure SP, AFM), if required	A	QA	QA
		Field Visit	**Smoke Detectors -** Confirm location of smoke detectors (if over 2000 cfm)	A	QA	QA
		Field Visit	**Testing - Filters -** Confirm filters are clean prior to testing	A	QA	QA
		Field Visit	**Filters -** Confirm filters are installed	—	—	—
		Field Visit	**Belts -** Confirm belt tightness and alignment	A	QA	QA
		Field Visit	**Coils -** Confirm all coils are clean	A	QA	QA
		Field Visit	**Vibration Isolators -** Confirm vibration isolators installed according to contract docs and unit secured	A	QA	QA
		Field Visit	**Damper -** Confirm damper operation and assembly tightness	A	QA	QA
		Field Visit	**Motor -** Confirm motor size (HP), voltage, amperage, and rpm	A	QA	QA
		Submittal Process	**Fans -** Verify provided have AMCA 210 certified fans with AMCA seal	A	QA	—
		Field Visit	**Fans -** Confirm fan rpm and rotation direction	A	QA	QA
		Field Visit	**OA Intake Plenum -** Confirm OA intake plenum configuration provides for drainage	A	QA	QA
		Field Visit	**AFM -** Confirm air flow monitoring station location in conformance with manufacturer requirements	A	QA	QA
		Field Visit	**Size -** Confirm unit matches schedule req	A	QA	QA
		Submittal Process/ Field Visit	**Fan bearings -** Verify fan bearings were greased (if req) and have min average life of 200,000 hours at design operating conditions	A	RA/ QA	—
		Field Visit	**Birdscreens -** Verify birdscreens provided for outdoor inlets and outlets	A	QA	QA
		Field Visit	Verify all filter and access doors are accessible for service and maintenance	A	QA	—
		Field Visit	Verify provided are modular construction, double wall AHU's with min of 25mm (1 inch) casing insulation	A	QA	—
		Submittal Process	Verify provided have ARI 430 certified fans and ARI certified coils	A	RA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process/ Field Visit	**Drain pan -** Verify provided has stainless steel, positive draining condensate drain pan	A	RA/ QA	—
		Submittal Process	**For 100% OA units -** Verify capability provided for cooling, heating, dehumidification, and reheat	A	RA	—
		Submittal Process/ Field Visit	**Ultraviolet disinfection system -** Verify central station ahu's provided with an ultraviolet c-band (UVC) disinfection system for mold, bacteria, and odor control in each air handler that has a chilled water or DX cooling coil	A	RA/ QA	—
		Submittal Process/ Field Visit	**Ultraviolet disinfection system -** Verify irradiation emitters and fixtures installed in sufficient quantity and in such an arrangement so as to provide an equal distribution of UVC energy on the coil and in the drain pan	A	RA/ QA	—
		Submittal Process/ Field Visit	**Ultraviolet disinfection system -** Verify the UVC energy produced has the lowest possible reflected and shadowed losses (To maintain energy efficiency)	A	RA/ QA	—
		Submittal Process/ Field Visit	**Ultraviolet disinfection system -** For energy efficiency, verify power supplies are of the high efficiency electronic type and matched to the emitter	A	RA/ QA	—
		Submittal Process/ Field Visit	**Ultraviolet disinfection system -** For intensity, verify the minimal UVC energy striking the leading edge (if nstalled upstream) or trailing edge (if installed downstream) of all the coil fins is not less than 820 uW/cm2 at the closest point and through pl	A	RA/ QA	—
		Submittal Process/ Field Visit	**Ultraviolet disinfection system -** Verify equal amounts strike the drain pan, either directly or indirectly through reflection	A	RA/ QA	—
		Submittal Process/ Field Visit	**Ultraviolet disinfection system -** For installation, verify emitters and fixtures are installed at right angles to the conforming lines of the coil fins, such that through incident angle reflection, UVC energy bathes all surfaces of the coil and drain pan	A	RA/ QA	—
		Submittal Process/ Field Visit	**Ultraviolet disinfection system -** Verify one complete set of spare bulbs supplied	A	RA/ QA	—
	AHU's - Split System	Submittal Process	Verify provided is factory assembled, packaged AHU rated in accordance with ARI 210/240 or ARI 340/360	A	RA	—
		Field Visit	Verify matching components provided are from the same manufacturer	A	QA	—
	AHU's - Rooftop	Submittal Process/ Field Visit	Verify provided is factory packaged unit in accordance with ARI 430 and suitable for outdoor installation	A	RA/ QA	—
		Field Visit	**Roof Curb -** Verify provided with manufacturer's roof curb	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
nent & Components (continued)	**Roof Curbs**	Field Visit	**Mounting Surface -** Confirm fan or unit mounting surface is parallel to the horizon, not the roof deck if sloped	A	QA	—
		Field Visit	**Waterproofing -** Confirm curb has been flashed properly and seal to the roofing material (no leaks) (waterproofing)	A	QA	—
		Field Visit	**Lightning Rods -** Confirm lightning rods have been attached to units and run to ground	A	QA	—
		Field Visit	**Insulation -** Confirm roof curb is insulated	A	QA	—
		Field Visit	**Size -** Confirm curb is the same size or smaller as the unit being placed on it (tight fit)	A	QA	—
	Fans - ALL	Submittal Process/ Field Visit	Verify fans are AMCA 210 certified with AMCA seal	A	RA/ QA	—
		Submittal Process	**Fan bearings -** Verify fan bearings have min average life of 200,000 hours at design operating conditions	A	RA	—
		Field Visit	**Rotation -** Confirm rotation and alignment	A	QA	QA
		Field Visit	**Belts -** Confirm belt tightness (if provided)	A	QA	QA
		Field Visit	**Motor -** Confirm HP, voltage, amperage	A	QA	QA
		Field Visit	**Size -** Confirm size matches schedule req	A	QA	QA
		Field Visit	Verify fans are accessible for service and maintenance	A	QA	
		Field Visit	**Birdscreens -** Verify bird screens provided for outdoor inlets and outlets	A	QA	QA
		Field Visit	**DDC -** Verify fans provided with means for verifying operation via DDC system	A	QA	QA
	Exhaust Fans (Roof)	Field Visit	**Roof Curb -** Confirm lag bolted to roof curb	A	QA	QA
		Field Visit	**Dome Top -** Confirm dome top is secured	A	QA	QA
		Field Visit	**Type -** Verify centrifugal fans provided	A	QA	
	In-line Fans	Field Visit	**Vibration Isolators -** Confirm hangers & isolation devices	A	QA	QA
		Field Visit	**Flex Connection -** Confirm flexible connection to ductwork	A	QA	QA
		Field Visit	**Speed Controller -** Confirm speed controller installation (if provided)	A	QA	QA
		Field Visit	**Access Panel -** Confirm access panel located properly	A	QA	QA
		Field Visit	**Type -** Verify centrifugal fans provided	A	QA	—
	Wall Fans	Field Visit	**Type -** Verify wall fans provided are propeller fans with fan guards	A	QA	—
		Field Visit	**Type -** Verify wall fans provided are centrifugal fans with backdraft dampers and wall bracket	A	QA	—
	Bathroom Fan	Submittal Process/ Field Visit	Verify provided are UL 507 and UL-Listed, Home Ventilating Institute (HVI) certified, and with AMCA seal for ceiling installation	A	RA/ QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipm	**Range Hoods**	Submittal Process/ Field Visit	Verify provided are UL 507 and UL-Listed, with AMCA seal	A	RA/ QA	—
		Submittal Process/ Field Visit	**Light -** Verify provided with light over stove	A	RA/ QA	—
		Submittal Process	Verify min fan capacity is 160 cfm with max sound level of 5.6 sones	A	RA	—
	Louvers & Hoods - ALL	Submittal Process	**Louver rating** - Verify louvers bear AMCA ratings seal for air performance and water penetration in accordance with AMCA 500 and AMCA 511	A	RA	—
		Submittal Process/ Field Visit	**Construction** - Verify hoods and louvers constructed of anodized aluminum alloy or stainless steel	A	RA/ QA	
		Submittal Process/ Field Visit	**Birdscreens** - Verify provided for louvers and hoods	A	RA/ QA	QA
	Intake Hood (Roof)	Submittal Process/ Field Visit	**Type -** Confirm type as specified	A	RA/ QA	QA
		Field Visit	Confirm top is secured	A	QA	QA
		Submittal Process/ Field Visit	**Size -** Confirm size matches schedule req (free area)	A	RA/ QA	QA
	OA Intake Louvers (Wall)	Submittal Process/ Field Visit	**Type -** Confirm type as specified	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Size -** Confirm size matches schedule req (free area)	A	RA/ QA	QA
		Submittal Process/ Field Visit	Confirm waterproof (when req) and velocity when water carry-over occurs	A	RA/ QA	QA
		Field Visit	**Intake Plenum -** Confirm intake plenum is sloped back to louver or drain has been provided	A	QA	QA
		Field Visit	**Damper -** Confirm opposed blade damper with actuator has been provided	A	QA	QA
		Field Visit	**AFM -** Confirm air flow monitoring type louver has been provided, if req	A	QA	QA

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)	**Ductwork**	Field Visit	**Construction -** Except as specified herein, verify ductwork constructed, braced, reinforced, installed, supported, and sealed per SMACNA standards	A	QA	QA
		Field Visit	Verify all dampers are accessible for service and maintenance	A	QA	—
		Field Visit	Confirm general construction conforms to contract documents	A	QA	QA
		Field Visit	Confirm correct pressure rating of ductwork has been conformed to SMACNA	A	QA	QA
		Field Visit	Confirm ductwork has been sealed in accordance with specified seal class	A	QA	QA
		Field Visit	**VAV inlet -** Confirm minimum straight duct is 6 duct diameters and same size as VAV terminal inlet	A	QA	QA
		Field Visit	Confirm DALT allowables are met	A	QA	QA
		Submittal Process/ Field Visit	**Access Doors -** Confirm access doors have been provided before every elbow with turning vanes	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Access Doors -** Confirm access doors provided at appropriate locations	A	RA/ QA	QA
		Field Visit	**Flexible duct** - Verify insulated flexible duct used only to adapt to minor offsets for connections to air distribution devices	A	QA	QA
		Submittal Process	**Flexible duct** - Verify is UL 181 listed and per SMACNA DCS with minimum R value of 4	A	RA	—
		Field Visit	**Flexible duct** - Verify maximum length is 2 meters (6 feet)	A	QA	QA
		Field Visit	**Flexible Duct -** Confirm, where flexible ductwork is specified, that the length of flex ductwork is provided to the max req length or less and is supported properly with no abrupt turns (ie: as straight as possible)	A	QA	QA
		Field Visit	**Flexible connectors** - Verify provided between fans and ducts	A	QA	QA
		Submittal Process/ Field Visit	**Damper -** Confirm balancing damper at branch take-off's, not at diffuser neck	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Damper -** Confirm balancing damper construction conforms to the specified seal class	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Damper -** Confirm discharge damper installed on VAV terminal discharge, if req	A	RA/ QA	QA
		Field Visit	**Damper -** Confirm control damper type and location along with actuator type	A	QA	QA
		Submittal Process	**Dampers** - Verify conforms to SMACNA DCS	A	RA	—
		Submittal Process	**Fire dampers** - Verify are rated per UL 555	A	RA	—
		Submittal Process	**Fire dampers** - Verify are dynamic type rated for closure against a moving airstream	A	RA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
ent & Components (continued)		Submittal Process/ Field Visit	**Fire dampers** - Verify do not intrude into air stream when in open position	A	RA/ QA	—
		Submittal Process	**Smoke dampers** - Verify are rated per UL 555S	A	RA	—
		Submittal Process/ Field Visit	**Elbows** - Confirm correct elbow type (ie: double wall turning vane, 1.5 radius curved, etc)	A	RA/ QA	QA
		Field Visit	**Bracing** - Confirm proper bracing of high pressure ductwork in accordance with SMACNA	A	QA	QA
		Field Visit	**Filters** - Confirm access to filter rack for ease of filter change out in duct mounted assemblies	A	QA	QA
		Submittal Process/ Field Visit	**Insulation** - Confirm ductwork insulated properly (ext batt, hard, int lined, double wall insulated, etc)	A	RA/ QA	QA
		Field Visit	**Insulation** - Inspect vapor barrier of insulation	A	QA	—
		Field Visit	**Hangers** - Confirm proper duct hangers have been utilized in accordance with spec req	A	QA	QA
		Field Visit	**Vibration Isolators** - Confirm the use of vibration isolation material at unit connection to ductwork free of holes (no leakage)	A	QA	QA
		Submittal Process	**Sound attenuators** - Verify fabricated sound attenuators reduces the rated sound pressure level of the fan down to at least 65 decibels in the 250 Hz (third octave band) center frequency by using a reference sound source calibrated in decibels of sound pow	A	RA	—
		Submittal Process/ Field Visit	**Sound attenuators** - Verify pressure drop does not exceed 157 Pa (0.63 inch of water)	A	RA/ QA	QA
	VAV Boxes - ALL	Submittal Process	Verify units are pressure-independent type and rated per ARI 880	A	QA	—
		Field Visit	**Primary air valve** - Verify not allowed to fully shut-off	A	QA	QA
		Field Visit	**Heating coil** - Verify each box provided with heating coil unless not required by space reheat or heating	A	QA	—
		Field Visit	Verify all VAV box control panels are accessible	A	QA	
		Field Visit	**Electronic controls** - Verify are provided	A	QA	QA
	VAV Terminal Box (Fan-Powered)	Submittal Process	**Type** - Verify units are pressure-independent, fan powered, rated per ARI 880, and UL listed	A	QA	—
		Field Visit	**Filters** - Confirm filter installed and clean	A	QA	QA
		Field Visit	Confirm ductwork on primary inlet is installed with 6 straight duct diameters the same size as the inlet	A	QA	QA
		Submittal Process/ Field Visit	**Dampers** - Confirm discharge damper has been provided and/or coordinated with sheet metal contractor	A	QA	QA
		Field Visit	Confirm fan size & primary inlet sized in accordance with contract documents	A	QA	—
		Field Visit	**Primary Air Valve** - Confirm max/min setting of primary air valve	A	QA	QA
		Field Visit	**Primary air valve** - Verify not allowed to fully shut-off	A	QA	QA

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment		Field Visit	**Size** - Confirm size matches schedule req	A	QA	QA
		Field Visit	**Motor** - Confirm HP, voltage, and amperage of fan motor	A	QA	QA
		Field Visit	**Heating coil** - Verify each box provided with heating coil, if required	A	QA	—
		Field Visit	**Reheat Coils** - Confirm reheat coil size, if req	A	QA	—
		Field Visit	**Reheat Coils** - Confirm reheat coil is piped properly	A	QA	QA
		Field Visit	**Sensors** - Confirm discharge temp sensor provided, if req	A	QA	QA
		Field Visit	Confirm hangers have provisions for vibration isolation	A	QA	QA
		Field Visit	**Electronic controls** - Verify provided with speed controller, discharge volume control damper(s), and return/recirculation air frame and filter	A	QA	QA
		Submittal Process	**Insulation** - Verify in accordance with ASHRAE 90.1	A	RA	—
	VAV Terminal Box (Shut Off)	Field Visit	Confirm ductwork on primary inlet is installed with 6 straight duct diameters the same size as the inlet	A	QA	QA
		Field Visit	**Primary Air Valve** - Confirm max and min setting of primary air valve	A	QA	QA
		Field Visit	**Reheat Coils** - Confirm reheat coil size, if req	A	QA	
		Field Visit	**Reheat Coils** - Confirm reheat coil in piping properly	A	QA	QA
		Field Visit	**Sensors** - Confirm discharge temp sensor provided, if req	A	QA	QA
		Field Visit	Confirm hangers have provisions for vibration isolation	A	QA	QA
		Field Visit	**Size** - Confirm box size matches schedule req	A	QA	QA
	DX VAV Units	Submittal Process	**Finish** - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	QA	—
		Submittal Process/ Field Visit	**Direct expansion equipment** - Verify is specifically designed and manufactured for VAV applications	A	RA/ QA	—
		Submittal Process/ Field Visit	**Equipment** - Verify from the same manufacturer (central air handling units, VAV boxes/ zone dampers, and zone controls)	A	RA/ QA	—
		Field Visit	**Evaporator coils** - Verify airflow through evaporator coils is not modulated	A	QA	—
		Field Visit	**Zone control damper units** - Verify duct mounted zone control damper units provided with integral control box designed for use with DX VAV packaged systems	A	QA	—
		Submittal Process/ Field Visit	**Air diffusers** - Verify self-modulating air diffusers are not used	A	RA/ QA	—
	Condensing Units	Submittal Process/ Field Visit	**Finish** - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	—
		Submittal Process	**Air conditioner** - Verify air-cooled, split system air conditioner provided with ducted air distribution	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process	**Construction and rating** - Verify units are factory assembled, designed, tested, and rated in accordance with ARI 210/ 240 or ARI 340/ 360	A	QA	—
		Submittal Process/ Field Visit	**Clearance** - Verify manufacturer's minimum recommended clearance around condensing units is provided	A	RA/ QA	QA
		Field Visit	**Refrigerant piping size** - Verify is per manufacturer's recommendations	A	QA	—
	Heat Pumps - Ground Source	Submittal Process/ Field Visit	**Finish** - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	—
		Submittal Process	**Construction and rating** - Verify units are factory assembled, designed, tested, and rated in accordance with ARI 330	A	QA	—
		Submittal Process	**Heat exchanger** - Verify connected to heat exchanger by closed loop ground source vertical well field	A	RA	—
		Submittal Process/ Field Visit	**Well field** - Verify design and installation of each well field comply with IGSHPA and ASHRAE standards	A	RA/ QA	—
	Heat Pumps - Water Source	Submittal Process/ Field Visit	**Finish** - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	—
		Submittal Process	**Construction and rating** - Verify units are factory assembled, designed, tested, and rated in accordance with ARI 210/ 240 or ARI 340/ 360	A	QA	—
	Heat Pumps - Air to Air	Submittal Process/ Field Visit	**Finish** - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	—
		Submittal Process	**Heat pumps** - Verify air-cooled, split system heat pumps provided with ducted air distribution	A	RA/ QA	—
		Submittal Process	**Construction and rating** - Verify units are factory assembled, designed, tested, and rated in accordance with ARI 210/ 240 or ARI 340/ 360	A	QA	QA
		Field Visit	**Clearance** - Verify manufacturer's minimum recommended clearance around condensing units is provided	A	QA	—
		Field Visit	**Refrigerant piping size** - Verify is per manufacturer's recommendations	A	QA	QA
		Field Visit	**Insulation** - Verify provided for refrigerant piping suction lines and condensate drain	A	QA	—
	Condensate Return Units	Submittal Process/ Field Visit	Verify has floor-mounted receiver and duplex pump unit	A	RA/ QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)	**Equipment Thermal Insulation**	Submittal Process/ Field Visit	**Insulation** - Verify insulation provided for hot and chilled water pumps and equipment as suitable for the temperature and service fit as closely as possible to equipment. May be rigid block, semi-rigid board, or flexible unicellular insulation.	A	RA/ QA	QA
			Vapor retarder - Verify provided for chilled water applications	A	QA	—
	Auxilliary Equipment	Submittal Process/ Field Visit	**Steam-to-hot-water converter** - Verify provided as required for application	A	RA/ QA	—
		Submittal Process	**Heat exchangers** - Verify factory assembled u-tube units provided constructed in accordance with ASME BPVC for steam or hot water. For hot water, plate type heat exchangers may be provided.	A	RA	—
	Furnaces	Submittal Process/ Field Visit	**Construction** - Confirm provided furnace is UL-listed, factory assembled, self-contained, and forced circulation	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Electronic ignition system** - Verify provided	A	RA/ QA	—
		Submittal Process/ Field Visit	**Gas furnace rating** - Confirm unit is design certified by AGA and GAMA efficiency rating certified for gas furnaces.	A	RA/ QA	—
		Submittal Process/ Field Visit	**Oil furnace rating** - Confirm unit meets requirements for NFPA 31 for oil furnaces.	A	RA/ QA	—
		Submittal Process/ Field Visit	**Cooling coil** - Verify provided, if necessary	A	RA/ QA	—
	Unit Ventilators	Submittal Process/ Field Visit	Verify unit is a factory assembled unit ventilator capable of up to 100% OA ventilation and UL-Listed	A	RA/ QA	—
	Unit Heaters	Submittal Process/ Field Visit	See D302004 for gas fired unit heaters	A	RA/ QA	—
	Unit Heaters-Steam	Submittal Process/ Field Visit	Verify provided is UL-Listed and factory assembled	A	RA/ QA	—
	Unit Heaters - Hot Water	Submittal Process/ Field Visit	Verify provided is UL-Listed and factory assembled	A	RA/ QA	—
	Unit Heaters - Cabinet	Submittal Process/ Field Visit	Verify provided is UL-Listed and factory assembled	A	RA/ QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
	Fuel-Fired Unit Heaters - Gas	Submittal Process/ Field Visit	Verify meets requirements for ANSI Z83.8 and AGA label	A	RA/ QA	—
		Submittal Process/ Field Visit	**Discharge louver** - Verify each heater equipped with individually adjustable package discharge louver	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Thermostat** - Verify provided	A	RA/ QA	QA
	Fuel-Fired Unit Heaters - Infrared	Submittal Process/ Field Visit	Verify meets requirements for ANSI Z83.8 and AGA label	A	RA/ QA	—
	Unit Heaters - Electric	Submittal Process/ Field Visit	Verify provided are factory assembled, UL-1025	A	RA/ QA	—
	Heaters - Baseboard	Submittal Process/ Field Visit	Verify provided are factory assembled, UL-1042	A	RA/ QA	—
	Heaters - Wall	Submittal Process/ Field Visit	Verify provided are factory assembled, UL-1025, cabinet heaters	A	RA/ QA	—
	Heaters - Infrared	Submittal Process/ Field Visit	Verify provided are factory assembled, UL-Listed and labeled heaters	A	RA/ QA	—
	Fin Tube Radiators & Convectors	Submittal Process	Verify fin tube radiators and convectors provided with copper tubes and aluminum fins	A	RA	—
		Submittal Process	**Control Valves -** Verify control valves provided are normally open, spring return	A	RA/ QA	QA
	Duct Heater	Submittal Process/ Field Visit	Verify provided is factory assembled, UL-Listed heater	A	RA/ QA	—
		Field Visit	Verify adequate duct length is provided per manufacturer's recommendations upstream & downstream	A	QA	—
		Submittal Process/ Field Visit	Verify control cabinet and heating coil provided	A	RA/ QA	—
	Pumps - ALL	Submittal Process/ Field Visit	Verify provided are centrifugal circulating pumps with motor, motor starter, and motor enclosure conforming to the appropriate NEMA standards	A	RA/ QA	—
		Field Visit	**Insulation -** Verify pumps used for hot service and chilled water service are insulated	A	QA	QA

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)	**Pumps - Base-mounted**	Field Visit	Confirm size and nameplate data matches schedule req	A	QA	QA
		Field Visit	Verify voltage service matches nameplate	A	QA	QA
		Field Visit	Verify provided are single-stage end suction pumps suitable for chilled, condenser, and hot water heating systems	A	QA	QA
		Field Visit	**Isolation Base -** Confirm isolation base is provided where req	A	QA	QA
		Field Visit	**Insulation -** Confirm insulation enclosure is provided where req	A	QA	QA
		Field Visit	Confirm pressure taps, gages, and shutoffs have been provided in the specified locations	A	QA	QA
		Field Visit	**Balancing Valves -** Confirm the balancing valves have been provided in accordance with manufacturers recommendations and/or in accordance with the appropriate contract document detail	A	QA	QA
		Field Visit	**Balancing Valves -** Confirm balancing valves provided with proper clearances	A	QA	QA
		Field Visit	**Rotation -** Verify rotation direction is correct	A	QA	QA
		Field Visit	**Suction diffusers -** Verify suction diffusers provided on base-mounted pumps	A	QA	QA
	Pumps - In-line	Field Visit	**Location -** Confirm location is correct(ie: in accordance with the contract documents)	A	QA	QA
		Field Visit	Verify constructed of manufacturer's standard materials suitable for chilled, condenser, and hot water heating systems	A	QA	QA
		Field Visit	Confirm voltage provided is correct	A	QA	QA
		Field Visit	**Valve Arrangement -** Confirm valve arrangement around the pump is correct	A	QA	QA
		Field Visit	**Balancing Valve -** Confirm balancing valve has been provided in accordance with the contract documents, if req	A	QA	QA
		Field Visit	**Balancing Valve -** Confirm balancing valves provided with proper clearances	A	QA	QA
	Diffusers, Registers, & Grilles	Field Visit	Confirm location, size, and type have been provided in accordance with the contract documents	A	QA	QA
		Field Visit	**Dampers -** Confirm branch balancing dampers have been provided and dampers, if any, provided with the air device are in the wide open position	A	QA	QA
		Field Visit	**Finish** - Verify are factory-finished	A	QA	—
		Field Visit	**Exterior and exposed edges** - Verify are rolled, or otherwise stiffened and rounded	A	QA	—
	Pipe Sleeves	Field Visit	Verify pipe sleeves provided at each wall and floor penetration	A	QA	—
		Field Visit	Verify sleeves are of a material suitable to protect the carrier pipe (2 pipe sizes larger) and sealed with an appropriate flexible material	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process/ Field Visit	**Fire Stopping -** In fire rated walls, verify fire stopping provided inaccordance with IBC	A	RA/ QA	—
	Piping Identification	Field Visit	Verify piping provided with identification labels or stencil names or code letters for piping systems in clearly visible letters and symbols	A	QA	—
		Field Visit	Verify arrow-shaped markings provided to indicate direction of flow	A	QA	QA
	Piping - Condensate Drain	Submittal Process/ Field Visit	Verify condensate drain piping provided is ASTM B 88, Type M or L, hard drawn copper	A	RA/ QA	—
	Piping	Field Visit	**Flushing -** Confirm/ witness pipe flushing (make sure water is clear prior to putting final chemicals into water system)	V	W	—
		Field Visit	**Strainers -** Confirm start-up strainer has been removed from **all** strainers (hang at location)	A	QA	—
		Field Visit	**Air Vents -** Confirm air vents are at specified locations and are auto type, if req	A	QA	QA
		Submittal Process/ Field Visit	**Pressure Relief Valves -** Confirm pressure relief valves are sized properly and installed where specified	A	RA/ QA	QA
		Field Visit	Confirm make-up water pressure setting is sufficient for facility (adjust if req for pressure req at highest point	A	QA	QA
		Field Visit	**Expansion Tanks -** Where diaphragm expansion tanks are provided, confirm tank pressure is set in accordance with nameplate	A	QA	QA
		Field Visit	Confirm valve arrangements for each unit coil are as specified on the contract documents	A	QA	QA
		Field Visit	Confirm all valve clearance req's, manufacturer, and/or contract have been adhered to	A	QA	QA
		Field Visit	**Layout -** Confirm piping layout conforms to the contract documents (physically walk all pipe runs to make sure there are no cross connections)	A	QA	QA
		Field Visit	Confirm traps have been provided on condensate lines per the contract documents	A	QA	
		Field Visit	Confirm slope of condensate lines meets spec req	A	QA	
		Field Visit	**Supports -** Confirm piping supported properly (ie: hangers, saddles, seismic (if req))	A	QA	QA
		Field Visit	**Insulation -** Confirm pipe insulated with specified insulation and vapor barrier is intact	A	QA	QA
		Submittal Process/ Field Visit	**Fittings -** Confirm dialectric fittings have been provided where piping of dissimilar metals connect	A	RA/ QA	—
		Field Visit	Confirm condensate piping from equip has been run to floor drains, if req	A	QA	QA
		Field Visit	**Identification -** Confirm piping is marked properly with water type and direction of flow	A	QA	QA
		Field Visit	Confirm provisions have been made in the piping arrangement at each coil for isolation of flow and ease of coil removal	A	QA	QA

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Components (continued)		Field Visit	Confirm steam piping relief valve has been piped to the exterior of the building in a safe location to personnel	A	QA	QA
		Field Visit	Confirm hazard warning and/or hot surface signage is in place at steam piping, equip. (This also applies to hot water systems)	A	QA	—
		Field Visit	**Flow Meters -** Confirm location of flow meters meets factory req for straight, unobstructed inlet and outlet piping	A	QA	QA
	Chillers	Field Visit	**Leaving Water Temp -** Confirm the leaving chilled water temp is below temp specified for terminal equip to compensate for pump heat gain (approx 1.8F/1.0C) (chiller leaving should **never** be same as temp req at terminal unit)	A	QA	QA
		Submittal Process/ Field Visit	Confirm piping/valve arrangement matches contract documents and balancing valve and flow monitoring device have been provided in accordance with manufacturers req and/or detail	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Decoupler -** Confirm decoupler leg is tied into chilled return piping before entering chilled water return header (for multiple chillers)	A	RA/ QA	QA
		Field Visit	Confirm piping arrangement has allotment for access to the cooling and condensing bundles	A	QA	QA
		Field Visit	**Flow Switch -** Confirm flow switch has been provided to protect the chiller from low or lack of flow	A	QA	QA
		Submittal Process/ Field Visit	Confirm BACNET compatable (if req in contract docs) and that the connection has been made to the DDC control system	A	RA/ QA	QA
	Chiller Systems - Closed Circuit Coolers	Submittal Process	**Construction and rating** - Confirm provided is factory assembled conforming to NFPA 214	A	RA	—
		Submittal Process	**Fire hazard rating** - Verify fire hazard rating for plastic impregnated materials does not exceed 25	A	RA	—
		Submittal Process	**Certification** - Verify Cooling Technology Institute 201 certification of tower capability and performance is provided	A	RA	—
		Submittal Process	**Cooler performance** - Verify meets or exceeds that listed in ASHRAE 90.1	A	RA	—
		Submittal Process/ Field Visit	**Hardware** - Verify stainless steel hardware provided	A	RA/ QA	—
		Submittal Process	**Vibration cutout switch** - Verify interlocked with fan motor	A	RA	—
		Submittal Process	**Fan motors** - Verify 2-speed or adjustable frequency drive fan motors provided	A	RA	—
		Field Visit	**Safety** - Verify OSHA safety requirements for stairs and handrails are met	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment &	**Chiller Systems - Water Cooled Chillers**	Submittal Process	**Construction and rating** - Verify self-contained chiller provided meeting requirements of ARI 550/590-98	A	RA	—
		Field Visit	**Control panel** - Verify provided with manufacturer's standard controls and protection circuits	A	QA	—
		Submittal Process/ Field Visit	**DDC system** - If DDC system required in project, verify control interface provided for remote monitoring of chiller's operating parameters, functions, and alarms from DDC control system central workstation	A	RA/ QA	QA
		Submittal Process	**Automatic capacity-reduction system** - Verify provided for stable operation from 100 to 10 percent of full load capacity	A	RA	—
	Chiller Systems - Air Cooled	Submittal Process	**Construction and rating** - Verify provided air-cooled chillers are type indicated in Project Program and meet requirements of ARI 550/590-98	A	RA	—
		Submittal Process	**Control panel** - Verify provided with manufacturer's standard controls and protection circuits	A	RA	—
		Submittal Process/ Field Visit	**DDC System** - If DDC system required in project, verify control interface provided for remote monitoring of chiller's operating parameters, functions, and alarms from DDC control system central workstation	A	RA/ QA	QA
		Submittal Process	**Reciprocating chillers** - Verify minimum of four stages of unloading provided at 25% per stage minimum	A	RA	—
		Submittal Process	**Reciprocating chillers** - Verify provided with hot gas bypass	A	RA	—
		Submittal Process	**Head pressure control** - Verify provided for cold temperature operation	A	RA	—
		Submittal Process/ Field Visit	**Freeze protection** - Verify provided for chiller and piping	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Condenser coils** - Verify provided are copper tube with aluminum fins unless specified otherwise	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Condenser coils** - If condenser coil coatings indicated in ESR Section D30, verify provided with copper tube/ copper fin construction or immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Condenser coils** - Verify condenser coils provided with manufacturer's optional louvered covers or hail guards for protection against vandalism, debris, or hail	A	RA/ QA	—
	Cooling Tower	Field Visit	Confirm tower size HP, voltage per contract docs	A	QA	QA
		Submittal Process/ Field Visit	Confirm tower constructed in accordance with specs (ie: galvanized, stainless steel, fiber-glass)	A	RA/ QA	QA
		Submittal Process/ Field Visit	**Sump** - Confirm height of cooling tower sump is above intake of condenser water pumps (min of 3 to 4 feet)	A	RA/ QA	QA

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process/ Field Visit	Confirm return line to tower has trap leg below well unless the by-pass is piped directly to cooling tower well	A	RA/ QA	QA
		Field Visit	**Overflow -** Confirm tower well overflow is low enough to prevent the well from overflowing	A	QA	QA
		Field Visit	**Make-up Float -** Confirm tower well make-up float setting shuts of prior to water level reaching the top of the overflow	A	QA	QA
		Field Visit	**Fan Rotation -** Confirm tower fan rotation is correct	A	QA	QA
		Field Visit	**Well Heater -** Confirm tower well heater is installed, if req	A	QA	QA
		Field Visit	**Shut-off Valve -** Confirm tower shut-off valve has been installed in proper location, if req	A	QA	QA
		Field Visit	**Fan Discharge -** Confirm tower fan discharge is unobstructed from above	A	QA	QA
		Field Visit	**Heat Trace -** Confirm tower piping above grade is heat traced, if req	A	QA	QA
		Submittal Process	**Construction and rating** - Confirm provided is factory assembled conforming to NFPA 214	A	RA	—
		Submittal Process	**Fire hazard rating** - Confirm fire hazard rating for plastic impregnated materials does not exceed 25	A	RA	—
		Submittal Process	**Certification** - Verify Cooling Technology Institute 201 certification of tower capability and performance is provided	A	RA	—
		Submittal Process	**Cooling tower performance** - Verify meets or exceeds that listed in ASHRAE 90.1	A	RA	—
		Submittal Process/ Field Visit	**Construction** - Verify construction is as indicated in ESR Section D30 with fill material of PVC formed sheets	A	RA/ QA	—
		Submittal Process/ Field Visit	**Hardware** - Verify stainless steel hardware provided	A	RA/ QA	—
		Submittal Process	**Vibration cutout switch** - Verify interlocked with fan motor	A	QA	—
		Submittal Process	**Fan motors** - Verify 2-speed or adjustable frequency drive fan motors provided	A	QA	—
		Submittal Process/ Field Visit	**Work platforms** - Verify provided at all locations in tower that require periodic maintenance	A	RA/ QA	
		Submittal Process/ Field Visit	**Isolation valves** - For multi-cell installations, verify isolation valves provided on inlets and outlets of each cell	A	RA/ QA	—
	Fan Coil Units	Field Visit	Confirm size and location in accordance with contract docs	A	QA	QA
		Field Visit	**Filter Access -** Confirm filter accessibility	A	QA	QA
		Field Visit	Confirm vibration isolation provided for on hangers and at ductwork connection	A	QA	QA
		Field Visit	Confirm installation of auxilliary drain pan (if req) along with respective condensate drain piping	A	QA	QA

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Field Visit	Confirm valves arranged properly including the straight pipe diameters req before and after the balancing valve	A	QA	QA
		Submittal Process/ Field Visit	**Speed Controller -** Confirm speed controller has been provided, if req in contract docs	A	RA/ QA	QA
		Field Visit	**Fan Access -** Confirm fan access is accessible by maintenance staff	A	QA	QA
		Field Visit	Confirm unit tagging has been provided	A	QA	—
		Field Visit	Confirm operational	A	QA	—
		Submittal Process/ Field Visit	**Sensors -** Confirm leaving air temp sensor has been provided	A	RA/ QA	QA
		Submittal Process	Verify provided are UL-Listed, factory assembled and tested fan coils, ARI 440, and ARI certified	A	QA	—
	Thru Wall Classroom Terminal Units	Field Visit	Confirm size and location in accordance with contract docs	A	QA	QA
		Field Visit	Confirm operational	A	QA	—
		Field Visit	Confirm piping arrangement meets contract docs req's	A	QA	QA
	Packaged Thru Wall Units	Submittal Process	Verify provided is factory assembled air conditioner or heat pump and rated in accordance with ARI 310 or ARI 380 and ARI certified	A	RA	—
		Submittal Process	Verify provided unit includes heat and operates under the standard unit controls (Not sure if worded correctly, D305006 1.4)	A	RA	—
		Submittal Process	**Wall Sleeve -** Verify unit designed to allow ease of maintenance by use of a wall sleeve	A	RA	QA
		Submittal Process/ Field Visit	**Condensate Removal -** Verify provided unit includes internal condensate removal (condensate shall not be externally drained)	A	RA/ QA	QA
	Room Air Conditioners	Submittal Process	Verify provided is factory assembled air conditioner or heat pump and rated in accordance with AHAM RAC-1	A	RA	—
		Submittal Process/ Field Visit	Verify auxiliary electric heat included and operates under the standard unit controls	A	RA/ QA	QA
		Submittal Process	Verify provided unit is AHAM certified or listed in AHAM DCRAC	A	RA	—
	Computer Room Units	Field Visit	Confirm size and location	A	QA	QA
		Field Visit	Confirm all features have been provided	A	QA	QA
		Field Visit	Confirm water connection to humidifier	A	QA	QA
		Field Visit	**Fan Rotation -** Confirm fan rotation	A	QA	QA
		Submittal Process	If computer room unit req'd, verify DOR utilized UFGS Spec section 23 81 23.00 20 (Computer Room Air Conditioning Units) for the project spec and submitted the edited spec section as part of the design submittal for the project	A	RA	—
	Boilers	Field Visit	Confirm size and location	A	QA	—
		Field Visit	**Stack -** Confirm stack material and arrangement meet contract doc req's	A	QA	QA

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
		Field Visit	**Stack -** Confirm stack above roof does not touch roof curb and guy wires have been provided	A	QA	QA
		Field Visit	**Stack -** Confirm stack type is per contract docs and the height above the parapet and/or building meets code req's	A	QA	QA
		Field Visit	Confirm fuel train meets contract docs and code req's with no leaks	A	QA	QA
		Submittal Process/ Field Visit	**Make-up Air -** Confirm adequate make-up air for the boiler(s) has been provided under positive pressure to the room	A	RA/ QA	QA
		Field Visit	**Relief Valve -** Confirm relief valve setting and operation	A	QA	—
		Field Visit	**DDC -** Confirm boilers have been interfaced with the DDC system	A	QA	QA
		Field Visit	Confirm pump/piping arrangement meets contract docs including circulation pump, if req	A	QA	QA
		Submittal Process/ Field Visit	Confirm boiler sequencing panel has been provided by the boiler manufacturer, if req in the contract docs	A	RA/ QA	QA
	Boilers - Hot Water	Submittal Process	**Load capacity -** Verify boiler type provided meets building load capacity as indicated in ESR Section D30, if required	A	RA	—
		Submittal Process/ Field Visit	**Construction and rating -** Verify boiler designed, tested, and installed per ASME CSD-1 (Controls and Safety Devices) and ASME BPVC (Boiler and Pressure Vessel Code)	A	RA/ QA	—
		Submittal Process/ Field Visit	**Construction -** Verify boiler meets requirements of UL 795, ANSI Z83.3, and ASME CSD	A	RA/ QA	—
		Submittal Process/ Field Visit	**Burners -** Confirm provided are make, model, and type certified and approved by manufacturer of provided boiler	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify burner controls and flame safety equipment conform to either ASME CSD-1 or NFPA 58 as dictated by input	A	RA/ QA	—
		Submittal Process/ Field Visit	**Boiler controls -** Verify are mounted on a single control panel mounted on the burner or separate from the burner (includes operating switches, indicating lights, gages, alarms, motor starters, fuses, and circuit elements of the control system). If separa	A	RA/ QA	—
		Submittal Process/ Field Visit	**Trim -** Verify boiler trim complies with ASME BPVC SEC IV, ASME CSD-1, and additional appurtenances as specified herein	A	RA/ QA	—
		Submittal Process/ Field Visit	**Pressure gages -** Confirm provided have scale equivalent to 1.5 times the outlet water pressure on supply water piping and return water piping	A	RA/ QA	—
		Submittal Process/ Field Visit	**Thermometers - Piping -** Confirm provided have scale equivalent to 1.5 times the outlet water temperature on supply water piping and return water piping	A	RA/ QA	—
		Field Visit	**Drain valve -** Verify provided and piped to floor drain	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process/ Field Visit	**Air vent valve** - Verify provided with screwed connection, stainless steel disk, and stainless steel seats to vent entrapped air	A	RA/ QA	—
		Submittal Process	**Boiler stack** - Verify provided boiler stack insulated in accordance with manufacturer's recommendations and conform to NFPA 211, or pre-manufactured multi-wall stacks provided complying with NFPA 54 or NFPA 58 and UL-listed	A	RA	—
		Submittal Process/ Field Visit	**Thermometer - Flue gas** - Verify provided and mounted in flue gas outlet	A	RA/ QA	—
		Field Visit	**Cleaning** - Verify boiler(s) cleaned in accordance with ASME Boiler and Pressure Vessel Code and manufacturer's recommendations prior to startup	A	QA	—
		Field Visit	**Testing** - Verify services are furnished of an engineer or technician approved by the boiler manufacturer for installation, startup, and operational and safety testing	V	W	W
		Field Visit	**Testing** - Verify boiler demonstrates proper operability of combustion control, flame safeguard control, and safety interlocks	V	W	W
	Boilers - Steam		**Confirm meets same requirements specified for hot water boilers except as follows:**			
		Submittal Process/ Field Visit	**Pressure gage** - Confirm provided have scale equivalent to 1.5 times the outlet water pressure on boiler feedwater supply piping and condensate return water piping	A	RA/ QA	—
		Submittal Process/ Field Visit	**Pressure gage** - Confirm provided boiler steam pressure gage has scale equivalent to 1.5 times the boiler rated working pressure	A	RA/ QA	—
		Submittal Process/ Field Visit	**Thermometers - Piping** - Confirm provided have scale equivalent to 1.5 times the outlet water temperature on boiler feedwater piping and return water piping	A	RA/ QA	—
	Insulation - Condensate Drain	Field Visit	**Insulation -** Verify condensate drain piping insulated with flexible cellular insulation	A	QA	—
	Insulation	Field Visit	Verify all ductwork provided with external thermal insulation	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Field Visit	Verify all ductwork in concelaed spaces insulated with blanket flexible mineral fiber	A	QA	—
		Field Visit	Verify ductwork in mechanical Rooms and exposed locations insulated with rigid mineral fiber insulation	A	QA	—
		Field Visit	Verify insulation provided with factory applied all-purpose jacket with integral vapor retarder	A	QA	—
		Field Visit	In exposed locations, verify jacket provided with white surface suitable for painting	A	QA	—
		Submittal Process/ Field Visit	Verify flame spread/smoke developed rating for all insulation does not exceed 25/ 50	A	RA/ QA	—
		Submittal Process	Verify minimum insulation thickness does not violate minimum required by ASHRAE 90.1	A	RA	—
		Field Visit	Verify the backs of all supply air diffusers insulated with blanket flexible mineral fiber insulation	A	QA	QA
	VFDs	Submittal Process/ Field Visit	Verify are factory-assembled VFD drive control systems for variable speed control	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify all AHU and pump VFD's are from same manufacturer	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify each VFD provided includes motor starter, motor disconnects, and controls as required for a complete system	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify VFD units provided are UL-Listed and comply with the National Electric Code	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify the following accessories were provided: Disconnect switch, Control circuit transformer with primary and secondary fuses, Manual bypass, System hand-off-auto switch with provisions for remote start/stop of the system, System initialized light, Run	A	RA/ QA	QA
	Air Separators	Submittal Process/ Field Visit	**For hot and chilled water -** Verify provided are ASME rated air separators with tangential inlet and outlet connections and automatic air vent	A	RA/ QA	—
	Solids Separators	Submittal Process/ Field Visit	Verify provided are centrifugal solids separators with automatic drain in open systems.	A	RA/ QA	—
	Expansion Tanks	Submittal Process/ Field Visit	For hot and chilled water - Verify provided are ASME rated expansion tanks with polypropylene or butyl diaphragm or compression tanks as indicated in UFC 3-400-10N.	A	RA/ QA	—
	Make-Up Water Station	Field Visit	Verify station consists of a water pressure-reducing valve, filter, and relief valve in the make-up water line to the chilled and hot water systems to maintain the operating pressure	A	QA	—
		Field Visit	Verify a 20mm (3/4 inch) globe valve by-pass provided around the pressure reducing station	A	QA	—
		Field Visit	Verify a reduced pressure backflow preventer provided upstream of the by-pass	A	QA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
ent & Components (continued)	**Glycol Make-Up Station**	Submittal Process/ Field Visit	If required, verify a glycol make-up system provided to maintain system proper operating mixture	A	RA/ QA	—
	Chemical Treatment	Submittal Process/ Field Visit	If required, verify chilled and hot water systems provided with automatic chemical treatment system for the control of pH, scale formation, and corrosion inhibition	A	RA/ QA	—
		Field Visit	Verify shot-type feeders provided for manual chemical feed	A	QA	—
		Submittal Process	Verify feeders rated for use with pressures up to 900 kPa (130 PSI) (gage)	A	RA	—
		Submittal Process/ Field Visit	Verify condenser water systems provided with automatic chemical treatment systems that monitor conductivity, pH, etc, and provide for water metering and bleed-off	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify chemicals provided are in accordance with EPA and equipment manufacturer's recommendations	A	RA/ QA	—
	System Flushing	Field Visit	Verify hydronic systems flushed thoroughly prior to system startup	A	QA	—
	Heat Tape	Submittal Process/ Field Visit	Verify heat tape provided is UL-Listed, and self-regulating	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify heat tape provided on piping subject to freezing	A	RA/ QA	QA
	Terminal & package Units	Submittal Process/ Field Visit	Where required in ESR Section D30, verify anti-corrosion coating provided on the casing and both the condenser and evaporater coils to protect against salt air damage	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify anti-corrosion coating is immersion applied, baked phenolic or other approved coating (Field applied coatings are not acceptable)	A	RA/ QA	—
	Seismic Design	Submittal Process	Verify provided inaccordance with UFC 3-400-10N, Mechanical Engineering	A	RA	—
	Energy Recovery Wheel (Enthalpy Wheel)	Field Visit	Verify provided is a total energy (enthalpy) type energy recovery wheel (heat wheel)	A	QA	—
		Submittal Process/ Field Visit	**Media -** Verify media is aluminum or a lightweight polymer coated with a corrosion resistance finish (Etched or oxidized surfaces are not acceptable)	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify heat transfer surfaces are coated with a non-migrating (permanently bonded) absorbent specifically developed for the selective transfer of water vapor	A	RA/ QA	—
		Submittal Process	Verify equal sensible and latent recovery efficiencies are documented through a certification program conducted per ASHRAE 84 and ARI 1060	A	RA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipme		Submittal Process/ Field Visit	Verify energy recovery wheel provided with insulating housing of double wall construction, rotor seals specifically designed to limit cross-contamination, and a rotation detector	A	RA/ QA	—
		Field Visit	Verify the rotation detector alarms the HVAC control system if rotation stops	A	QA	—
		Field Visit	**Filter Access -** Verify filter sections are readily accessible for maintenance	A	QA	QA
	Heat Pipes	Submittal Process	Verify provided are factory fabricated, assembled and tested heat pipes with counter-flow arrangement	A	RA	—
		Submittal Process	Verify are provided with hermitically sealed, seamless aluminum tube cores with extended surfaces	A	RA	—
		Submittal Process	Verify heat exchanger frame constructed of not less than 16-gage galvanized steel and fitted with intermediate tube supports and flange connections	A	RA	—
		Submittal Process	Verify tube end covers and a partition of galvanized steel provided to separate exhaust and supply air streams without cross-contamination	A	RA	—
		Submittal Process	**Refrigerant -** Verify refrigerant used as the working fluid (Type I refrigerants are not allowed)	A	RA	—
	Exterior Piping Manholes	Submittal Process/ Field Visit	**Manholes -** Verify system manholes are constructed of reinforced, 206.8 bar (3000 psi) concrete. Verify manhole floor and sides are watertight and were made in one monolithic pour. Verify manhole top extends a minimum of 300 mm (6 inches) above grade. V	A	RA/ QA	—
		Submittal Process	Verify a sump pit and a vertical sump pump designed for an operating temperature design of 93 degrees C (195 degrees F) minimum are provided in each system manhole.	A	RA	—
		Submittal Process	**Sump Pump - Float Control -** Verify a 2-pole float control is provided for each manhole sump pump.	A	RA	—
	Exterior Piping Cathodic Protection	Field Visit	If underground steel piping is installed, verify a cathodic protection system is provided.	A	QA	—
		Submittal Process	If a cathodic protection system is provided, verify the system was designed by a National Association of Corrosion Engineers (NACE) certified Cathodic Protection Engineer and they supervised, inspected and tested the installation and performance of the ca	A	QA	QA
		Field Visit	Verify the test stations were post mounted and placed at the manhole or nearby building and test stations were provided at each end of each cathodically protected section.	A	QA	—
	DDC		Verify one of the following provided as directed in ESR Section D30			
		Submittal Process	A) Verify Direct Digital Controls (DDC) provided to comply with UFGS Section 23 09 54.00 20, Direct Digital Control Systems	A	RA	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process	A) Verify DOR utilized UFGS Spec Section 23 09 54.00 20, Direct Digital Control Systems, for the project spec, and submitted the edited spec section as part of the design submittal for the project	A	RA	—
		Submittal Process/ Field Visit	B) Verify a partial DDC system provided that communicates with the existing DDC system	A	RA/ QA	—
		Submittal Process	B) Notwithstanding any other provisions of this contract, no other product will be acceptable other than that indicated in ESR Section D30	A	RA	—
		Submittal Process/ Field Visit	B) Verify the system has stand alone digital controllers, a communication network, and a workstation computer with control software (Pneumatic controllers and components are not acceptable)	A	RA/ QA	—
		Submittal Process	B) Verify all 120-volt wiring complies with NFPA 70	A	RA	—
		Submittal Process/ Field Visit	B) Verify all 24-volt wiring complies with the IMC and terminal device manufacturer's recommendations	A	RA/ QA	—
	DDC - Equipment Controllers	Submittal Process/ Field Visit	Verify DDC hardware are UL-916 rated	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify controllers used in a distributed control manner	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify controllers are stand alone with an internal clock and modem	A	RA/ QA	QA
		Submittal Process	Verify the total number of I/O hardware points do not exceed 48 in any controller	A	RA	QA
		Submittal Process	Verify sufficient memory provided for each controller to support required control, communication, trends, alarms, and messages	A	RA	QA
		Submittal Process/ Field Visit	Verify communications ports provided for controller to controller, on-site interface, remote workstation interface, and telecommunications interface	A	RA/ QA	QA
	DDC - Electronic Controls	Submittal Process/ Field Visit	If required, verify programmable thermostats provided with built in keypads for scheduling of day and night temps with two setback periods per day	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify independent summer and winter programs provided	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify thermostats have temporary and manual override of schedule and battery backup	A	RA/ QA	QA
	All Submittals	Submittal Process	All equipment and controls hardware reviewed by A/E	A	RA	RA
	DALTS - Submittals	Submittal Process	TAB contractor qualifications & certification	RA	RA	A
		Submittal Process	DALT test equip with certification	RA	RA	A

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
		Submittal Proces	DALT test plan	RA	RA	A
		Submittal Proces	DALT tests report including plan drawing of duct to be tested and square foot calc for each section	RA	RA	A
	DALTS - Testing	Submittal Process	Ductwork to be DALT'd	RA	RA	A
		Field Visit	Testing	V	W	W
		Submittal Proces	Pre-final DALT report	RA	C	A
		Submittal Proces	Certified final DALT report	RA	C	A
	DALTS - Acceptance Testing	Field Visit	Quality assurance - Contracting officer DALT field checks	V	W	W
		Field Visit	Additional field checks	V	W	W
	TABS - Submittals	Submittal Process	TAB contractors qualifications & certification	RA	RA	A
		Submittal Process	Pre-TAB engineering report	RA	RA	A
		Submittal Process	*Discussion on TAB procedure	RA	RA	A
		Submittal Process	*Pre-requisite checklist	RA	RA	A
		Submittal Process	*Design review report	RA	RA	A
		Submittal Process	*Preliminary TAB test report	RA	RA	A
		Submittal Process	Certified TAB test report (Season 1)	RA	RA	A
		Submittal Process	Certified TAB test report (Season 2 (coil data))	RA	RA	A
	TABS - Pre-Test Checklist		**1) Variable Air Volume Series Boxes**			
			a) General			
		Field Visit	Louvers installed	V	W	—
		Field Visit	Manual dampers open and locked	V	W	—
		Field Visit	Automatic dampers set properly	V	W	—
		Field Visit	Housing construction leakage	V	W	—
		Field Visit	Access doors per plans & specs.	V	W	—
		Field Visit	Condensate drain piping & pan	V	W	—
		Field Visit	Free from dirt & debris	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			b) Filters			
		Field Visit	Type / size / number correct	V	W	—
		Field Visit	Clean	V	W	—
		Field Visit	Blank-off plates installed	V	W	—
		Field Visit	Frame leakage at a minimum	V	W	—
			c) Coils (Hydronic – Water / Steam)			
		Field Visit	Size & rows	V	W	—
		Field Visit	Fin spacing & condition	V	W	—
		Field Visit	Obstructions and/or debris	V	W	—
		Field Visit	Correct air flow direction	V	W	—
		Field Visit	Correct piping connections / flow	V	W	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
		Field Visit	Valves open & set	V	W	—
		Field Visit	Vents / traps installed correctly	V	W	—
		Field Visit	Provisions for TAB measurements	V	W	—
			d) Coils (Electric)			
		Field Visit	Size & construction	V	W	—
		Field Visit	Airflow direction	V	W	—
		Field Visit	Duct connections	V	W	—
		Field Visit	Safety switches	V	W	—
		Field Visit	Obstructions	V	W	—
		Field Visit	Free from debris	V	W	—
		Field Visit	Contractors & disconnect switches	V	W	—
		Field Visit	Electrical service & connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			e) Fans			
		Field Visit	Rotation	V	W	—
		Field Visit	Wheel clearance & balance	V	W	—
		Field Visit	Bearing & motor lubrication	V	W	—
		Field Visit	Drive alignment	V	W	—
		Field Visit	Belt tension	V	W	—
		Field Visit	Drive set screws tight	V	W	—
		Field Visit	Belt guards in place	V	W	—
		Field Visit	Flex duct connector alignment	V	W	—
		Field Visit	Proper unit / duct alignment	V	W	—
		Field Visit	Starters & disconnect switches	V	W	—
		Field Visit	Electrical service & connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			f) Vibration isolation			
		Field Visit	Springs & compression	V	W	—
		Field Visit	Base level & free	V	W	—
			2) DUCT SYSTEMS			
			a) General			
		Field Visit	Manual damper positioned & locked	V	W	—
		Field Visit	Damper adjustments accessible	V	W	—
		Field Visit	Access doors closed & tight	V	W	—
		Field Visit	Fire dampers open & accessible	V	W	—
		Field Visit	Terminal units open & set	V	W	—
		Field Visit	Registers/diffusers wide open & set	V	W	—
		Field Visit	Turning vanes in square elbows	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	System installed per plans & specs.	V	W	—
		Field Visit	All ductwork sealed as required	V	W	—
			b) Architectural			
		Field Visit	Windows installed & closed	V	W	—
		Field Visit	Doors closed as required	V	W	—
		Field Visit	Ceiling plenums installed/sealed	V	W	—
		Field Visit	Access doors closed & tight	V	W	—
		Field Visit	Air shafts/openings as required	V	W	—
			3) PUMPS			
			a) Motors			
		Field Visit	Rotation	V	W	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
System Acceptance (continued)		Field Visit	Lubrication	V	W	—
		Field Visit	Alignment	V	W	—
		Field Visit	Set screws tight	V	W	—
		Field Visit	Guards in place	V	W	—
		Field Visit	Tank level and controls	V	W	—
		Field Visit	Starters & disconnects	V	W	—
		Field Visit	Electrical service & connections	V	W	—
			b) Piping			
		Field Visit	Correct flow	V	W	—
		Field Visit	Correct connections	V	W	—
		Field Visit	Leakage	V	W	—
		Field Visit	Valves positioned & set	V	W	—
		Field Visit	Strainers clean	V	W	—
		Field Visit	Air Vented	V	W	—
		Field Visit	Flexible connectors installed	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	System water clean	V	W	—
			c) Bases			
		Field Visit	Vibration isolation	V	W	—
		Field Visit	Grouting (if required)	V	W	—
		Field Visit	Leveling	V	W	—
			4) HYDRONIC EQUIPMENT			
			a) Boilers			
		Field Visit	Operating controls & devices	V	W	—
		Field Visit	Safety controls & devices	V	W	—
		Field Visit	Lubrication of fans & pumps	V	W	—
		Field Visit	Draft controls & devices	V	W	—
		Field Visit	Piping controls & devices	V	W	—
		Field Visit	Valves set & open	V	W	—
		Field Visit	Water make-up provisions	V	W	—
		Field Visit	Blowdown provisions	V	W	—
		Field Visit	Electrical connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			b) Heat Exchangers			
		Field Visit	Correct flow & connections	V	W	—
		Field Visit	Valves open or set	V	W	—
		Field Visit	Air vents or steam traps	V	W	—
		Field Visit	Leakage	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			c) Cooling Towers/Evaporative Condensers			
		Field Visit	Correct flow & connections	V	W	—
		Field Visit	Valves open or set	V	W	—
		Field Visit	Leakage	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	Sump water level	V	W	—
		Field Visit	Spray nozzles	V	W	—
		Field Visit	Fan/Pump rotation	V	W	—
		Field Visit	Motor/Fan lubrication	V	W	—
		Field Visit	Drives & alignment	V	W	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
System Acceptance (continued)		Field Visit	Guards in place	V	W	—
		Field Visit	Starters & disconnects	V	W	—
		Field Visit	Electrical connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			5) REFRIGERANT EQUIPMENT			
		Field Visit	Crankcase heaters energized	V	W	—
		Field Visit	Operating controls & devices	V	W	—
		Field Visit	Safety controls & devices	V	W	—
		Field Visit	Valves open	V	W	—
		Field Visit	Piping connections & flow	V	W	—
		Field Visit	Flexible connectors	V	W	—
		Field Visit	Oil level & lubrication	V	W	—
		Field Visit	Alignment & drives	V	W	—
		Field Visit	Guards in place	V	W	—
		Field Visit	Vibration isolation	V	W	—
		Field Visit	Starters/Contactors/Disconnects	V	W	—
		Field Visit	Electrical connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			6) HYDRONIC PIPING SYSTEM			
		Field Visit	Leak tested	V	W	—
		Field Visit	Fluid levels & make-up	V	W	—
		Field Visit	Relief or safety valves	V	W	—
		Field Visit	Expansion tanks & air vents	V	W	—
		Field Visit	Steam traps & connections	V	W	—
		Field Visit	Strainers clean	V	W	—
		Field Visit	Valves open & set	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	Systems installed per plans & specs.	V	W	—
			7) CONTROLS & CONTROL SYSTEMS			
		Field Visit	Data centers	V	W	—
		Field Visit	Outdoor/return Air/reset	V	W	—
		Field Visit	Economizer set & tested	V	W	—
		Field Visit	AHU Static pressure set	V	W	—
		Field Visit	Room controls calibrated	V	W	—
		Field Visit	VAV box regulators set to design	V	W	—
		Field Visit	VAV box P.E. switches set	V	W	—
		Field Visit	Proper end-of-line static pressure	V	W	—
		Field Visit	VAV box reheats tested	V	W	—
			8) OTHER CHECKS			
		Submittal Process	Appropriate contractors notified of TABS	A	RA	S
		Submittal Process	Preliminary data complete	A	RA	S
		Submittal Process	Test report forms prepared	S	RA	A

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
	TABS - Testing	Field Visit	TAB field work	V	W	
		Submittal Process	Preliminary procedures	RA	C	A
		Field Visit	TAB air distrbution systems	V	W	—
		Field Visit	TAB water distribution systems	V	W	—
		Field Visit	Sound measurement work	V	W	—
		Field Visit	TAB work on performance tests without seasonal limitations	V	W	—
		Field Visit	TAB work on performance tests with seasonal limitations	V	W	—
		Field Visit	Marking settings	V	W	—
		Field Visit	Marking of test ports	V	W	—
	TABS - Acceptance Testing	Field Visit	Quality assurance - Contracting officer TAB field checks	V	W	W
		Field Visit	Additional field checks	V	W	W
	ACATS - Submittals	Submittal Process	Controls contractor qualifications	RA	RA	A
		Submittal Process	Manufacturers field report	RA	RA	A
		Submittal Process	Performance verification test plan (PVT)	RA	RA	A
		Submittal Process	Pre-PVT checklist	RA	RA	A
		Submittal Process	Final certified PVT report (with all mods incorporated in as-builts)	RA	RA	A
	ACATS - Pre-PVT Checklist	Field Visit	Prior to conducting the PVT, thoroughly inspect the installed work with the Contractor's QC representative and the mechanical contractor using the following checklist. Submit the checklist with items checked off once verified. Provide a detailed explana	V	W	—
		Field Visit	a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).	V	W	—
		Field Visit	b. Verify HVAC motors operate below full-load amperage ratings.	V	W	—
		Field Visit	c. Verify all required control system components, wiring, and accessories are installed.	V	W	—
		Field Visit	d. Verify the installed control system architecture matches approved drawings.	V	W	—
		Field Visit	e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.	V	W	—
		Field Visit	f. Verify all required surge protection is installed and functions correctly.	V	W	—
		Field Visit	g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.	V	W	—

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System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
System Acceptance (continued)		Field Visit	h. Verify all DDC network communications function properly, including uploading and downloading programming changes.	V	W	—
		Field Visit	i. Using the BACnet protocol analyzer (if provided or required in this specification), verify communications are error free.	V	W	—
		Field Visit	j. Verify each digital controller's programming is backed up.	V	W	—
		Field Visit	k. Verify all wiring, components, and panels are properly labeled.	V	W	—
		Field Visit	l. Verify all required points are programmed into devices.	V	W	—
		Field Visit	m. Verify all TAB work affecting controls is complete.	V	W	—
		Field Visit	n. Verify all valve and actuator zero and span adjustments are set properly.	V	W	—
		Field Visit	o. Verify all sensor readings are accurate and calibrated.	V	W	—
		Field Visit	p. Verify each control valve and actuator goes to normal position upon loss of power.	V	W	—
		Field Visit	q. Verify all control loops are tuned for smooth and stable operation. View trend data where applicable.	V	W	—
		Field Visit	r. Verify each controller works properly in stand-alone mode.	V	W	—
		Field Visit	s. Verify all safety controls and devices function properly, including interfaces with building fire alarm systems.	V	W	—
		Field Visit	t. Verify all electrical interlocks work properly.	V	W	—
		Field Visit	u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook. Notify the Government when phone lines or netw	V	W	—
		Field Visit	v. Verify the as-built (shop) control drawings are completed.	V	W	—
	ACATS - Testing	Field Visit	Field testing of components	V	W	—
		Field Visit	Field testing of programming	V	W	—
		Field Visit	Pre-performance verification testing	V	W	—
	ACATS - Acceptance Testing	Field Visit	Performance verification testing	V	W	W
		Field Visit	Performance verification re-resting	V	W	W

ROOFING ROLES and RESPONSIBILITIES

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System	Sub-Systems	Phase	Elements	Roof QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Roofing	**Low Sloped Roofs**	Design Guidance	Post Award Kick Off Meeting		S	A
		Design Guidance	Verify Roof Design Assurance	A	R	S
		Submittal Process	Review Shop Drawings	A	S	S
		Submittal Process	Review Manufacturer's Product Data Sheets	A	S	S
		Submittal Process	Review Design Data (to include wind and fire resistance)	A	S	S
		Submittal Process	Review Test Reports	A	S	S
		Submittal Process	Review Certificates	A	S	S
		Submittal Process	Review Sample Roof Warranty	A	S	C
		Field Visit	Conduct Pre Roofing Conference	V	S	S
		Field Visit	Review Delivery, Storage, and Handling	A	S	S
		Field Visit	Verify Conditions for roof application	A	S	S
		Field Visit	Verify Preparation	A	S	S
		Field Visit	Verify Application	A	S	S
		Field Visit	Verify Protection of Applied Roofing	A	S	S
		Field Visit	Verify Field Quality Control	A	S	S
		Field Visit	Verify Operation Maintenance and Support Information (Roof Warranty and Information Card)	A	S	S
	Steep Sloped Roofs	Design Guidance	Post Award Kick Off Meeting		S	A
		Design Guidance	Verify Roof Design Assurance	A	R	S
		Submittal Process	Review Shop Drawings	A	S	S
		Submittal Process	Review Manufacturer's Product Data Sheets	A	S	S
		Submittal Process	Review Design Data (to include wind and fire resistance)	A	S	S
		Submittal Process	Review Test Reports	A	S	S
		Submittal Process	Review Certificates	A	S	S
		Submittal Process	Review Sample Roof Warranty	A	S	C
		Field Visit	Conduct Pre Roofing Conference	V	S	S
		Field Visit	Review Delivery, Storage, and Handling	A	S	S
		Field Visit	Verify Conditions for roof application	A	S	S
		Field Visit	Verify Preparation	A	S	S
		Field Visit	Verify Application	A	S	S
		Field Visit	Verify Protection of Applied Roofing	A	S	S
		Field Visit	Verify Field Quality Control	A	S	S
		Field Visit	Verify Operation Maintenance and Support Information (Roof Warranty and Information Card)	A	S	S

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UNDERWATER STRUCTURES ROLES and RESPONSIBILITIES

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System	Sub-Systems	Phase	Elements	UW QC / DOR (Ktr)	FEAD (SIOH)	FEC/NF ESC (PCAS)
Waterfront Structure H10 (Uniformat II) - Substructure H1010	**Pile Foundations (H101001) Sheet Piles (H101001) Caissons (H101001) Cofferdams (H101001) Wraps and Encasements (H101001) Sheet Pile Bulheads (H101003) Gravity Walls (H101003) Block Walls (H101003) Seawalls (H101006) Boat Ramps (H101007) Cut-Off Walls (H101008) Wave Attenuation Walls (H101009) Fender Piles (H104001) Dolphins (H104004)**	Submittal Process	Shop Drawings	A	C	S
		Submittal Process	Manufacturer's Data Sheets	A	C	S
		Submittal Process	Pile driving records	A	C	S
		Submittal Process	Concrete testing: petrographic, chemical, service-life modeling	A	C	S
		Submittal Process	As-built drawings, 3D AUTOCAD format	A	C	S
		Field Visit	Validate in-water/underwater structure complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Inspect in-water prestressed/precast concrete piles or sheetpiles for alignment, spalls, cracks, damages, defects, lifting hoops cut/area patched, exposed steel ties, penetrations, etc.	A	—	W
		Field Visit	Inspect in-water cast-in-place concrete drilled caissons for alignment, spalls, cracks, damages, defects, concrete quality (hardness), honeycombing, etc.	A	—	W
		Field Visit	Inspect in-water steel piles and/or p/c p/s concrete sheetpiles for alignment, damage/buckling, coating damage, penetrations, gaps, etc.	A	—	W
		Field Visit	Inspect underwater concrete placement for defects such as honeycombing, concrete quality (hardness)	A	—	W
		Field Visit	Inspect underwater slope protection for conformance with RFP requirements such as rock/boulder size, placement gap limits, angle, location (e.g., toe of slope protection), consistency, etc.	A	—	W
		Field Visit	Inspect underwater Cathodic Protection anodes and connections	A	—	W
		Field Visit	Inspect for underwater debris, existing or by construction.	A	—	W
		Field Visit	Validate in-water/underwater structure complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Validate in-water/underwater structure complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Validate in-water/underwater structure complies with RFP requirements, e.g., number, location, size, etc.	A	—	W

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UNDERWATER STRUCTURES ROLES and RESPONSIBILITIES

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System	Sub-Systems	Phase	Elements	UW QC / DOR (Ktr)	FEAD (SIOH)	FEC/NFESC (PCAS)
Underwater Cables	All	Submittal Process	Shop Drawings	A	C	S
		Submittal Process	Manufacturer's Data Sheets	A	C	S
		Field Visit	Validate in-water/underwater cable complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Inspect underwater cable for defects/damages, kinks, missing anchors, coating damage, etc.	A	—	W
		Field Visit	Inspect for underwater debris, existing or by construction.	A	—	W
Underwater Utility Pipes and Conduits	All	Submittal Process	Shop Drawings	A	C	S
		Submittal Process	Manufacturer's Data Sheets	A	C	S
		Field Visit	Validate in-water/underwater component complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Inspect underwater component for defects/damages, cracks, missing anchors, coating damage, etc.	A	—	W
		Field Visit	Inspect for underwater debris, existing or by construction.	A	—	W

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DEFINITIONS

Approve	(A)	Professional or quality control endorsement of the submittal or installed system meets the contract requirements
Review	(R)	To confirm accuracy of the submittal and that it meets contract requirements
Witness	(W)	Observe demonstration of system performance for acceptance
Receipt **A**cknowledge	(RA)	Confirm receipt of submittal with no review necessary
Surveillance Review	(S)	A quality assurance review based on risk, complexity, and workload
Performance **V**erification and Acceptance Testing	(V)	A demonstration of satisfactory construction and system performance
Receive **C**opy of Correspondence	(C)	Receive a copy of the transmittal sheet and/or correspondence letter
Quality **A**ssurance Inspection	(QA)	Witnessing satisfactory performance without testing all devices or visual inspection of various parts of the system

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
05/13

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

1.2 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.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2007) Standard for Reduced-Pressure Principle Backflow Prevention Assembly

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies
FCCCHR Manual	(10th Edition) Manual of Cross-Connection Control

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2013) Standard for Safeguarding Construction,Alteration, and Demolition Operations
NFPA 70	(2011; Errata 2 2012) National Electrical Code

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2007; Rev K) Obstruction Marking and Lighting

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009) Manual on Uniform Traffic Control Devices

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Traffic control plan; G

Construction site plan; G

SD-06 Test Reports

Backflow Preventer Tests; G

SD-07 Certificates

Backflow Tester Certification; G

Backflow Preventers Certificate of Full Approval

1.4 CONSTRUCTION SITE PLAN

Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.5 BACKFLOW PREVENTERS CERTIFICATE

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

1.5.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with any company participating in any other phase of this Contract.

1.5.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Immediately upon beginning of work, provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained

in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

2.1.2 Project and Safety Signs

The requirements for the signs, their content, and location are as specified in Section 01 58 00 PROJECT IDENTIFICATION. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Haul Roads

At contractors expense construct access and haul roads necessary for proper prosecution of the work under this contract. Construct with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic are be avoided. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.2.3 Fencing

a. Provide fencing along the construction site at all open excavations and tunnels to control access by unauthorized people. Fencing must be installed to be able to restrain a force of at least 250 pounds against it.

2.2.4 Temporary Wiring

Provide temporary wiring in accordance with NFPA 241 and NFPA 70, Article 305-6(b), Assured Equipment Grounding Conductor Program. Include frequent inspection of all equipment and apparatus.

2.2.5 Backflow Preventers

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound flanged cast iron, mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. The particular make, model/design, and size of backflow preventers to be installed must be included in the latest edition of the List of Approved Backflow Prevention Assemblies issued by the FCCCHR List

and be accompanied by a Certificate of Full Approval from FCCCHR List. After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the FCCCHR Manual Standards.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Contractor employees will 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 must not interfere with existing and established parking requirements of the government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Utilities at Special Locations

a. Reasonable amounts of utilities will be made available to the Contractor at the prevailing Government rates and may be obtained upon application to the Base Maintenance Officer, Bldg. 1202, Marine Corps Base, Camp Lejeune. A refundable security deposit to the Officer in Charge of Construction shall be made prior to application for services. Provide transformers, meter bases, electrical service poles and drops for electrical services, and backflow preventer devices on connections to domestic water lines. Final taps and tie-ins to the Government utility grid will be made by Base Maintenance who will also provide and seal a 120 or 208 volt, three-wire kWh meter. Tap-in cost, if any, shall be the responsibility of the Contractor. Tampering or movement of a sealed meter without notification to base maintenance is grounds for discontinuance of electrical service. Provide larger meters required if they are not available from the Government. The Contractor is responsible for the cost of utility services required until the date of Government acceptance. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water.

3.2.3 Sanitation

a. Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. Any penalties and / or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times without nuisance. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

3.2.4 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.2.5 Obstruction Lighting of Cranes

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

3.2.6 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.2.7 Location of Underground Utilities

See specification section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS paragraph "Location of Underground Utilities".

3.3 TRAFFIC PROVISIONS

3.3.1 Maintenance of Traffic

a. Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Make all notifications and obtain any permits required for modification to traffic movements outside Station's jurisdiction. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

c. Provide, erect, and maintain, at contractors expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to

and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of any damage to roads caused by construction operations.

3.3.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations for Marine Corps Base, Camp Lejeune, NC without notification to and approval by the Contracting Officer.

3.3.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Treat dust abatement on access roads with applications of calcium chloride, water sprinklers, or similar methods or treatment.

3.4 CONTRACTOR'S TEMPORARY FACILITIES

3.4.1 Safety

Protect the integrity of any installed safety systems or personnel safety devices. If entrance into systems serving safety devices is required, the Contractor must obtain prior approval from the Contracting Officer. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.4.2 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. For the duration of the construction of the Landfill, provide and maintain the following for CQA Consultant use:

a. Office space meeting the requirements specified in paragraph "New Building" of 10 foot x 12 foot minimum with a work table, desk and chair, two additional chairs, a copier machine, and paper supplies throughout construction to support copying of QC documents, and one legal size locking file cabinet; the office space shall be a separate room from other administrative areas, or may be a separate trailer within 50 feet of the Contractor's administrative office.

Government office and warehouse facilities will not be available to the Contractor's personnel.

3.4.3 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts, colored brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store Trailers, materials, or equipment 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 installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on any given day. Do not stockpile materials outside the fence in preparation for the next day's

work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.4.4 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 will be within the installation boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor is 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.

3.4.5 Appearance of Trailers

a. Trailers utilized by the Contractor for administrative or material storage purposes must present a clean and neat exterior appearance and 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 installation property.

b. Paint using suitable paint materials and maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

3.4.6 Maintenance of Storage Area

a. Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles; gravel gradation will be at the Contractor's discretion. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers will be edged or trimmed neatly.

3.4.7 New Building

In the event a new building is constructed for the temporary project field office, it will be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, 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 must be furnished. Screen the windows and doors and provide the doors with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins will be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, furnish 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. Any new building erected for a temporary field office must be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work become the property of the Contractor and removed from the site. All charges for telephone service for the temporary field office will be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

3.4.8 Security Provisions

Provide adequate outside security lighting at the Contractor's temporary facilities. The Contractor will be responsible for the security of its own equipment; in addition, the Contractor will notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

3.4.9 Storage Size and Location

The open site available for storage must be confined to the indicated operations area.

3.4.10 Storage in Existing Buildings

The Contractor will be working around existing buildings; the storage of material will not be allowed in the buildings.

3.4.11 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.4.11.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.4.11.2 Hurricane Condition of Readiness

Unless directed otherwise, comply with:

a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards. Contact Contracting Officer for Condition of Readiness (COR) updates and completion of required actions.

b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.

c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours): Curtail or cease routine activities until securing operation is complete. Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and Condition of Readiness (COR) updates and completion of required actions.

d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

3.5 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor must install a satisfactory means of communication, such as telephone or other suitable devices and made available for use by Government personnel.

3.6 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. The safety fencing must 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. Maintain the safety fencing during the life of the contract and, upon completion and acceptance of the work, will become the property of the Contractor and be removed from the work site.

3.7 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store within the fenced area described above or at the supplemental storage area any materials resulting from demolition activities which are salvageable. Neatly stacked stored materials not in trailers, whether new or salvaged.

3.8 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletinboard, signs, barricades, haulroads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore to the

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original or better condition, areas used by the Contractor for the storage of equipment or material, or other use. Gravel used to traverse grassed areas must be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01 57 13.00 22

EROSION AND SEDIMENT CONTROL
05/13

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 in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D3787	(2007; R 2011) Bursting Strength of Textiles - Constant-Rate-of-Traverse (CRT), Ball Burst Test
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles

NORTH CAROLINA SEDIMENT CONTROL COMMISSION (NCSCC)

NCSCC ESCM	(2006; R 2009) Erosion and Sediment Control Planning and Design Manual

1.2 DESCRIPTION OF WORK

The work includes the provision of temporary and permanent erosion control measures to prevent the pollution of air, water, and land within the project limits and in areas outside the project limits where work is accomplished in conjunction with the project.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Sequence Schedule; G

SD-03 Product Data

Sediment Fence

Dust Suppressors

Erosion Control Matting

Temporary Channel Liner

Filter Fabric

1.4 CONSTRUCTION SEQUENCE SCHEDULE

Submit a Contractor furnished construction work sequence schedule, a minimum of 30 days prior to start of construction. The work schedule shall coordinate the timing of land disturbing activities with the provision of erosion control measures to reduce on site erosion and off site sedimentation. Installation of temporary erosion control features shall be coordinated with the construction of permanent erosion control features to assure effective and continuous control of erosion and pollution.

1.5 STATE APPROVED PLAN

The erosion control plan indicated has been approved by the State. No additional State review and approval of the erosion control plan is required, unless the Contractor desires to modify the erosion control plan indicated. Should the Contractor desire to modify the State approved plan, a resubmittal to the State, including the State's approval is required prior to the start of construction. The contractor shall be responsible for any additional costs and time incurred as a result of the resubmittal of the previously approved erosion control plan. The contractor shall anticipate a minimum 45 day review period by the State. Provide and maintain erosion control measures in accordance with NCSCC ESCM, and as specified herein.

PART 2 PRODUCTS

2.1 SEDIMENT FENCE

2.1.1 State Standard Sediment Fence

NCSCC ESCM Standard 6.62, sediment fence (maximum height of 18 inches).

2.2 SILT FENCE DROP INLET PROTECTION

2.2.1 State Standard Drop Inlet Protection

NCSCC ESCM Standard 6.51, using silt fencing.

2.3 CONSTRUCTION ENTRANCE

2.3.1 State Standard Construction Entrance

2.3.1.1 Aggregate

NCSCC ESCM, Standard 6.06.

2.3.1.2 Filter Fabric

A woven or nonwoven polypropylene, nylon, or polyester containing stabilizers and/or inhibitors to make the fabric resistant to deterioration from ultraviolet, and with the following properties:

a. Minimum grab tensile strength (TF 25 #1/ASTM D4632) 180 pounds

b. Minimum Puncture (TF 25 #4/ASTM D3787) 75 psi in the weakest direction

c. Apparent Opening Size 40-80 (U.S. Sieve Size)

d. Minimum Trapezoidal tear strength (TF 25 #2/ASTM D4533) 50 pounds

2.4 DUST SUPPRESSORS

Calcium chloride, or other standard manufacturer's spray on adhesives designed for dust suppression.

2.5 TEMPORARY SEEDING

2.5.1 State Standard Temporary Seeding

Provide seed, lime, fertilizer , and mulch in accordance with NCSCC ESCM, Standards 6.10 and 6.14. Provide straw mulch.

2.6 EROSION CONTROL MATTING

Jute, excelsior, or paper matting that has not been bleached or dyed. Provide matting in minimum 4 feet widths. Staples for anchoring the matting shall be minimum 11 gage wire, formed into a "U" shape with a minimum throat width of one inch and minimum length of 6 inches after forming.

2.6.1 Jute Matting

A uniform open plain weave of single jute yarn providing an average weight of 0.9 pounds per square yard of matting. Yarn shall be of a loosely twisted construction and shall not vary in thickness by more than one-half its normal diameter. Matting shall have openings between strands length wise of 0.45 to 0.75 inch, and between strands crosswise of 0.67 to 1.13 inch.

2.6.2 Excelsior Matting

A machine produced mat of wood excelsior with a minimum of 80 percent of wood fibers 6 inches in length or longer. The matting shall have an average weight of 0.75 to 0.85 pounds per square yard with an even fiber distribution producing a consistent mat thickness, and shall have on one side a woven fabric. The woven fabric shall be twisted paper cord, cotton cord, or an extruded plastic mesh with a minimum mesh size of one by one inch and a maximum mesh size of 1 1/2 by 3 inch.

2.6.3 Straw Matting

A machine produced straw mat with a minimum thickness of 1/2 inch +/- 1/8 inch. The straw shall be evenly distributed throughout the mat to provide a minimum average dry weight of .70 pounds per square yard. The topside of the mat shall be covered with a 3/8 inch biodegradable plastic mesh, with the mesh attached to the straw by a knitting process using biodegradable thread.

2.7 TEMPORARY CHANNEL LINER

Provide temporary channel liner in accordance with NCSCC ESCM, Standard 6.17.

PART 3 EXECUTION

3.1 CONSTRUCTION SEQUENCE SCHEDULE

Stabilize areas for construction access immediately with gravel. Install

principal sediment basins and traps before any major site grading takes place. Provide additional sediment traps, and sediment fences as grading progresses. Provide drop inlet protection around existing drainage structures, and inlet and outlet protection at the ends of new drainage systems. Stabilize graded and disturbed areas immediately after grading. Permanent stabilization shall be provided immediately on areas that have been final graded. Temporary seeding and mulching shall be provided on disturbed areas as specified in the paragraph entitled "Temporary Seeding." Installation of temporary erosion control features shall be coordinated with the construction of permanent erosion control features to assure effective and continuous control of erosion and sediment deposition. Remove temporary erosion control measures at the end of construction and provide permanent seeding.

3.2 SEDIMENT FENCES

Install posts at the spacing indicated, and at an angle between 2 degrees and 20 degrees towards the potential silt load area. Sediment fence height shall be approximately 18 inches. Do not attach filter fabric to existing trees. Secure filter fabric to the post and wire fabric using staples, tie wire, or hog rings. Imbed the filter fabric into the ground as indicated. Splice filter fabric at support pole using a 6 inch overlap and securely seal.

3.3 DROP INLET PROTECTION

Provide stakes evenly spaced around the perimeter of the drop inlet, a maximum of 3 feet apart. Stakes shall be driven immediately adjacent to the drainage structure, a minimum of 18 inches into the ground. The fabric shall be securely fastened to the outside of the stakes, with the bottom of the fabric placed into a trench and backfilled.

3.4 CURB INLET PROTECTION

Provide wire mesh over the curb inlet opening so at least 12 inches of wire mesh extends across the inlet cover and at least 12 inches of wire mesh extends across the gutter from the inlet opening, as indicated. Place stone on wire mesh against curb inlet.

3.5 CONSTRUCTION ENTRANCE

Provide as indicated, a minimum of 6 inches thick, at points of vehicular ingress and egress on the construction site. Construction entrances shall be cleared and grubbed, and then excavated a minimum of 3 inches prior to placement of the filter fabric and aggregate. The aggregate shall be placed in a manner that will prevent damage and movement of the fabric. Place fabric in one piece, where possible. Overlap fabric joints a minimum of 12 inches.

3.6 DUST SUPPRESSORS

Immediately dampen the surface before calcium chloride application. Apply dust suppressors on unsurfaced base, subbase and other unsurfaced travel ways. Apply calcium chloride at the rate of 1.0 to 1.25 pounds per square yard of surface for pellets for the initial application. For subsequent applications of calcium chloride, application rates may be approximately 75 percent of initial application rates. Do not apply when raining or the moisture conditions exceed that required for proper application. Apply other dust suppressors in accordance with manufacturers instructions.

Protect treated surfaces from traffic for a minimum of 2 hours after treatment. Repeat application of dust suppressors as required to control dust emissions.

3.7 TEMPORARY SEEDING

3.7.1 Time Restrictions

Within 48 hours after attaining the grading increment specified herein, provide seed, fertilizer, mulch and water on graded areas when any of the following conditions occur:

a. Grading operations stop for an anticipated duration of 30 days or more.

b. When it is impossible or impractical to bring an area to finish grade so that permanent seeding operations can be performed without serious disturbance from additional grading.

c. Grading operations for a specific area are completed and the dates specified for permanent seeding and sodding are more than 30 days away.

d. When an immediate cover is required to minimize erosion, or when erosion has occurred.

e. Provide on erosion control devices constructed using soil materials.

3.7.2 Seeding Requirements

3.7.2.1 State Standard Seeding Requirements

Provide seed, lime, fertilizer, and mulch in accordance with NCSCC ESCM, Standards 6.10 and 6.14. Provide hay or straw mulch in an air dried condition, and secure mulch in place.

3.7.2.2 Permanent Seeding and Sodding

Temporary seeding shall be removed, and permanent seeding and sodding shall be provided in accordance with Sections 32 92 19 SEEDING and 32 92 23 SODDING. Provide sodding where indicated.

3.8 EROSION CONTROL MATTING

Place matting in the direction of the flow of water. The up channel mat ting end shall be toed in a narrow trench a minimum of 5 inches deep. Where one roll of matting ends and a second roll begins, the end of the upper roll shall be brought over the buried end of the second roll, to provide a 6 inch overlap. Where matting widths are laid side by side, the overlap between matting shall be 4 inches. Provide check slots every 50 feet longitudinally in the matting. Construct check slots by providing a narrow trench 5 inches deep and folding the matting down in to the trench, across the bottom of the trench, and then back up the trench to the existing ground Backfill and compact the trench using the excavated material from the trench. Staple matting ends, junctions, and check slots at 10 inches on center. Staple matting outer edges and overlaps and the center of each matting strip at 3 feet on center. Install excelsior matting with the woven fabric on top.

3.9 TEMPORARY CHANNEL LINER

Provide temporary channel liner in accordance with NCSCC ESCM, Standard 6.17.

3.10 MAINTENANCE AND INSPECTION

Inspect erosion control devices after each rainfall and daily during pro longed rainfall. Remove sediment deposits after each rainfall or when sediment reaches approximately one-half the barrier height. Immediately repair damaged erosion control devices and damaged areas around and underneath the devices. Maintain erosion control devices to assure continued performance of their intended function. Modify the erosion control plan as required to control problem areas noticed after each inspection. Modifications shall be approved by the Contracting Officer.

3.11 CLEAN UP

At the completion of the job, or when directed or approved by the Contracting Officer, temporary erosion control devices shall be removed. Erosion control devices and areas immediately adjacent to the device shall be filled (where applicable), shaped to drain and to blend into the surrounding contours, and provided with permanent seeding. Erosion control devices may remain in place after job completion when approved by the Contracting Officer.

-- End of Section --

SECTION 01 57 19.00 20

TEMPORARY ENVIRONMENTAL CONTROLS
05/13

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.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004	(1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)
EPA 833-R-060-04	(2000) Developing Your Storm Water Pollution Prevention Plan, a Guide for Construction Sites

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
40 CFR 112	Oil Pollution Prevention
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific

	Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 271	Requirements for Authorization of State Hazardous Waste Programs
40 CFR 272	Approved State Hazardous Waste Management Programs
40 CFR 273	Standards For Universal Waste Management
40 CFR 279	Standards for the Management of Used Oil
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 355	Emergency Planning and Notification
40 CFR 372-SUBPART D	Specific Toxic Chemical Listings
40 CFR 51	Requirements For Preparation, Adoption, And Submittal Of Implementation Plans
40 CFR 52	Approval And Promulgation Of Implementation Plans
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 63	National Emission Standards For Hazardous Air Pollutants For Source Categories
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for

Shipments and Packagings

49 CFR 178 Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.2 Solid Waste

Garbage, refuse, debris, sludge, or other discharged material, including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations. Types of solid waste typically generated at construction sites may include:

a. Green waste: The vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

b. Surplus soil: Existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included.

c. Debris: Non-hazardous solid material generated during the construction, demolition, or renovation of a structure which exceeds 2.5 inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

d. Wood: Dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated and/or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included.

e. Scrap metal: Scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

f. Paint cans: Metal cans that are empty of paints, solvents, thinners and adhesives. If permitted by the paint can label, a thin dry film may remain in the can.

g. Recyclables: Materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company. Paint cans may not be included as recyclable if sold to a scrap metal company.

h. Hazardous Waste: By definition, to be a hazardous waste a material must first meet the definition of a solid waste. Hazardous waste and hazardous debris are special cases of solid waste. They have additional regulatory controls and must be handled separately. They are thus defined separately in this document.

   Material not regulated as solid waste are: nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.3 Hazardous Debris

As defined in Solid Waste paragraph, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) per 40 CFR 261; or debris that exhibits a characteristic of hazardous waste per 40 CFR 261.

1.2.4 Chemical Wastes

This includes salts, acids, alkalizes, herbicides, pesticides, and organic chemicals.

1.2.5 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.6 Hazardous Waste

Any discarded material, liquid, solid, or gas, which meets the definition of hazardous material or is designated hazardous waste by the Environmental Protection Agency or State Hazardous Control Authority as defined in 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 271, 40 CFR 272, 40 CFR 273, 40 CFR 279, and 40 CFR 280.

1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that:

a. Is regulated as a hazardous material per 49 CFR 173, or

b. Requires a Material Safety Data Sheet (MSDS) per 29 CFR 1910.120, or

c. During end use, treatment, handling, packaging, storage, transpiration, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D.

Designation of a material by this definition, when separately regulated or controlled by other instructions or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this instruction for "control" purposes. Such material include ammunition,

weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs). Nonetheless, the exposure may occur incident to manufacture, storage, use and demilitarization of these items.

1.2.8 Waste Hazardous Material (WHM)

Any waste material which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial hazard to human health or the environment and which has been so designated. Used oil not containing any hazardous waste, as defined above, falls under this definition.

1.2.9 Oily Waste

Those materials which are, or were, mixed with used oil and have become separated from that used oil. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, used oil and may be appropriately tested and discarded in a manner which is in compliance with other State and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that:

a. It is not prohibited in other State regulations or local ordinances

b. The amount generated is "de minimus" (a small amount)

c. It is the result of minor leaks or spills resulting from normal process operations

d. All free-flowing oil has been removed to the practical extent possible

Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, a hazardous waste determination must be performed prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.10 Regulated Waste

Those solid waste that have specific additional Federal, state, or local controls for handling, storage, or disposal.

1.2.11 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

chlorofluorocarbon-11 (CFC-11)
chlorofluorocarbon-12 (CFC-12)
chlorofluorocarbon-13 (CFC-13)
chlorofluorocarbon-111 (CFC-111)

chlorofluorocarbon-112 (CFC-112)
chlorofluorocarbon-113 (CFC-113)
chlorofluorocarbon-114 (CFC-114)
chlorofluorocarbon-115 (CFC-115)
chlorofluorocarbon-211 (CFC-211)
chlorofluorocarbon-212 (CFC-212)
chlorofluorocarbon-213 (CFC-213)
chlorofluorocarbon-214 (CFC-214)
chlorofluorocarbon-215 (CFC-215)
chlorofluorocarbon-216 (CFC-216)
chlorofluorocarbon-217 (CFC-217)
chlorofluorocarbon-500 (CFC-500)
chlorofluorocarbon-502 (CFC-502)
chlorofluorocarbon-503 (CFC-503)
halon-1211
halon-1301
halon-2402
carbon tetrachloride
methyl bromide
methyl chloroform

1.2.11.1 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (e.g., thermostats) and lamps (e.g., fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey; G

Solid Waste Management Plan and Permit; G

Regulatory Notifications; G

Environmental Management Plan; G

Storm Water Pollution Prevention Plan; G

Air Emissions Source Specification Data; G

Dirt and Dust Control Plan

Contractor Hazardous Material Inventory Log; G

SD-06 Test Reports

Laboratory Analysis

Erosion and Sediment Control Inspection Reports

Storm Water Inspection Reports for General Permit

Contractor 40 CFR employee training records

Solid Waste Management Report; G

SD-11 Closeout Submittals

Some of the records listed below are also required as part of other submittals. For the "Records" submittal, maintain on-site a separate three-ring Environmental Records binder and submit at the completion of the project. Make separate parts to the binder corresponding to each of the applicable sub items listed below.

Storm Water Pollution Prevention Plan compliance notebook; G

Waste Determination Documentation

Disposal Documentation for Hazardous and Regulated Waste

Contractor 40 CFR Employee Training Records

Solid Waste Management Permit

Solid Waste Management Report

Contractor Hazardous Material Inventory Log; G

Hazardous Waste/Debris Management

Regulatory Notifications

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

The Contractor may be required to promptly conduct tests and procedures for the purpose of assessing whether construction operations are in compliance with Applicable Environmental Laws. Analytical work shall be done by qualified laboratories; and where required by law, the laboratories shall be certified.

1.4.1 Environmental Compliance Assessment Training and Tracking System (ECATTS)

The QC Manager is responsible for environmental compliance on projects unless an Environmental Manager is named. The QC Manager (and alternative QC Manager) or Environmental Manager shall complete ECATTS training prior

to starting respective portions of on-site work under this contract. If personnel changes occur for any of these positions after starting work, replacement personnel shall complete ECATTS training within 14 days of assignment to the project.

Submit an ECATTS certificate of completion for personnel who have completed the required "Environmental Compliance Assessment Training and Tracking System (ECATTS)" training. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

Register for NAVFAC Environmental Compliance Training and Tracking System, by logging on to http://navfac.ecatts.com/. Use password "navfac" (in all lower case letters) to gain access to the training site.

This training has been structured to allow contractor personnel to receive credit under this contract and also to carry forward credit to future contracts. Contractors shall ensure that the QC Manager (and alternate QC Manager) or Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work. Some training modules are tailored for specific State regulatory requirements; therefore, Contractors working in multiple states will be requires to re-take modules tailored to the state where the contract work is being performed.

ECATTS is available for use by all contractor and subcontractor personnel associated with this project. These other personnel are encouraged (but not required) to take the training and may do so at their discretion.

1.4.2 Conformance with the Environmental Management System

The Contractor shall perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). The Contractor shall perform work in a manner that conforms to objectives and targets, environmental programs and operational controls identified by the EMS. The Contractor will provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, the Contractor shall take corrective and/or preventative actions. In addition, the Contractor shall ensure that its employees are aware of their roles and responsibilities under the EMS and how these EMS roles and responsibilities affect work performed under the contract.

The Contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training, and keep up to date on regulatory required specific training for the type of work to be conducted onsite. All on-site Contractor personnel, and their subcontractor personnel, performing tasks that have the potential to cause a significant environmental impact shall be competent on the basis of appropriate education, training or experience. Upon contract award, the Contracting Officer's Representative will notify the installation's EMS coordinator to arrange EMS training. Refer to Section 01 57 19.01 20, Supplemental Temporary Environmental Controls for additional site specific EMS requirements related to construction. The installation's EMS coordinator shall identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. The Contractor shall provide training documentation to the Contracting Officer. The EMS coordinator shall retain associated records.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey

Perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record.

1.5.2 Regulatory Notifications

The Contractor is responsible for all regulatory notification requirements in accordance with Federal, State and local regulations. In cases where the Navy must also provide public notification (such as stormwater permitting), the Contractor must coordinate with the Contracting Officer. The Contractor shall submit copies of all regulatory notifications to the Contracting Officer prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all inclusive): demolition, renovation, NPDES defined site work, remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the activity; types and quantities of wastes/wastewater that may be generated during the contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and activity environmental staff to discuss the proposed Environmental Management Plan. Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, required permits, permit requirements, and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager will be directly responsible for coordinating contractor compliance with Federal, State, local, and station requirements. The Environmental Manager will ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the Environmental Management Plan; ensure that all environmental permits are obtained, maintained, and closed out; ensure compliance with Storm Water Program Management requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure all Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out.

1.5.5 Contractor 40 CFR Employee Training Records

Prepare and maintain employee training records throughout the term of the contract meeting applicable 40 CFR requirements. The Contractor will ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with Federal, State and local regulatory requirements for RCRA Large Quantity Generator. The Contractor will provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility. Submit these training records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 ENVIRONMENTAL MANAGEMENT PLAN

Prior to initiating any work on site, the Contractor will meet with the Contracting Officer to discuss the proposed Environmental Protection Plan and develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken. The Contractor's Environmental Plan shall incorporate construction related objectives and targets from the installation's Environmental Management System. The Environmental Management Plan will be submitted in the following format and shall include the elements specified below.

a. Description of the Environmental Management Plan

(1) General overview and purpose

(a) A brief description of each specific plan required by environmental permit or elsewhere in this contract.

(b) The duties and level of authority assigned to the person(s) on the job site that oversee environmental compliance.

(c) A copy of any standard or project specific operating procedures that will be used to effectively manage and protect the environment on the project site.

(d) Communication and training procedures that will be used to convey environmental management requirements to contractor employees and subcontractors.

(e) Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

(2) General site information

(3) A letter signed by an officer of the firm appointing the

Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

b. Management of Natural Resources

(1) Land resources

(2) Tree protection

(3) Replacement of damaged landscape features

(4) Temporary construction

(5) Stream crossings

(6) Fish and wildlife resources

(7) Wetland areas

c. Protection of Historical and Archaeological Resources

(1) Objectives

(2) Methods

d. Storm Water Management and Control

(1) Ground cover

(2) Erodible soils

(3) Temporary measures

(a) Mechanical retardation and control of runoff

(b) Vegetation and mulch

(4) Effective selection, implementation and maintenance of Best Management Practices (BMPs).

e. Protection of the Environment from Waste Derived from Contractor Operations

(1) Control and disposal of solid and sanitary waste. If Section 01 74 19.05 20 is included in the contract, submit the plan required by that section as part of the Environmental Management Plan.

(2) Control and disposal of hazardous waste (Hazardous Waste Management Section)

This item will consist of the management procedures for all hazardous waste to be generated. The elements of those procedures will coincide with the Activity Hazardous Waste Management Plan. A copy of the Activity Hazardous Waste Management Plan will be provided by the Contracting Officer. As a minimum, include the following:

(a) Procedures to be employed to ensure a written waste determination is made for appropriate wastes which are to be generated;

(b) Sampling/analysis plan;

(c) Methods of hazardous waste accumulation/storage (i.e., in tanks and/or containers);

(d) Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted);

(e) Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268);

(f) Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and the like;

(g) Used oil management procedures in accordance with 40 CFR 279;

(h) Pollution prevention\hazardous waste minimization procedures;

(i) Plans for the disposal of hazardous waste by permitted facilities;

(j) Procedures to be employed to ensure all required employee training records are maintained.

f. Prevention of Releases to the Environment

(1) Procedures to prevent releases to the environment

(2) Notifications in the event of a release to the environment

g. Regulatory Notification and Permits

(1) List what notifications and permit applications must be made. Demonstrate that those permits have been obtained by including copies of all applicable, environmental permits.

3.1.1 Environmental Protection Plan Review

Within thirty days after the Contract award date, submit the proposed Environmental Management Plan for further discussion, review, and approval. Commencement of work will not begin until the environmental management plan has been approved.

3.1.2 Licenses and Permits

Obtain licenses and permits pursuant to the "Permits and Responsibilities" FAR Clause 52.236-7.

Only an air emissions permit will be obtained by the Contracting Officer.

Where required by the State regulatory authority, the inspections and certifications will be provided through the services of a Professional

Engineer (PE), registered in the State where the work is being performed. As a part of the quality control plan, which is required to be submitted for approval by the quality control section, provide a sub item containing the name, appropriate professional registration or licence number, address, and telephone number of the professionals or other qualified persons who will be performing the inspections and certifications for each permit.

3.2 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. If the work is near streams, lakes, or other waterways, conform to the national permitting requirements of the Clean Water Act.

Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor will be responsible for any resultant damage.

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed. Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before replacement.

The Contracting Officer's approval is required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the Contracting Officer.

3.2.1 Erosion and Sediment Control Inspection Reports

Submit "Erosion and Sediment Control Inspection Reports" (E&S) (form provided at the pre-construction conference) and Storm Water Inspection Reports for General Permit NCG010000 - Land Disturbing Activities (form provided at http://h20.enr.state.nc.us/su/PDF_Files/SW_General_Permits/NCG01_Inspect_log.pdf) to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inch or more of rain.

Note erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports if applicable.

3.2.1.1 Storm Water Pollution Prevention Plan

In conjunction with the Contracting Officer, the Contractor shall apply for

and obtain coverage under the North Carolina General Pollution Discharge and Elimination System General Permit for discharges of stormwater from Construction Activities, when 10,000 square feet or more, of land area is disturbed by construction or related construction support operations, including clearing, grubbing, grading, excavation, soil or gravel lay down areas, and demolition that exposes soil.

In North Carolina, the NPDES General Permit is issued with the Erosion and Sediment Control Permit; no separate application is necessary. Coverage under this permit required the D-B Contractor to prepare a financial responsibility/ownership form and forward to MCB Camp Lejeune for concurrence prior to submittal. In addition, the Contractor shall provide the permit fee to the North Carolina Department of Environmental and Natural Resources (NCDENR) before any land disturbing activities begin. The Contractor shall file for permit coverage on behalf of the Contracting Officer and himself and file a Notice of Termination once construction is complete and the site is stabilized with a final sustainable cover.

Under the terms and conditions of the permit, the Contractor may be required to install, inspect, maintain best management practices (BMPs), and submit stormwater BMP inspection reports and stormwater pollution prevention plan inspection reports. The Contractor shall ensure construction operations and management are constantly in compliance with the terms and conditions of the general permit for storm water discharges from construction activities.

a. The SWPPP shall:

(1) Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

(2) Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

(3) Ensure compliance with terms of the EPA or State general permit for storm water discharge.

(4) Select applicable best management practices from EPA 833-R-060-04.

(5) Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

3.2.1.2 Storm Water Pollution Prevention Plan Compliance Notebook

The contractor shall create and maintain a three ring binder of documents that demonstrate compliance with the Stormwater Construction Activity permit. The binder shall include a copy of the permit Registration Statement, proof of permit fee payment, SWPPP and SWPPP update amendments, inspection reports, copies of correspondence with the North Carolina Department of Environmental and Natural Resources (NCDENR) and a copy of the permit Notice of Termination. At the completion of the project the folder shall become the property of the Government. The compliance notebook shall be provided to Contracting Officer. An advance copy of the Registration Statement shall be provided to the Contracting Officer immediately after the form is presented to the permitting agency.

3.2.2 Stormwater Drainage and Construction Dewatering

There will be no discharge of excavation ground water to the sanitary sewer, storm drains, or to the river without prior specific authorization of the Environmental Division in writing. Discharge of hazardous substances will not be permitted under any circumstances.

Construction site runoff will be prevented from entering any storm drain or the river directly by the use of straw bales or other method suitable to the Environmental Division. Contractor will provide erosion protection of the surrounding soils.

Construction Dewatering shall not be discharged to the sanitary sewer. If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Authorization for any contaminated groundwater release shall be obtained in advance from the base Environmental Officer. Discharge of hazardous substances will not be permitted under any circumstances.

3.2.3 Wetlands

Do not enter, disturb, destroy, or allow discharge of contaminants into any wetlands except as authorized herein. The protection of wetlands is the Contractor's responsibility. Authorization to enter specific wetlands identified will not relieve the Contractor from any obligation to protect other wetlands within, adjacent to, or in the vicinity of the construction site and associated boundaries. Contractor shall ensure wetland boundaries are clearly marked prior to any clearing and grubbing operations. The wetland delineation will be conducted on site by the design engineer with assistance as needed from the Army Corps of Engineers and the base Environmental Management Division.

3.2.4 Air Emissions Permit Application - Government Prepared

This contract may include the design and/or construction of regulated air emission sources that require an air quality permit for construction and operation in accordance with North Carolina Department of Environment and Natural Resources (NCDENR) Division of Air Quality (NCDAQ) permitting procedures. The government will prepare a permit application package for all applicable emission sources in the contract, however the contractor is required to coordinate submission of all Air Emissions Source Specification Data necessary for the preparation of the application package a minimum of 180 calendar days prior to any construction or installation of any emission source point associated with this project. Marine Corps Base, Camp Lejeune and Marine Corps Air Station, New River, have been issued one Clean Air Act Title V Construction and Operation Permit issued by NCDAQ. The facility is considered a major source for both criteria pollutants and federally listed Hazardous Air Pollutant (HAP). The facility is also subject to North Carolina Toxic Air Pollutant (TAP) regulations to include requirements for facility wide air dispersion modeling and facility fence line emission limits for certain pollutants. Typical emission sources requiring a permit include:

a. Boilers (Greater than 400,000 Btu/hr)

(1) Boilers less than 10 MMBtu/hr are considered insignificant per NC regulations (15A NCAC 2Q.0503), but may still require analysis & permitting.

b. Storage Tanks

c. Fuel Dispensing

d. Emergency Generators

e. Non-Emergency Generators

f. Engine Testing Stations or Stands (where engine is removed from mobile vehicle/craft for testing)

g. Fire Training Pits

h. Woodworking/Grinding

i. Abrasive Blasting

j. Paint Stripping

k. Parts Cleaners/Ovens

l. Surface Coating (Paint Booths)

m. Epoxy Curing Benches

n. Remediation Systems

o. Welding/Soldering

p. Refrigerant Recovery/Recycling

3.2.4.1 Regulations Applicability

The permit application will require an evaluation of the applicability of the following regulations:

a. New Source Review (NSR) / Prevention of Significant Deterioration (PSD)(40 CFR 51, 40 CFR 52)

b. New Source Performance Standards (NSPS) (40 CFR 60)

(1) Possible source categories include but are not limited to boilers & internal combustion engines/generators

c. National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61,40 CFR 63)

(1) Possible source categories include but are not limited to Reciprocating Internal Combustion Engines (RICE)

d. North Carolina Air Toxics Program (15A NCAC 2D.1100, 2Q.0700)

(1) Many new air emission sources may require air dispersion modeling to receive a permit and/or demonstrate compliance. A draft rule is in the North Carolina regulatory process that would remove the exemption of combustion sources (e.g. boilers, generators) from the air toxics program effective for sources permitted after March 1, 2009 also requiring modeling for these types of sources. Once

passed this will impose additional permitting requirements on the facility. As of May 2009 this rule had not been passed or finalized. Projects including combustion sources should be coordinated on a case-by-case basis with the NAVFAC IPT and the installation Environmental Management Division.

3.2.4.2 Type Of Permit Required

Based on preliminary review, it is not anticipated that new emission sources will require New Source Review (NSR) permitting; however, potential air emission rates for new emission sources may exceed Prevention of Significant Deterioration (PSD) thresholds, therefore PSD avoidance permit conditions and/or operating limits (e.g. fuel usage or operating hour limits).

3.2.4.3 Permit Application Package

The permit application package will include the following:

a. Clear, concise, & explanatory supporting documentation & narrative

b. Required permit application forms (Title V)

c. Air emissions calculations

d. Equipment drawings and specifications

e. Facility diagrams and/or maps

3.2.4.4 Time Allowance For Permit

The contractor should allow for approximately six months from the time of permit application submission to permit issuance. Construction of an air emission source cannot begin without a permit or a waiver, and operation of the source cannot begin without a permit.

3.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Upon discovery, notify the Contracting Officer. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.4 SOLID WASTE MANAGEMENT PLAN and PERMIT

Provide to the contracting officer written notification of the quantity of solid waste/debris that is anticipated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance or as applicable, submit one copy of a State and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

3.4.1 Solid Waste Management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the

definitions provided in this section), amount, location, and name of the business receiving the solid waste.

The Contractor will include copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, the Contractor may submit a statement indicating the disposal location for the solid waste which is signed by an officer of the Contractor firm authorized to legally obligate or bind the firm. The sales documentation or Contractor certification will include the receiver's tax identification number and business, EPA or State registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained by the Contractor for his own use, the Contractor will submit on the solid waste disposal report the information previously described in this paragraph. Prices paid or received will not be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.4.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged and can be coordinated with the Contracting Officer and the activity recycling coordinator. Remove all solid waste (including non-hazardous debris) from Government property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage spent hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, as per environmental law.

3.5 WASTE DETERMINATION DOCUMENTATION

Complete a Waste Determination form (provided at the pre-construction conference) for all contractor derived wastes to be generated. Base the waste determination upon either a constituent listing from the manufacturer used in conjunction with consideration of the process by which the waste was generated, EPA approved analytical data, or laboratory analysis (Material Safety Data Sheets (MSDS) by themselves are not adequate). Attach all support documentation to the Waste Determination form. As a minimum, a Waste Determination form must be provided for the following wastes (this listing is not all inclusive): oil and latex based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and all containers of the original materials.

3.6 CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG

Submit the "Contractor Hazardous Material Inventory Log"(found at: http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Material Safety Data Sheets (MSDS) to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

3.6.1 Disposal Documentation for Hazardous and Regulated Waste

Manifest, pack, ship and dispose of hazardous or toxic waste and universal waste that is generated as a result of construction in accordance with the generating facilities generator status under the Recourse Conservation and Recovery Act. Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or State permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifest must be reviewed, signed, and approved by the Navy before the Contractor may ship waste. To obtain specific disposal instructions the Contractor must coordinate with the Activity environmental office. Refer to Section 01 57 19.01 20 for the Activity Point of Contact information.

3.7 POLLUTION PREVENTION/HAZARDOUS WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of hazardous waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the Environmental Management Plan. Consult with the activity Environmental Office for suggestions and to obtain a copy of the installation's pollution prevention/hazardous waste minimization plan for reference material when preparing this part of the plan. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the types of the hazardous materials expected to be used in the construction when requesting information.

3.8 WHM/HW MATERIALS PROHIBITION

No waste hazardous material or hazardous waste shall be disposed of on government property. No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract. The government is not responsible for disposal of Contractor's waste material brought on the job site and not required in the performance of this contract. The intent of this provision is to dispose of that waste identified as waste hazardous material/hazardous waste as defined herein that was generated as part of this contract and existed within the boundary of the Contract limits and not brought in from offsite by the Contractor. Incidental materials used to support the contract including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive. The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or to the river or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

3.9 HAZARDOUS MATERIAL MANAGEMENT

No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract.

Include hazardous material control procedures in the Safety Plan. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Submit a MSDS and estimated quantities to be used for each hazardous material to the Contracting

Officer prior to bringing the material on base. Typical materials requiring MSDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. At the end of the project, provide the Contracting Officer with the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. Ensure that hazardous materials are utilized in a manner that will minimize the amount of hazardous waste that is generated. Ensure that all containers of hazardous materials have NFPA labels or their equivalent. Keep copies of the MSDS for hazardous materials on site at all times and provide them to the Contracting Officer at the end of the project. Certify that all hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste per 40 CFR 261.

3.10 PETROLEUM PRODUCTS AND REFUELING

Conduct the fueling and lubricating of equipment and motor vehicles in a manner that protects against spills and evaporation. Manage all used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while on-site exhibits a characteristic of hazardous waste. Used oil containing 1000 parts per million of solvents will be considered a hazardous waste and disposed of at Contractor's expense. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

3.10.1 Oily and Hazardous Substances

Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR 112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation. The berm will be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

3.10.2 Inadvertent Discovery of Petroleum Contaminated Soil or Hazardous Wastes

If petroleum contaminated soil or suspected hazardous waste is found during construction that was not identified in the contract documents, the Contractor shall immediately notify the Contracting Officer. The Contractor shall not disturb this material until authorized by the Contracting Officer.

3.11 FUEL TANKS

Petroleum products and lubricants required to sustain up to 30 days of construction activity may be kept on site. Storage and refilling practices shall comply with 40 CFR 112. Secondary containment shall be provided and be no less than 110 percent of the tank volume plus five inches of free-board. If a secondary berm is used for containment then the berm shall be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Drip pans are required and the tanks must be covered during inclement weather.

3.12 RELEASES/SPILLS OF OIL AND HAZARDOUS SUBSTANCES

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated by environmental law. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Base or Activity Fire Department, the activity's Command Duty Officer, and the Contracting Officer. If the contractor's response is inadequate, the Navy may respond. If this should occur, the contractor will be required to reimburse the government for spill response assistance and analysis.

The Contractor is responsible for verbal and written notifications as required by the federal 40 CFR 355, State, local regulations and Navy Instructions. Spill response will be in accordance with 40 CFR 300 and applicable State and local regulations. Contain and clean up these spills without cost to the Government. If Government assistance is requested or required, the Contractor will reimburse the Government for such assistance. Provide copies of the written notification and documentation that a verbal notification was made within 20 days.

Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous (WHM) waste spills. The Contractor shall reimburse the government for all material, equipment, and clothing generated during any spill cleanup. The Contractor shall reimburse the government for all costs incurred including sample analysis materials, equipment, and labor if the government must initiate its own spill cleanup procedures, for Contractor responsible spills, when:

a. The Contractor has not begun spill cleanup procedure within one hour of spill discovery/occurrence, or

b. If, in the government's judgment, the Contractor's spill cleanup is not adequately abating life threatening situation and/or is a threat to any body of water or environmentally sensitive areas.

3.13 CONTROL AND MANAGEMENT OF HAZARDOUS WASTES

3.13.1 Facility Hazardous Waste Generator Status

MCB Camp Lejeune is designated as a Large Quantity Generator. All work conducted within the boundaries of this activity must meet the regulatory requirements of this generator designation. The Contractor will comply with all provisions of Federal, State and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of all construction derived wastes.

3.13.2 Hazardous Waste/Debris Management

Identify all construction activities which will generate hazardous waste/debris. Provide a documented waste determination for all resultant waste streams. Hazardous waste/debris will be identified, labeled, handled, stored, and disposed of in accordance with all Federal, State, and local regulations including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Hazardous waste will also be managed in accordance with the approved Hazardous Waste Management Section of the Environmental Protection Plan. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities will be identified as being generated by the Government.

Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by activity personnel from the Station Environmental Office. No hazardous waste will be brought onto Government property. Provide to the Contracting Officer a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D. For hazardous wastes spills, verbally notify the Contracting Officer immediately.

3.13.2.1 Regulated Waste Storage/Satellite Accumulation/90 Day Storage Areas

If the work requires the temporary storage/collection of regulated or hazardous wastes, the Contractor will request the establishment of a Regulated Waste Storage Area, a Satellite Accumulation Area, or a 90 Day Storage Area at the point of generation. The Contractor must submit a request in writing to the Contracting Officer providing the following information:

Contract Number	_____	Contractor	_____
Haz/Waste or Regulated Waste POC	_____	Phone Number	_____
Type of Waste	_____	Source of Waste	_____
Emergency POC	_____	Phone Number	_____

Location of the Site: _____
(Attach Site Plan to the Request)

Attach a waste determination form. Allow ten working days for processing this request. The designated area where waste is being stored shall be barricaded and a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.13.2.2 Sampling and Analysis of HW

a. Waste Sampling

Sample waste in accordance with EPA 530/F-93/004. Each sampled drum or container will be clearly marked with the Contractor's identification number and cross referenced to the chemical analysis performed.

b. Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. The Contractor will provide all analytical results and reports performed to the Contracting Officer.

c. Analysis Type

Identify waste hazardous material/hazardous waste by analyzing for the following properties as a minimum: ignitability, corrosiveness, total chlorides, BTU value, PCBs, TCLP for heavy metals, and cyanide.

3.13.2.3 Hazardous Waste Disposal

No hazardous, toxic, or universal waste shall be disposed or hazardous material abandoned on government property. And unless otherwise other wise noted in this contract, the government is not responsible for disposal of Contractor generated waste material. The disposal of incidental materials used to accomplish the work including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive.

The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or water way or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

Control of stored waste, packaging, sampling, analysis, and disposal will be determined by the details in the contract. The requirements for jobs in the following paragraphs will be used as the guidelines for disposal of any hazardous waste generated.

a. Responsibilities for Contractor's Disposal

Contractor responsibilities include any generation of WHM/HW requiring Contractor disposal of solid waste or liquid.

(1) The Contractor agrees to provide all service necessary for the final treatment/disposal of the hazardous material/waste in accordance with all local, State and Federal laws and regulations, and the terms and conditions of the contract within sixty (60) days after the materials have been generated. These services will include all necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal, and/or transportation, including manifesting or completing waste profile sheets, equipment, and the compilation of all documentation is required).

(2) Contain all waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 272, 40 CFR 273, 40 CFR 279, 40 CFR 280, and 40 CFR 761.

(3) Obtaining a representative sample of the material generated for each job done to provide waste stream determination.

(4) Analyzing for each sample taken and providing analytical results to the Contracting Officer. Provide two copies of the results.

(5) Determine the DOT proper shipping names for all waste (each container requiring disposal) and will demonstrate how this determination is developed and supported by the sampling and analysis requirements contained herein to the Contracting Officer.

<u>Contractor Disposal Turn-In Requirements</u>

For any waste hazardous materials or hazardous waste generated which requires the Contractor to dispose of, the following conditions must be complied with in order to be acceptable for disposal:

a. Drums compatible with waste contents and drums meet DOT requirements for 49 CFR 173 for transportation of materials.

b. Drums banded to wooden pallets. No more than three (3) 55 gallon drums to a pallet, or two (2) 85 gallon over packs.

c. Band using 1-1/4 inch minimum band on upper third of drum.

d. Recovery materials label (provided by Code 106.321) located in middle of drum, filled out to indicate actual volume of material, name of material manufacturer, other vendor information as available.

e. Always have three (3) to five (5) inches of empty space above volume of material. This space is called 'outage'.

3.13.3 Class I ODS Prohibition

Class I ODS as defined and identified herein will not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition will be considered to prevail over any other provision, specification, drawing, or referenced documents. Regulations related to the protection of stratosphere ozone may be found in 40 CFR 82.

Heating and air conditioning technicians must be certified through an EPA-approved program. Copies of certifications shall be maintained at the employees' place of business and be carried as a wallet card by the technician, as provided by environmental law. Accidental venting of a refrigerant is a release and shall be reported to the Contracting Officer.

3.13.3.1 Universal Waste/e-Waste Management

Universal waste including but not limited to some mercury containing building products such florescent lamps, mercury vapor lamps, high pressure sodium lamps, CRTs, batteries, aerosol paint containers, electrical equipment containing PCBs, and consumed electronic devices, shall be managed in accordance with applicable environmental law and installation instructions.

3.14 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.14.1 Dirt and Dust Control Plan

Submit truck and material haul routes along with a plan for controlling dirt, debris, and dust on base roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

3.15 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during the designated times. Confine pile-driving operations to the period between 8 a.m. and 4 p.m., Monday through Friday, exclusive of holidays, unless otherwise specified.

3.16 MERCURY MATERIALS

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed. Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Cleanup of a mercury spill shall not be recycled and shall be managed as a hazardous waste for disposal.

-- End of Section --

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SECTION 01 57 19.01 20

SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS
05/13

PART 1 GENERAL

1.1 REGIONAL REQUIREMENTS

1.1.1 Mid-Atlantic

1.1.1.1 North Carolina

a. MCB Camp Lejeune

(1) Removal of Waste from Camp Lejeune:

Remove and dispose of rubbish and debris from Government property.

(a) Provide 24-hour advance written notice to the Contracting Office of Contractor's intention to dispose of off base.

(b) Disposal at sites or landfills not holding a valid state of North Carolina permit is specifically prohibited. The prohibition also applies to sites where a permit my have been applied for but not yet obtained.

(c) Off-base disposal of construction debris outside the parameters of this paragraph at site without State permits and/or not in accordance with regulatory requirements will require the Contractor at his own expense to remove, transport and relocate the debris to a State approved site. The Contractor will also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris.

(d) Materials which may be deposited in the landfill include:

CATEGORY	**CONSTRUCTION DEBRIS DISPOSAL - BASE SANITARY LANDFILL EXAMPLE/GENERAL INFORMATION FOR DEPOSIT IN THE LANDFILL**
Recyclable Cardboard	Breakdown corrugated cardboard boxes and deliver to the Base Recycling Center located at Building 913. If Base personnel rejects the cardboard, remove from government property.
Asphalt Pavement	Remove pavement from Government property and deliver to an asphalt-recycling establishment. Provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling establishment receiving the removed asphalt.
Asbestos	Asbestos will be accepted at the landfill.
Lead Based Paint and Materials	Well adhered lead containing paint debris as whole unit removal, will be accepted at the base landfill.

Lead scrapping chips from areas identified within the contract scope, after TCLP testing, will be disposed of at the base landfill if under 5 ppm; over 5 ppm is considered hazardous and will require manifesting per EMD rules and disposal off base at a certified, licensed disposal site.

Metals

Metals will not be accepted at the landfill. Remove metals from each and every category before delivery to the landfill. (Example: Remove hardware from doors and windows.)

Segregate metals and dispose of metal construction debris at Defense Reutilization Maintenance Office (DRMO) Building TC-861, Camp Geiger.

(2) Open Burning of Vegetative Debris for MCB Camp Lejeune and MCAS New River:

Open burning of vegetative debris is allowed in some cases. Contact Lisa Gideon, Camp Lejeune Air Quality Program Manager at (910) 451-5836 for the latest regulations, and requirements for open burning of vegetative debris.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 58 00

PROJECT IDENTIFICATION
05/13

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.

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C1	(2003) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C2	(2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

preliminary drawing indicating layout and text content; G

1.3 PROJECT SIGN

Prior to initiating any work on site, provide one project identification sign at the location designated. Construct the sign in accordance with project sign detail attached at the end of this section. Maintain sign throughout the life of the project. Upon completion of the project, remove the sign from the site.

1.3.1 Project Identification Signboard (Navy)

A project identification signboard shall be provided in accordance with the attached Plates. Provide preliminary drawing indicating layout and text content. The signboard shall be provided at a conspicuous location on the job site where directed by the Contracting Officer.

a. The field of the sign shall consist of a 4 by 8 foot sheet of grade B-B medium density overlaid exterior plywood.

b. Lumber shall be B or better Southern pine, pressure-preservative treated in accordance with AWPA C1 and AWPA C2. Nails shall be aluminum or galvanized steel.

c. The entire signboard and supports shall be given one coat of exterior alkyd primer and two coats of exterior alkyd enamel paint. The lettering and sign work shall be performed by a skilled sign painter

using paint known in the trade as bulletin colors. The colors, lettering sizes, and lettering styles shall be as indicated. Where preservative-treated lumber is required, utilize only cured pressure-treated wood which has had the chemicals leached from the surface of the wood prior to painting.

d. Use spray applied automotive quality high gloss acrylic white enamel paint as background for the NAVFAC logo. NAVFAC logo shall be an applied 2 millimeter film sticker/decal with either transparent or white background or paint the logo by stencil onto the sign. The weather resistant sticker/decal film shall be rated for a minimum of 2-year exterior vertical exposure. The self-adhering sticker shall be mounted to the sign with pressure sensitive, permanent acrylic adhesive. Shop cut sticker/decal to rectangular shape and provide pull-off backing sheet on adhesive side of design sticker for shipping.

e. Sign paint colors (manufacturer's numbers/types listed below for color identification only)

(1) Blue = To match dark blue color in the NAVFAC logo.

(2) White = To match Brilliant White color in the NAVFAC logo.

f. NAVFAC logo must retain proportions and design integrity. NAVFAC logos in electronic format may be obtained from the NAVFAC web portal via the following link:
https://portal.navfac.navy.mil/portal/page?_pageid=181,3465071&_dad=portal&_schema=p
Use the following to choose color values for the paint to be used:

(1) Dark Blue = equivalent to CMYK values 100, 72, 0, 8.

(2) Light Blue = equivalent to CMYK values 69, 34, 0, 0.

(3) Cyan = equivalent to CMYK values 100, 9, 0, 6.

(4) Yellow = equivalent to CMYK values 0.9,94, 0.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

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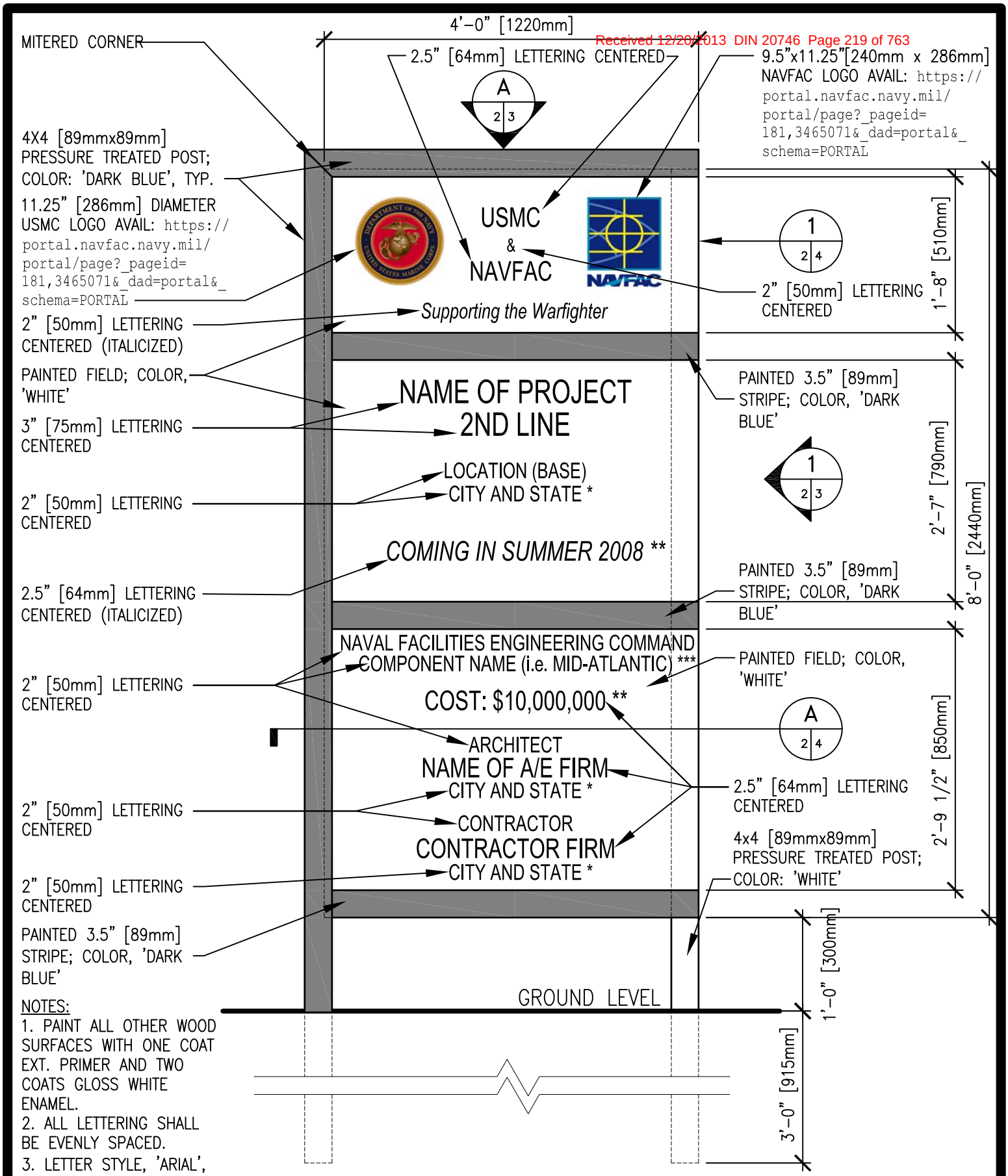


NOTES:

1. PAINT ALL OTHER WOOD SURFACES WITH ONE COAT EXT. PRIMER AND TWO COATS GLOSS WHITE ENAMEL.
2. ALL LETTERING SHALL BE EVENLY SPACED.
3. LETTER STYLE, 'ARIAL', COLOR 'DARK BLUE'. TYPICAL FOR ALL LETTERING.

*–ABBREVIATE STATE
**–CONFIRM USE WITH CONTRACTING OFFICER
***–VERIFY NAME WITH CONTRACTING OFFICER

PROJECT IDENTIFICATION SIGNBOARD FOR MARINE CORPS PROJECTS

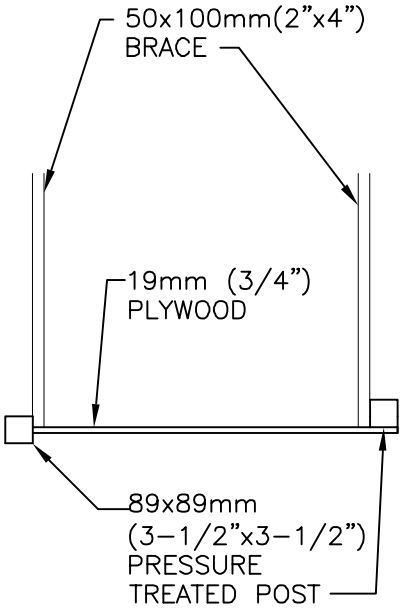
SCALE: 3/4" = 1'-0"

PLATE 1MC

REV DATE: 2008 03 18 rem

NOTE: POSTS AND BRACES SHALL BE PRESSURE TREATED. ALL FASTENINGS SHALL BE ZINC COATED.

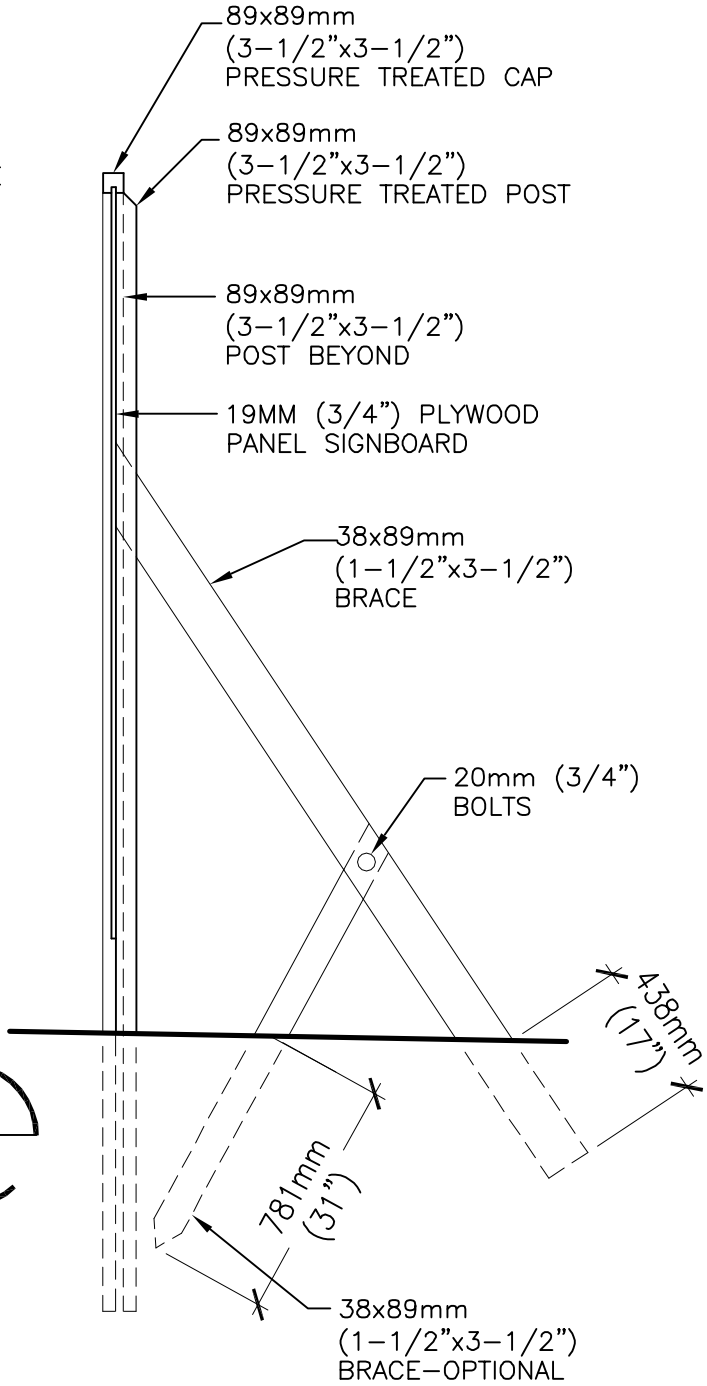
INCLUDE OPTIONAL BRACING IN UNSTABLE SOIL OR HIGH WIND ENVIRONMENTS.



TOP VIEW

SCALE: 3"=1'-0"

A
1, 2 | 3



SIDE VIEW

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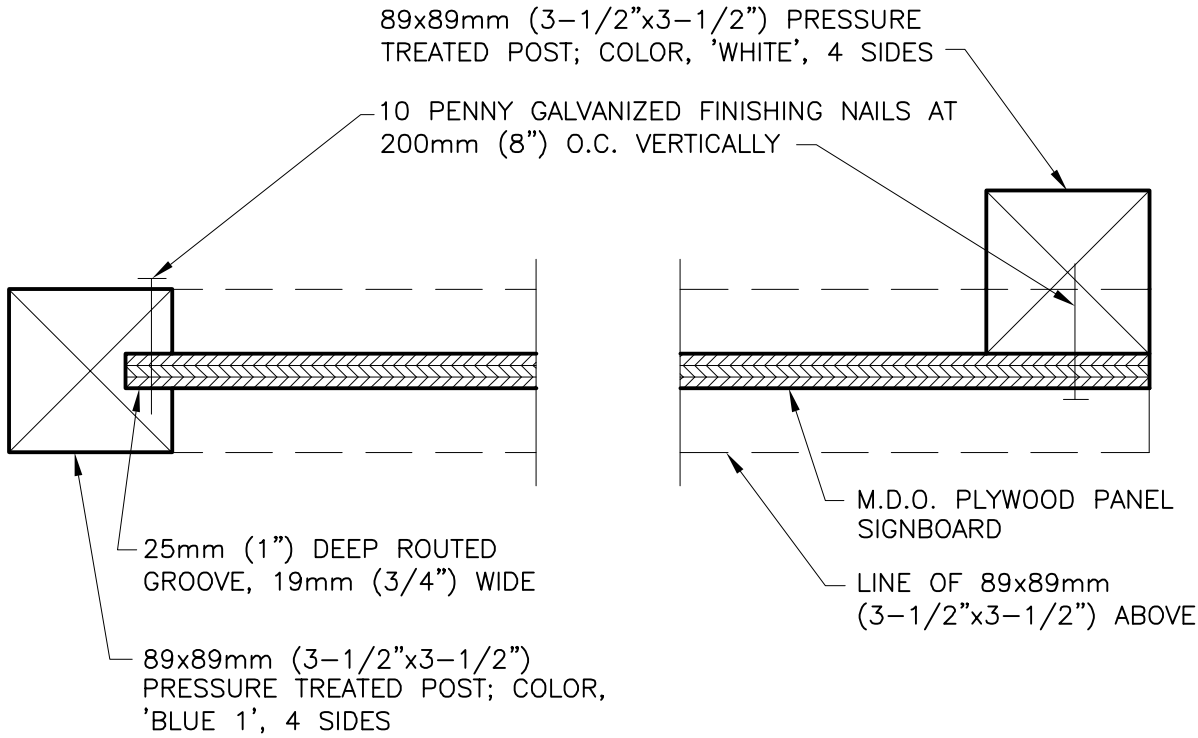
1, 2 | 3

PROJECT IDENTIFICATION SIGNBOARD SUPPORT DETAILS

SCALE: NONE

PLATE 3 OF 5



PLAN SECTION

SCALE: NONE

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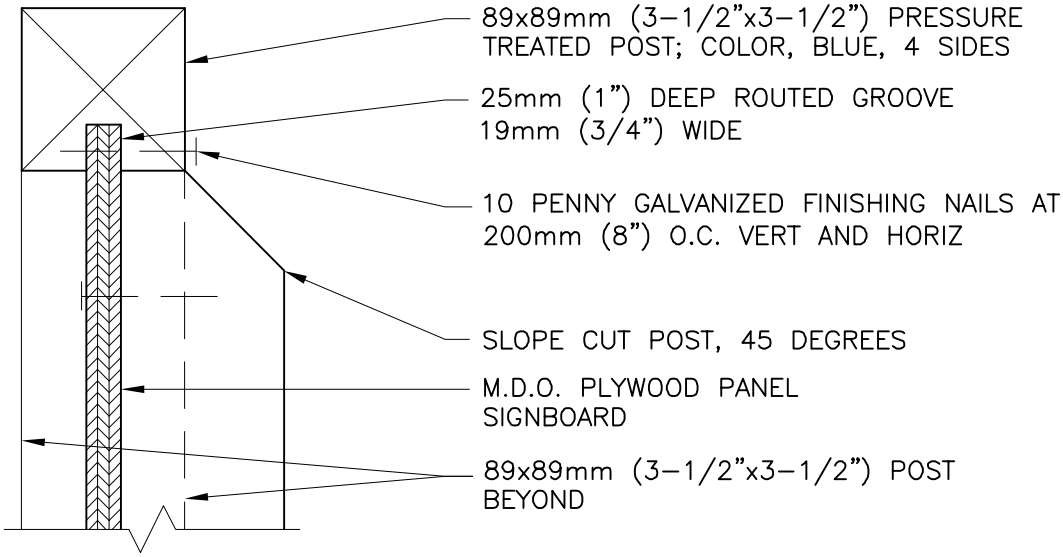

DETAIL @ END

SCALE: NONE

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PROJECT IDENTIFICATION SIGNBOARD SECTIONS

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SECTION 01 60 00.00 22

REQUIREMENTS FOR PESTICIDE AND HERBICIDE COORDINATION
05/13

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Certificate of North Carolina Licensed Applicator

SD-11 Closeout Submittals

Completed Field Pesticide/Herbicide Management Record Form

1.2 QUALITY ASSURANCE

1.2.1 Certificate of North Carolina Licensed Applicator

A North Carolina licensed applicator is required. Submit a copy of the certificate(s) to the Base Pest Management Coordinator (PMC) through the Contracting Officer.

PART 2 PRODUCTS

2.1 PESTICIDE/HERBICIDE LIST

The Contractor shall comply with Base Regulations and use only approved pesticides listed on the current "Approved Pesticide List for Camp Lejeune NC". This list is also applicable for projects located at Cherry Point, NC. The attached document is current as of the date indicated but may be revised at any time. The approved list that is current at the time of application must be utilized. Contact the Contracting Officer to obtain the current approved list.

PART 3 EXECUTION

3.1 COORDINATION WITH BASE PEST MANAGEMENT COORDINATOR (PMC)

Contractor shall coordinate with the PMC before proceeding with any pesticide/herbicide application.

3.2 Field Pesticide/Herbicide Management Record Form

Following the pesticide/herbicide application, the Contractor shall complete the attached Field Pesticide/Herbicide Management Record Form and submit to the Base Pest Management Coordinator (PMC) through the Contracting Officer. The completed form(s) shall be submitted within 15 days after application.

-- End of Section --

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FIELD **PESTICIDE / HERBICIDE** MANAGEMENT RECORD FORM

Revised 24 October 2012

Electronic Form

PROJECT / CONTRACT# _____

Instructions: **A separate form will be filled out for EACH formulation at EACH location or building (if treating inside AND outside of a building, use two separate forms).**

1. Date of Application: _____

2. Location: (Check One) ☐ Inside or ☐ Outside

3. Building # and/or Name: _____

4. Type of Pest Control Operation: _____
   (i.e. Baiting, Power Spray, Manual application of pesticides, ULV, etc.)

5. Site Description: _____
   (i.e. Office, Barracks, Housing, Warehouse, Snack Bar, Lawn, Unimproved Grounds, etc.)

6. Pest type: _____
   (i.e. Ants, Fire Ants, Cockroaches, Spiders, Termites, etc.)

7. **Contractor/Subcontractor's Company Name**: _____

8. Pesticide Used:
   a. Pesticide Trade Name: _____

   b. Pesticide Active Ingredient: _____

   c. EPA Registration #: _____

   d. Formulation (i.e. Liquid, Granular, Gel, EC, Aerosol, etc.): _____

9. Total Area treated (approximate):_____
   Units: (Check one) ☐ SF ☐ LF ☐ AC ☐ CF
   ☐ EA (for baiting, aerosol cans, etc.) ☐ Other

10. Quantity of **Pesticide Concentrate** applied (approximate) _____
    Units: (Check one) ☐ FLoz ☐ DRoz ☐ Gal ☐ QT ☐ PT ☐ LB
    ☐ PKT ☐ GR ☐ Bait Block ☐ Bait Station ☐ Briquette ☐ Other

11. **Quantity of Dilutant applied (if applicable)**:
    a. Type of Dilutant (i.e. Water, Oil, etc.): _____
    b. Units: (Check one) ☐ FLoz ☐ Gal ☐ LT ☐ ML ☐ Other

12. Comments: (i.e. Survey results, Wind conditions, Sanitation deficiencies, etc.)

    _____

13. Printed Name **AND** Signature of Applicator:

    _____

14. Certification # of Applicator: _____

APPROVED PESTICIDE LIST FOR CAMP LEJEUNE NC

Per OPNAVINST 6250.4C "All personnel applying pesticides shall be certified"

IPM - APPENDIX E

Updated: 13 August 2013

EPA Reg #	Trade Name	Intended Use	REMARKS
***Approve	Must be secured inside tamper-resistant bait boxes		
100-1006	Demon TC	Insecticide	Approve:certified applicators only
100-1055	WeatherBlok XT (formerly 10182-339) (NOTE: Must be secured inside tamper-resistant bait boxes)	Rodenticide	Approve:certified applicators only
100-1066	Demand CS (NSN#6840-01-428-6646)	Insecticide	Approve:certified applicators only
100-1091	Reward (NSN#6840-01-005-7523)	AQUATIC weeds	Approve:certified applicators only
100-1111	Archer	Roaches	Approve:certified applicators only
100-1134	Monument 75WG	Weeds	Approve:certified applicators only
100-1139	Barricade 4FL	Insecticide	Approve:certified applicators only
100-1218	Demon Max	Insecticide	Approve:certified applicators only
100-619	Subdue 2E **(NOTE: Discontinued-USE UNTIL DEPLETED)**	Fungicide	Approve:certified applicators only
100-834	Barricade 65 WG	Crabgrass,weeds	Approve:certified applicators only
100-937	Primo MAXX	Growth Regulator	Approve:certified applicators only
10163-274	Rubigan A.S. (MCCS Golf Crse)	Herbicide	Approve:certified applicators only
10182-100	Demon WP	Insecticide	Approve:certified applicators only
10182-105	Demon EC	Insecticide/Gen Household	Approve:certified applicators only
10182-107	Demon TC	Ants,Termites	Approve:certified applicators only
10182-339	Weather Block (NOTE:Must be secured inside tamper-resistant bait boxes)	Rodenticide	Approve:certified applicators only
10182-361	Demand CS	Insecticide	Approve:certified applicators only
10182-71	Demon WP	Insecticide	Approve:certified applicators only
1021-1177	Pyrocide	Insecticide	Approve:certified applicators only
1021-1620-10182	Archer	Roaches	Approve:certified applicators only
1021-1641-57056	Conquer	Insecticide	Approve:certified applicators only
1021-1812	Cirrus Fogging Concentrate	Insecticide	Approve:certified applicators only
10404-43	Three-Way **(Labeled "DANGER")**	Herbicide	Approve:certified applicators only
10404-89	Stonewall .43% Plus Fertilizer	Herbicide	Approve:certified applicators only
11540-1	ULD BP-300	Insecticide	Approve:certified applicators only

11540-27	Pro-Control Fogger II	Insecticide	Approve:certified applicators only
11540-9	ULD BP-100	Insecticide	Approve:certified applicators only
11649-7	Avitrol Whole Corn	Avicide	Approve:certified applicators only
12455-34	Contrac All Weather Cake (NOTE: Must be secured inside tamper-resistant bait boxes)	Rodenticide	Approve:certified applicators only
12455-5AA	Bell Rodent Cake (Quintox) (NOTE: Must be secured inside tamper-resistant bait boxes)	Rodenticide	Approve:certified applicators only
12455-61	Liqua-Tox II (NSN#6840-00-753-4972) (NOTE: Must be secured inside tamper-resistant bait boxes)	Rodenticide	Approve:certified applicators only
12455-69	Contrac Bait (NOTE: use only OUTSIDE of bldgs)	Rodenticide	Approve:certified applicators only
12455-79	Contrac All Weather Bait Blocks (NSN#6840-01-501-2858)	Rodenticide	Approve:certified applicators only
12455-82	Contrac Blox (Super Size)	Rodenticide	Approve:certified applicators only
149-8	Terro Liquid Ant Killer (1 oz))(Lowe's)	Ants	Approve:certified applicators only
149-8-64405	Terro Ant Bait Gel	Insecticide	Approve:certified applicators only
1624-39	Tim-Bor	Termites	Approve:certified applicators only
1730-67	Maxforce Roach Control System	Insecticide	Approve:certified applicators only
1730-72	Maxforce Pharaoh Ant Killer	Insecticide	Approve:certified applicators only
1812-307	K-Tea	Algaecide	Approve:certified applicators only
19713-60	Simazine 4L	Weeds & Vines	Approve:certified applicators only
2217-774	Gordans Brushkiller	Poison Ivy/Vines	Approve:certified applicators only
2217-833	SpeedZone	Weeds	Approve:certified applicators only
2217-835	Southern Speedzone	Weeds	Approve:certified applicators only
228-317	Cool Power	Weeds	Approve:certified applicators only
228-480	Polaris AC (G10 Aerial Spray approved 5/18/2010)	Herbicide	Approve:certified applicators only
228-534	Polaris	Herbicide	Approve:certified applicators only
239-1349	Sevin 5 Dust	Insecticide/Miticide	Approve:certified applicators only
239-2663	Ortho Home Defense	Insecticide	Approve:certified applicators only
239-2665	Ortho Weed B-Gone / Crabgrass Killer	Weeds/Crabgrass	Approve:certified applicators only
241-267	Maxforce Roach Control System	Insecticide	Approve:certified applicators only
241-365	Plateau (NSN#6840-01-525-5869)	Herbicide	Approve:certified applicators only
241-372	Sahara DG Herbicide	Cracks, Concrete	Approve:certified applicators only

241-392	Phantom (NSN#6840-01-525-7139)	Insecticide	Approve:certified applicators only
241-426	Habitat (NSN#6840-01-532-5403) (NOTE:only MCAS is approved for use to control alligator weeds)	Herbicide	Approve:certified applicators only
241-430	Chopper Gen2 (approved for Wildlife)	Herbicide	Approve:certified applicators only
2724-274	Golden Malrin (NSN#6840-01-183-7244)	Flying insects	Approve:certified applicators only
2724-304-50809	Gencor 5E	IGR	Approve:certified applicators only
2724-311-50809	Gencor Fogger	IGR	Approve:certified applicators only
2724-324-50809	Gencor Plus Fogger	IGR	Approve:certified applicators only
2724-351	Gentrol IGR (NSN#6840-01-318-7416)	Roaches	Approve:certified applicators only
2724-404-50809	Petcor Flea Spray	IGR	Approve:certified applicators only
2724-421	Altosid XR Briquets (NSN#6840-01-424-2495)	AQUATIC mosquito larvae	Approve:certified applicators only
2724-451	Prestrike IGR	Insecticides	Approve:certified applicators only
2724-475	Extinguish Professional Fire Ant Bait	Fire Ants	Approve:certified applicators only
2724-490	Precor 2000 Plus / Premise	Insecticide	Approve:certified applicators only
279-3062	Dragnet	Insecticide	Approve:certified applicators only
279-3105	Talstar Flowable Insecticide/Miticide	Insecticide	Approve:certified applicators only
279-3162	Talstar lawn & Tree Flowable Insecticide/Miticide	Insecticide	Approve:certified applicators only
279-3167	Talstar GC Granular Insecticide	Insecticide	Approve:certified applicators only
279-3168	Talstar PL	Insecticide	Approve:certified applicators only
279-3206	Talstar One (Pre-treat for Termites)(NSN#6840-01-525-6888)	Insecticide	Approve:certified applicators only
3125-121	Baygon 2% Bait	Insecticide	Approve:certified applicators only
3125-390	Tempo Ultra WP	Insecticide	Approve:certified applicators only
3125-498	Tempo SC Ultra	Insecticide	Approve:certified applicators only
352-346	Hyvar XL (NSN#6840-00-392-7593)	Herbicide	Approve:certified applicators only
352-439	Escort XP	Kudzu	Approve:certified applicators only
352-627	Advion Fire Ant Bait Granular	Insecticide	Approve:certified applicators only
352-643	TranXit	Weeds	Approve:certified applicators only
352-651	Advion Insect Granule	Rodenticide	Approve:certified applicators only
352-652	Advion Cockroach Gel Bait	Insecticide/Roaches	Approve:certified applicators only
352-664	Advion Ant Bait Arena	Insecticide	Approve:certified applicators only

352-668	Advion Roach Arena	Roaches	Approve:certified applicators only
352-746	Advion Ant Gel Bait	Ants	Approve:certified applicators only
352-776	Arilon	Insecticide	Approve:certified applicators only
35915-12-48234	Regal Wynstar	Weeds	Approve:certified applicators only
397-13	SteriFab (Mattress Sanitizer)	Insecticide/Sanitizer	Approve:certified applicators only
40208-2	RAZE	Crawling & Flying insects	Approve:certified applicators only
40849-76	RoachMax Bait Stations	Insecticide	Approve:certified applicators only
42750-29	Weed-Hoe 108	Weeds	Approve:certified applicators only
432-1217	TOP CHOICE Fire Ant / Fipronil (NSN#6840-01-585-9950) **(Labeled "RESTRICTED USE")**	Insecticide/Fire Ants	Approve:certified applicators only
432-1223	ProStar 70 WP	Fungicide	Approve:certified applicators only
432-1231	Illoxan 3EC **(NOTE:Discontinued:use until depleted)**	Goosegrass,crabgrass	Approve:certified applicators only
432-1251	Maxforce Roach Station	Insecticide	Approve:certified applicators only
432-1254	Maxforce Gel Bait	Roaches	Approve:certified applicators only
432-1255	Maxforce Granular Insect Bait	Insecticide	Approve:certified applicators only
432-1256	Maxforce Ant Bait Stations (NSN#6840-01-298-1122)	Insecticide	Approve:certified applicators only
432-1257	Maxforce FC (Sml Roach)	Insecticide	Approve:certified applicators only
432-1264	Maxforce FC Ant Killer Bait Gel (NSN#6840-01-500-4579)	Insecticide	Approve:certified applicators only
432-1318	Prokox Zenith 75 WSP	Turf Pests	Approve:certified applicators only
432-1331	Premise (Pre Construction Insecticide)	Insecticide	Approve:certified applicators only
432-1332	Premise 75 / Centerfire 75 WSP	Termites	Approve:certified applicators only
432-1332-73748	Imaxx Pro	Insecticide	Approve:certified applicators only
432-1368	Premise Gel	Insecticide	Approve:certified applicators only
432-1375	Maxforce Fly Granular Bait (NSN#6840-01-518-5807)	Flying insects	Approve:certified applicators only
432-1391	Premise Foam	Termites	Approve:certified applicators only
432-1433	MaxForce FC Fire Ant Bait	Insecticide	Approve:certified applicators only
432-1449	Premise Pro	Insecticide	Approve:certified applicators only
432-1455	Maxforce Fly Spot Bait (NSN#6840-01-555-9369)	Insecticide	Approve:certified applicators only
432-1460	Maxforce FC Magnum Roach Killer Bait Gel	Insecticide/Roaches	Approve:certified applicators only
432-1477	ProStar 70 WDG	Insecticide	Approve:certified applicators only

432-1483	Temprid SC	Ants, Roaches	Approve:certified applicators only
432-667	SCOURGE **(Labeled "RESTRICTED USE")** Note: BASE use only	Mosquitos	Approve:certified applicators only
432-716	SCOURGE (NSN#6840-01-359-8533) **(Labeled "RESTRICTED USE")** Note: PrevMed or BASE use only	Mosquitos	Approve:certified applicators only
432-763	Suspend SC	Ants	Approve:certified applicators only
432-772	Delta Dust (NSN#6840-01-431-3345)	Bees,Wasps,Hornets	Approve:certified applicators only
432-824	DeltaGard G Insecticide Granules	Ants	Approve:certified applicators only
432-835	Delta Guard GC	Insecticide	Approve:certified applicators only
432-836	DeltaGard G Insecticide Granules	Insecticide	Approve:certified applicators only
432-900	Termidor 80 WG	Insecticide	Approve:certified applicators only
432-901	Termidor SC	Insecticide	Approve:certified applicators only
432-992	Drione Dust	Insecticide/Gen Household	Approve:certified applicators only
499-450	Pyrethrin / PBO / UDL BP-300 (NSN#6840-01-104-0780)	Adult Mosquitos	Approve:certified applicators only
44313-4-550	Borid	Insecticide	Approve:certified applicators only
47000-73-1677	SSI-50	Insecticide	Approve:certified applicators only
4787-23	Glyfos X-tra	Weeds & Vines	Approve:certified applicators only
4816-353	Drione Insecticide	Insecticide	Approve:certified applicators only
4822-167	OFF Deep Woods Insect Repellent-6 oz (available thru SERVMART-GSA)	Insecticide	Locally approved:SERVMART-GSA
4822-513	Raid Ant & Roach Killer (aerosol)	Insecticide	Approve:certified applicators only
48234-15	RegalStar II Weed & Feed	Weeds	Approve:certified applicators only
48813-1	Saf-T-Side	Insecticides	Approve:certified applicators only
499-147	Whitmire PT 270 Dursban **(NOTE: Discontinued:use until depleted)**	Insecticide	Restricted-cxld 2001:certified applicators only
499-156	Whitmire PT 260 Diazinon **(NOTE: Discontinued:use until depleted)**	Insecticide	Restricted-cxld 2004:certified applicators only
499-233	Whitmire PT 170 X-clude	Insecticide	Approve:certified applicators only
499-235	Whitmire PT 170A X-clude	Insecticide	Approve:certified applicators only
499-290	PT 565 Plus XLO (NSN#6840-00-823-7849)	Roaches	Approve:certified applicators only
499-294	Avert Dry Flowable Cockroach Bait/ Whitmire AvertPT310 Abamectin Dust (NSN#6840-01-561-9766)	Insecticide/Roaches	Approve:certified applicators only
499-304	Cy-Kick CS Prescription Treatment	Insecticide	Approve:certified applicators only
499-362	Wasp Freeze / Wasp Stopper II Plus / Whitmire PT 515 Wasp Freeze (NSN#6840-00-459-2243)	Wasps, bees, hornets	Approve:certified applicators only

499-370	Advance 375A Select Granular Ant Bait / PT Advance Granular Ant Bait / Whitmire PT 370 Ascend Fire Ant Bait	Insecticides/Ants	Approve:certified applicators only
499-373	PT Orthene / Orthene Crack & Crevice Residual	Ants,Roaches	Approve:certified applicators only
499-381	PT Microcare	Insecticide	Approve:certified applicators only
499-384	Perma Dust Boric Acid Aerosol (NSN#6840-01-287-3938)	Roaches	Approve:certified applicators only
499-385	Tri-Die	Insecticide	Approve:certified applicators only
499-394	Whitmire Avert Prescript Treatment 320 Crack&CreviceGelBait	Insecticide	Approve:certified applicators only
499-404	Ultracide Flea IGR & Adulticide	Insecticide	Approve:certified applicators only
499-406	Avert Prescription Treatment Cockroach Bait Gel Formula 2	Insecticide	Approve:certified applicators only
499-410	Avert Prescription Treatment TC 93B Cockroach Bait Gel	Insecticide	Approve:certified applicators only
499-444	PT 580P (Pyrethrins) / Whitmire P.I. Contact Insecticide	Insecticide	Approve:certified applicators only
499-452	BP-100	Insecticide	Approve:certified applicators only
499-459	Advance Dual Choice Ant Bait Stations	Insecticide	Approve:certified applicators only
499-462	Pro-Control Plus	Insecticide	Approve:certified applicators only
499-465	Pro-Control	Insecticide	Approve:certified applicators only
499-470	Cy-Kick (NSN#6840-01-561-9717)	Insecticide	Approve:certified applicators only
499-501	PT 250 Propoxur (NSN#6840-01-338-2486)	Insecticide	Approve:certified applicators only
499-518	PT 2% Propoxur Bait	Insecticide	Approve:certified applicators only
499-535	Cyhalocap CS	Pesticide	Approve:certified applicators only
50404-5	Permanone Aerosol 0.5% (NSN#6480-01-278-1336) Bldg 1606 Re-issue	Tick/Mosquito Repellant	Approve:certified applicators only
50404-6	Permanone Aerosol 0.5% (NSN#6480-01-278-1336) Bldg 1606 Re-issue	Tick/Mosquito Repellant	Locally approved
50534-202	Daconil Ultrex	Fungicide	Approve:certified applicators only
51036-330-59807	OHP 6672 50W	Fungicide	Approve:certified applicators only
51036-392	Bifenthrin Pro	Insecticide	Approve:certified applicators only
524-343	Aqua Master	AQUATIC Herbicide	Approve:certified applicators only
524-454	Honcho Plus Herbicide (G10 Aerial Spray approved 5/18/2010)	Weeds & Vines	Approve:certified applicators only
524-465	Manage / SedgeHammer **(NOTE: Discontinued:use until depleted)**	Nutsedges	Approve:certified applicators only
524-475	ROUND-UP PRO / Ranger Pro (NSN#6840-01-108-9578)	Herbicide/Weeds	Approve:certified applicators only
524-535	Quick Pro Roundup (NSN#6840-01-399-0673)	Weeds & Vines	Approve:certified applicators only
53883-118	Bifenthrin	Insecticide	Approve:certified applicators only

53883-124	Bifen LP Granules	Insecticide	Approve:certified applicators only
53883-125-48234	Broadcide **(Labeled "RESTRICTED USE")** Note: MCCS Golf Crs use	Insecticide	Approve:certified applicators only
53883-165-73220	Qualif-Pro Bifenthrin 7.9 **(Labeled "RESTRICTED USE")** Note: MCCS Golf Crs use	Insecticide	Approve:certified applicators only
55809-3	Wasp & Hornet Killer Plus "Available SERVMART-GSA or issued to units thru SELF HELP 451-0071 (WO needed)"	Insecticide	Approve: SERVMART-GSA / SELF HELP or certified applicators only
56-42	JT Eaton Bait Block Rodenticide	Rodenticide	Approve:certified applicators only
56-58	JT Eaton AC Formula (NSN#684CL0002194) (Note: used in tamper-resistant bait stations unless they are being placed into rodent burrows)	Rodenticide	Approve:certified applicators only
58007-1	DEET repellent / Ultrathron/arthropod (NSN#6840-01-284-3982)	Mosquitos	Approve:certified applicators only
58630-1	Snake-A-Way	Repellent	Approve:certified applicators only
59639-114	Esteem Ant Bait	Fire Ants	Approve:certified applicators only
59639-31	Orthene PCO Pellets	Insecticide	Approve:certified applicators only
60063-26-10404	Stonewall 65WDG	Herbicide	Approve:certified applicators only
6218-47	Summit Bti Briquets (NSN#6840-01-377-7049)	AQUATIC Mosquito larvae	Approve:certified applicators only
62719-142	Rubigan A.S. (MCCS Golf Crse)	Herbicide	Approve:certified applicators only
62719-175	SnapShot 2.5 TG	Herbicide	Approve:certified applicators only
62719-260	Crossbow Brush Killer	Weeds & Vines	Approve:certified applicators only
62719-324	Rodeo / Accord (NSN#6840-01-356-8893)	AQUATIC herbicide	Approve:certified applicators only
62719-37	**Garlon 3A (NAVFAC Disapproved 10/9/08)**	**Kudzu**	**DISAPPROVED**
62719-37-67690	Renovate 3 **(Labeled "DANGER"-follow label/PPE guidelines)**	Herbicide/Weeds	Approve:certified applicators only
62719-388	Fore 80 WP Rainshield	Fungicide	Approve:certified applicators only
62719-397	Kerb 50 WP	Weeds	Approve:certified applicators only
62719-40	GARLON 4 / Element 4	Kudzu	Approve:certified applicators only
62719-426	Dimension EC	Weeds	Approve:certified applicators only
62719-529	Scythe Herbicide	Cracks, Flowerbeds	Approve:certified applicators only
62719-553	Garlon XRT (G10 Aerial Spray approved 5/18/2010)	Herbicide	Approve:certified applicators only
63120-1	Insect/Arthropod Repellent Fabric Treatment (NSN#6840-01-334-2666) (Note:PrevMed Use only)	Insecticide	Approve:certified applicators only
64248-1	Maxforce Roach Control System	Insecticide	Approve:certified applicators only
64248-11	Maxforce FC Roach Bait Stations	Insecticide	Approve:certified applicators only

64248-12	Maxforce Large Roach Bait F03	Insecticide	Approve:certified applicators only
64248-14	Maxforce FC Roach Killer Bait Gel	Insecticide	Approve:certified applicators only
64248-19	Maxforce Fine Granule Insect Bait	Ants	Approve:certified applicators only
64248-2	Maxforce Ant Killer Bait Station	Ants	Approve:certified applicators only
64248-21	Maxforce EC Bait Gel	Insecticide	Approve:certified applicators only
64248-5	Maxforce Roach Killer Bait Gel	Roaches	Approve:certified applicators only
64248-6	Maxforce Ant Killer/Granular Bait	Insecticide	Approve:certified applicators only
64405-1	Bora-Care	Insect/Fungicide	Approve:certified applicators only
64405-2	Niban Fine Granular Bait	Fire Ants	Approve:certified applicators only
64405-8	Tim-Bor	Wood Destroying Fungi	Approve:certified applicators only
655-798	ExciteR	Insecticide	Approve:certified applicators only
655-802	Larva-Lur	Insecticide	Approve:certified applicators only
66222-149-73220	PrimeraOne Chlorothalonil DF **(Labeled "DANGER"-follow label/PPE guidelines)** Note:MCCS Golf Crs use	Insecticide	Approve:certified applicators only
66222-212-48234	Solace	Insecticide	Approve:certified applicators only
66222-22	PRAMITOL 25E (NSN#6840-00-145-0013)	Weeds	Approve:certified applicators only
67425-14	EcoPCO ACU	Insecticide	Approve:certified applicators only
67425-15	EcoPCO WPX	Insecticide	Approve:certified applicators only
6754-22-5802	Drione	Insecticide	Approve:certified applicators only
6959-51	Cessco 5 E	Insecticide	Approve:certified applicators only
70506-6	Tenguard	Insecticide	Approve:certified applicators only
7173-188	Maki Pellets (NSN#6840-01-151-4884)	Rodenticide	Approve:certified applicators only
7173-258	**First Strike (NAVFAC Disapproved 8/12/2011)**	**Rodenticide**	**DISAPPROVED**
71995-33	ROUND-UP READY TO-USE-PLUS (NSN#6840-01-377-7113) "issued to units ONLY thru SELF HELP 451-0072 (WO needed)"	Weeds	Approve: SELF HELP or certified applicators only
71995-36	ROUND-UP READY TO USE-PLUS POISON IVY "issued to units ONLY thru SELF HELP 451-0072 (WO needed)"	Poison Ivy/Vines	Approve: SELF HELP or certified applicators only
72155-55	Bayer Advanced	Insecticide	Approve:certified applicators only
72155-58	Tempo 2.5 SC Ultra	Insecticide	Approve:certified applicators only
73079-2	In Tice granular bait	Roaches	Approve:certified applicators only
73342-1	AMDRO Fire Ant Bait "issued to units ONLY thru SELF HELP 451-0072 (WO needed)"	Fire Ants	Approve: SELF HELP or certified applicators only

7969-209	Termidor 80 WG (NSN#6840-01-483-3072)	Termites	Approve:certified applicators only
7969-210	Termidor SC T/L (NSN#6840-01-483-3068)	Termites	Approve:certified applicators only
7969-212	OVER & OUT (Fipronil)(Lowe's)	Fire Ants	Approve:certified applicators only
81880-1-10163	SedgeHammer	Nutsedges	Approve:certified applicators only
81927-7	Alligare MSM 60 (Base Stables)	Herbicide	Approve:certified applicators only
8254-5-56	Bird-B-Gone Transparent Bird Gel Repellent	Pigeons	Locally approved:certified applicators only
8329-40	Biomist 1.5+7.5 ULV	Mosquitos	Approve:certified applicators only
83487-1	Uncle Albert's Super Smart Ant Bait	Insecticide	Approve:certified applicators only
83529-2	Midash 2SC T&O	Insecticide	Approve:certified applicators only
9444-129	Borid	Insecticide	Approve:certified applicators only
9444-131	Drax Ant Kill Gel	Insecticide	Approve:certified applicators only
9444-135	Drax Ant Kil PF	Insecticide	Approve:certified applicators only
9444-150	Turbo Aerosol (Aerosol Boric Acid)	Insecticide	Approve:certified applicators only
9444-158	**Purge III (NAVFAC Disapproved 8/4/2000)**	**Flies**	**DISSAPPROVED**
9444-175	CB 80 Extra	Insecticide	Approve:certified applicators only
9444-182	Air Devil Aerosol (NSN#6840-01-561-9726)	Insecticide	Approve:certified applicators only
9444-183	Intruder HPX Aerosol	Roaches	Approve:certified applicators only
9444-217	D-Force HPX (NSN#6840-01-561-9745)	Insecticide	Approve:certified applicators only
9688-123-8845	Spectracide Immunox Fungicide Spray	Insecticide	Approve:certified applicators only
9688-193-8845	HOTSHOT MAXATTRAX ULTRA ROACH BAIT (12 per pk) "issued to units thru SELF HELP 451-0072 (WO needed)"	Insecticide	Locally approved: SELF HELP
9688-214-8845	HOTSHOT MAXATTRAX ANT BAIT (4 per pk) "issued to units thru SELF HELP 451-0072 (WO needed)"	Insecticide	Locally approved: SELF HELP
9688-237-8845	Spectracide Triazicide Insect Killer Concentrate	Insecticide	Approve:certified applicators only
FIFRA Exempt	Eco Exempt IC	Insecticide	Approve:certified applicators NOT required
Not regulated	Bac A Zap	Bacteria/Odor/Drain Fly	Approve:certified applicators NOT required
Not regulated	Deer Stopper Concentrate-Messina Wildlife	Deer	Locally approved:certified applicators NOT required
Not regulated	Osmocote Slow Release	Fertilizer not pesticide	Approve:certified applicators NOT required
Not regulated	Kleer-Out - Geraniol	Fire Ants	Locally approved:certified applicators NOT required
Not regulated	EcoSMART (Flying & Crawling Insects) (available thru SERVMART-GSA)	Flying & Crawling insects	Locally approved:SERVMART-GSA / certified applicators NOT required

Not regulated	Liquid Fertilizer	Housing area	Approve:certified applicators NOT required
Not regulated	Eco Exempt D	Insecticide	Approve:certified applicators NOT required
Not regulated	Eco Exempt G	Insecticide	Approve:certified applicators NOT required
Not regulated	Mosquito Barrier	Mosquitos	Approve:certified applicators NOT required
Not regulated	Allure Pheromone Moth Traps	Moth	Approve:certified applicators NOT required
Not regulated	StorGard Pheromone Traps	Moth	Approve:certified applicators NOT required
Not regulated	CatchMaster Glueboards	Rodents & Insects	Approve:certified applicators NOT required
Not regulated	Predascent (available thru SERVMART-GSA)	Snake Repellent	Approve:SERVMART-GSA / certified applicators NOT required
Not regulated	Pyrethiums	Fruit Bug	Approve:certified applicators NOT required
Not requlated	Cazamoscas Fly Catcher (Base Stables)	Flys	Approve:certified applicators NOT required
	*****BELOW LIST DOES NOT REQUIRE CERTIFIED APPLICATORS (NOT REGULATED OR EXEMPT)*****		

Camp Lejeune Pest Management Coordinator:
William Parkin (Environmental Management Department) (910) 451-7018 email william.parkin@usmc.mil
Link to the AUL for the PMP:
For External Site: http://www.lejeune.marines.mil/OfficesStaff/EnvironmentalMgmt/HazardousWasteMaterialManagement.aspx
For Internal Site :https://em.usmc.mil/sites/le/default.aspx

SECTION 01 62 35

RECYCLED / RECOVERED MATERIALS
09/12

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.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. Make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or

proposed by EPA to include recycled or recovered materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 74 19

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
05/13

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse.

1.2 MANAGEMENT

Develop and implement a waste management program as specified. Take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste 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 completion mandates. The Contractor is responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling accrue to the Contractor. Appropriately permit firms and facilities used for recycling, reuse, and disposal for the intended use to the extent required by federal, state, and local regulations. Also, provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Waste Management Plan; G

SD-11 Closeout Submittals

Records

1.4 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting

with the Contracting Officer to discuss the proposed Waste Management Plan and to develop a mutual understanding relative to the details of waste management. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting outlined in Section 01 45 00.00 20 QUALITY CONTROL. At a minimum, environmental and waste management goals and issues shall be discussed at the following additional meetings:

a. Pre-bid meeting.

b. Preconstruction meeting.

c. Regular meetings.

d. Work safety meetings.

1.5 WASTE MANAGEMENT PLAN

A waste management plan shall be submitted within 15 days after contract award and not less than 10 days before the preconstruction meeting. The plan shall demonstrate how the project waste diversion goal shall be met and shall include the following:

a. Name of individuals on the Contractor's staff responsible for waste prevention and management.

b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.

c. Description of the regular meetings to be held to address waste management.

d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of wastes.

e. Characterization, including estimated types and quantities, of the waste to be generated.

f. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.

g. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity. Include the name, location, and phone number for each reuse facility to be used, and provide a copy of the permit or license for each facility.

h. List of specific waste materials that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Recycling facilities that will be used shall be identified by name, location, and phone number, including a copy of the permit or license for each facility.

i. Identification of materials that cannot be recycled/reused with an explanation or justification, to be approved by the Contracting Officer.

j. Description of the means by which any waste materials identified in item (h) above will be protected from contamination.

k. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).

l. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Distribute copies of the Waste Management Plan to each subcontractor, the Quality Control Manager, and the Contracting Officer.

1.6 RECORDS

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 by landfill or incineration. Quantities may be measured by weight or by volume, but must be consistent throughout. List each type of waste separately noting the disposal or diversion date. Identify the landfill, recycling center, waste processor, or other organization used to process or receive the solid waste. Provide explanations for any waste not recycled or reused. With each application for payment, submit updated documentation for solid waste disposal and diversion, and submit manifests, weight tickets, receipts, and invoices specifically identifying the project and waste material. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction.

1.7 COLLECTION

Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in a manner that maximizes recyclability and salvagability of identified materials. Provide the necessary containers, bins and storage areas to facilitate effective waste management and clearly and appropriately identify them. Provide materials for barriers and enclosures around recyclable material storage areas which are nonhazardous and recyclable or reusable. Locate out of the way of construction traffic. Provide adequate space for pick-up and delivery and convenience to subcontractors. Recycling and waste bin areas are to be kept neat and clean, and recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials. Clean contaminated materials prior to placing in collection containers. Use cleaning materials that are nonhazardous and biodegradable. Handle hazardous waste and hazardous materials in accordance with applicable regulations. Separate materials by one of the following methods:

1.7.1 Source Separated Method.

Waste products and materials that are recyclable shall be separated from

trash and sorted as described below into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the following category types as appropriate to the project waste and to the available recycling and reuse programs in the project area:

a. Land clearing debris.

b. Asphalt.

c. Concrete and masonry.

d. Metal (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, lead brass, bronze).

(1) Ferrous.

(2) Non-ferrous.

e. Wood (nails and staples allowed).

f. Debris.

g. Glass (colored glass allowed).

h. Paper.

(1) Bond.

(2) Newsprint.

(3) Cardboard and paper packaging materials.

i. Plastic.

(1) Type 1: Polyethylene Terephthalate (PET, PETE).

(2) Type 2: High Density Polyethylene (HDPE).

(3) Type 3: Vinyl (Polyvinyl Chloride or PVC).

(4) Type 4: Low Density Polyethylene (LDPE).

(5) Type 5: Polypropylene (PP).

(6) Type 6: Polystyrene (PS).

(7) Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

j. Gypsum.

k. Non-hazardous paint and paint cans.

l. Carpet.

m. Ceiling tiles.

n. Insulation.

o. Beverage containers.

1.7.2 Co-Mingled Method.

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.7.3 Other Methods.

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.8 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures. Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.8.1 Reuse.

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Coordinate reuse with the Contracting Officer. Sale or donation of waste suitable for reuse shall be considered.

1.8.2 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

1.8.3 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

1.8.4 Return

Set aside and protect misdelivered and substandard products and materials and return to supplier for credit.

PART 2 PRODUCTS

Not used.

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PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS
05/13

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.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37	(2000; R 2009) Industrial and Institutional Cleaners

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08	(2009, with Change 2) Criteria for Transfer and Acceptance of DoD Real Property

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials
Warranty Management Plan
Warranty Tags
Final Cleaning
Spare Parts Data

SD-08 Manufacturer's Instructions

Preventative Maintenance
Condition Monitoring (Predictive Testing)
Inspection
Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

Record Drawings
NAVFAC Sustainable & Energy Data Record Card; G
Certification of EPA Designated Items; G
Preliminary Interim DD Form 1354; G
Updated Interim DD Form 1354; G

1.3 PROJECT RECORD DOCUMENTS

1.3.1 Record Drawings

This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions. The final CAD record drawings must consist of one set of electronic CAD drawing files in the specified format, 2 sets of prints, and one set of the approved working Record drawings.

1.3.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file record drawings.

1.3.1.2 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Prepare final record (as-built) drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final record (as-built) drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final record drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the record drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. Show on the working and final record drawings , but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, show only the option selected for construction on the final as-built prints.

h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

j. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.

(1) Follow directions in the modification for posting descriptive changes.

(2) Place a Modification Delta at the location of each deletion.

(3) For new details or sections which are added to a drawing, place a Modification Delta by the detail or section title.

(4) For minor changes, place a Modification Delta by the area changed on the drawing (each location).

(5) For major changes to a drawing, place a Modification Delta by the title of the affected plan, section, or detail at each location.

(6) For changes to schedules or drawings, place a Modification Delta either by the schedule heading or by the change in the schedule.

(7) The Modification Delta size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.3.1.3 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate. These drawings are part of the

permanent records of this project and must be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor must be satisfactorily replaced by the Contractor at no expense to the Government.

1.3.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only employ personnel proficient in the preparation of CADD drawings to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CADD files. The Contractor will be furnished "as-designed" drawings in AutoCad Release 2010 format compatible with a Windows XP operating system. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). Provide all program files and hardware necessary to prepare final record drawings. The Contracting Officer will review final record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

a. Provide CADD "base" colors of red, green, and blue. Color code for changes as follows:

   (1) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

   (2) Additions (Green) - Added items, lettering in notes and leaders.

   (3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

b. Rename the Contract Drawing files in a manner related to the contract number (i.e., 98-C-10.DGN) as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. All changes shall be made on the layer/level as the original item.

c. When final revisions have been completed, show the wording "RECORD DRAWINGS / AS-BUILT CONDITIONS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Mark all other contract drawings either "Record" drawing denoting no revisions on the sheet or "Revised Record" denoting one or more revisions. Date original contract drawings in the revision block.

d. Within 20 days for contracts $5 million and above after Government approval of all of the working record drawings for a phase of work, prepare the final CADD record drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days for contracts $5 million and above revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days for contracts $5 million and above of substantial completion of all phases of work,

submit the final record drawing package for the entire project. Submit one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working record drawings. They must be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record drawing files and marked prints as specified will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made to the Contractor.

1.3.1.5 Payment

No separate payment will be made for record drawings required under this contract, and all costs accrued in connection with such drawings are considered a subsidiary obligation of the Contractor.

1.3.2 As-Built Record of Equipment and Materials

Furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Submit Two sets of final record of equipment and materials 10 days after final inspection. Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

1.3.3 Final Approved Shop Drawings

Furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.3.4 Construction Contract Specifications

Furnish final record (as-built) construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.3.5 Real Property Equipment

Furnish a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of

manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Furnish a draft list at time of transfer. Furnish the final list 30 days after transfer of the completed facility.

1.4 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

1.5 PREVENTATIVE MAINTENANCE

Submit Preventative Maintenance, Condition Monitoring (Predictive Testing) and Inspection schedules with instructions that state when systems should be retested.

a. Define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a signoff blank for the Contractor and Contracting Officer for each test feature; e.g., gpm, rpm, psi. Include a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9, "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials: 1) The product does not meet appropriate performance standards; 2) The product is not available within a reasonable time frame; 3) The product is not available competitively (from two or more sources); 4) The product is only available at an unreasonable price (compared with a comparable non-recycled content product)." Record each product used in the project that has a requirement or option of containing recycled content in accordance with Section 01 62 35 RECYCLED/RECOVERED MATERIALS, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, exemptions (1, 2, 3, or 4, as indicated), and comments. Recycled content values may be determined by weight or

volume percent, but must be consistent throughout.

1.7 WARRANTY MANAGEMENT

1.7.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to the clause Warranty of Construction. At least 30 days before the planned pre-warranty conference, submit one set of the warranty management plan for Government approval. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan , but not limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, Subcontractors, manufacturers or suppliers involved.

b. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

c. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

d. A list for each warranted equipment, item, feature of construction or system indicating:

(1) Name of item.
(2) Model and serial numbers.
(3) Location where installed.
(4) Name and phone numbers of manufacturers or suppliers.
(5) Names, addresses and telephone numbers of sources of spare parts.
(6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
(7) Cross-reference to warranty certificates as applicable.
(8) Starting point and duration of warranty period.
(9) Summary of maintenance procedures required to continue the warranty in force.
(10) Cross-reference to specific pertinent Operation and Maintenance manuals.

(11) Organization, names and phone numbers of persons to call for warranty service.
(12) Typical response time and repair time expected for various warranted equipment.

e. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

f. Procedure and status of tagging of all equipment covered by extended warranties.

g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.7.2 Performance Bond

The Contractor's Performance Bond must remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.7.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.7.4 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

1.8 OPERATION AND MAINTENANCE MANUALS

Submit 6 copies of the project operation and maintenance manuals 30 calendar days prior to testing the system involved. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

1.8.1 Configuration

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals must have 0.3937-inch holes and

be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.8.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, must be made available to the Contracting Officer.

1.9 CLEANUP

Provide final cleaning in accordance with ASTM E1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Remove temporary labels, stains and foreign substances. Clean debris from drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on the project site.

1.10 REAL PROPERTY RECORD

DD Form 1354 "Transfer and Acceptance of Military Real Property" is utilized to record and maintain the Base's real property inventory and to manage capital improvements costs.

A Draft DD Form 1354 is attached to this section. Note: The Draft DD Form 1354 will not contain cost or quantity information. The Contractor shall provide this information based on "as constructed" conditions.

Near the completion of the project, but a minimum of 60 days prior to the projected Beneficial Occupancy Date (BOD), update the Draft DD Form 1354 and submit a Preliminary Interim DD Form 1354, accounting for all installed property. Required data will include costs, quantities, units of measure, etc. as indicated on the DD Form 1354. Include any additional assets/improvements/alterations from the Draft DD Form 1354. An Excel version of this document can be provided by the Government for use in providing this data. Contact the Contracting Officer for any project specific information necessary to complete the DD Form 1354.

The DD Form 1354 shall be prepared in accordance with UFC 1-300-08, available at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4.

Submit an Updated Interim DD Form 1354 for approval with the Final Invoice. The Updated Interim DD Form 1354 shall address all requested revisions to the Preliminary Interim DD Form 1354 and shall be updated to contain Contractor's "Final" quantity and cost information.

The Final DD Form 1354 will be prepared by the Activity Real Property

Accountability Officer (RPAO) at final project closeout after all outstanding issues have been resolved. The Final DD Form 1354 will be prepared using the Contractor provided project data.

1.10.1 MCB Camp Lejeune / MCAS New River

Point of Contact (POC) for assistance in completing the DD Form 1354:

Facilities Planner
Installation Dev Div/Fac Planning Branch
Building 12 Marine Corps Base
PSC Box 20004
Camp Lejeune, NC 28542-0004
Phone: (910) 451-1833

Coordinate with Section 01 20 00.00 20 PRICE AND PAYMENT PROCEDURES paragraph "EARNED VALUE REPORT".

The Contractor's Earned Value Report shall allocate the total cost of construction to the appropriate category codes. If a supporting facility feature has a unique category code, it shall be listed separately on the DD Form 1354. If a supporting facility does not have a unique category code the costs associated with the feature shall be included in the primary facility cost.

When documenting demolition work, the DD Form 1354 shall list the quantitative data associated with this work as a negative value to show the costs should be deleted from the Navy Asset Data Store. Coordinate with the POCs listed above in determining the negative value for demolition work.

The Contractor shall complete DD Form 1354 to the satisfaction of the Installation Development Division of MCB Camp Lejeune.

1.11 GEOSPATIAL INFORMATION SYSTEMS (GIS) DELIVERABLES

Provide geospatial data and documents for all features added, demolished or modified as part of this project in accordance with Section 01 78 30.00 22 DIGITAL DATA DELIVERABLES (GIS).

1.12 NAVFAC SUSTAINABLE & ENERGY DATA RECORD CARD

Within 60 days of the completion of Project, complete an electronic copy of the NAVFAC Sustainable & Energy Data Record Card, and submit to the Contracting Officer. Draft Record card for this project should be available from Designer of Record (DOR) or Contracting Officer. Instructions and a blank DD Form (fill-able) in ADOBE (PDF) may be obtained at the Whole Building Design Guide web site by navigating: Home > Participating Agencies > Department of Defense (DoD) > NAVFAC Sustainable Development Program > Contract Documents > NAVFAC Sustainable & Energy Data Record Card; or directly at http://www.wbdg.org/pdfs/navfac_sustainable_energy_data_record_card.pdf.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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-- End of Section --

TRANSFER AND ACCEPTANCE OF DOD REAL PROPERTY

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Washington Headquarters Servcies. Executive Services Directorate, Information Management Division, 4800 Mark Center Drive, Alexandria, VA 22350-3100 (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION.

1. FROM (Organization Name)	2. DATE PREPARED (YYYYMMDD)	3. PROJECT/JOB NUMBER	4. SERIAL NO.
	20131111	14P1353	

5. TO (Organization - Installation Code and Name)	6. RPSUID/SITENAME INSTCODE/INSTNAME	7. CONTRACT NUMBER(S)	7A. PLACED-IN-SERVICE DATE (YYYYMMDD)
COMMANDING GENERAL ATTN: PUBLIC WORKS DIVISION MARINE CORPS BASE PSC BOX 20004 CAMP LEJEUNE, NC 28542-0004	M67001		

8. TRANSACTION DETAILS

a. METHOD (X all that apply)
- ☐ ACQUISITION BY CONSTRUCTION
- ☐ TRANSFER BETWEEN SERVICES
- ☐ CAPITAL IMPROVEMENT
- ☐ INVENTORY ADJUSTMENT

b. WHEN/EVENT (X ONE)
- ☐ TOTAL ASSET PLACED-IN- SERVICE
- ☐ PARTIAL ASSET PLACED-IN- SERVICE

C. TYPE (X one)
☑ DRAFT ☐ FINAL ☐ INTERIM

9. ITEM NO.	10a. FACILITY NO.	10b. RPUID	11. CATEGORY CODE	12. CATCODE DESCRIPTION	13. TYPE CODE	14. SUST. CODE	AREA 15. PRIMARY UM	AREA 16. PRIMARY UM QUANTITY	OTHER 17. SECONDARY UM	OTHER 18. SECONDARY UM QUANTITY	19. COST	20. FUND SOURCE	21. FUND ORG	22. INTER-EST CODE	23. ITEM REMARKS
1			833-15	SANITARY/CUT FILL DISPOSAL AREA			EA								
2			811-60	STANDBY GENERATOR PLANT			KW								
3			812-31	OVERHEAD ELECTRICAL DISTRIBUTION			LF								
7			812-32	UNDERGROUND ELECTRICAL, DISTRIBUTION			LF								
4			851-10	ROADS			SY								
5			852-10	PARKING AREA			SY								
6			871-20	DRAINAGE DITCHES			LF								
8			933-10	DEMOLITION			EA								
9															

24. STATEMENT OF COMPLETION. The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

a. TRANSFERRED BY (Typed Name and Signature)	b. DATE SIGNED (YYYYMMDD)
c. TITLE (Area Engr./Base Engr./DPW/Construction Agent)	

25.a. ACCEPTED BY (Typed Name and Signature)	b. DATE SIGNED (YYYYMMDD)
c. TITLE (DPW/RPAO)	26. PROPERTY VOUCHER NUMBER

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27. CONSTRUCTION DEFICIENCIES (Attach blank sheet for continuations)

28. PROJECT REMARKS (Attach blank sheet for continuation)

DD 1354 Prepared by: Anna Lee Bamforth (Draft)

INSTRUCTIONS

GENERAL. This form has been designed and issued for use in connection with the transfer of military real property between the military departments and to or from other government agencies. It supersedes ENG Forms 290 and 290B (formerly used by the Army and Air Force) and NAVDOCKS Form 2317 (formerly used by the Navy).

Existing instructions issued by the military departments relative the the preparation of DD Form 1354 are applicable to this revised form to the extent that the various items and columns on the superseded forms have been retained. The military departments may promulgate additional instructions, as appropriate.

For detailed instructions on how to fill out this form, please refer to Unified Facilities Criteria (UFC) 1-300-08, dated 16 April 2009 or later.

SPECIFIC DATA ITEMS.

1. From. Name of the transferring agency.

2. Date Prepared. Date of actual preparation. Enter all dates in YYYYMMDD format (Example: March 31, 2010 = 20100331).

3. Project/Job Number. Project number on a DD Form 1391 or Individual Job Order Number.

4. Serial Number. Sequential serial number assigned by the preparing organization. (e.g., 2010-0001).

5. To. Name and address of the receiving installation, activity, and Service of the Real Property Accountable Officer (RPAO).

6. RPSUID/SITENAME/INSTCODE/INSTNAME. Site Unique Identifier and name or installation code and name where the constructed facility is located.

7. Construct Number(s). Contract number(s) for this project.

7a. Placed-In-Service Date. RPA Placed in Service Date. This is the date the asset is actually placed-in-service.

8. Transaction Details.

a. Method of Transaction. Mark (X) as many boxes as apply.

b. When/Event. When or event causing preparation of DD Form 1354. X only one box.

c. Type. Draft, interim, or final DD Form 1354. X only one box.

9. Item Number. Use a separate item number for each facility, no item number for additional usages.

10a. Facility Number. Assigned in accordance with the Installation/Base Master Numbering Plan.

10b. RPUID. Identified in Real Property Inventory.

11. Category Code. The category code describes the facility usage.

12. Catcode Description. The category code name which describes the facility usage.

13. Type. Type of construction. **P** for Permanent; **S** for Semi- permanent; **T** for Temporary

14. Sustainability Code. Reports whether or not an asset meets the sustainability guidelines set forth in section 2(g) of Executive Order 13514. Valid values are: 1 (asset meets the guidelines); 2 (asset does not meet the guidelines); 3 (asset not evaluated); 4 (asset not subject to guidelines.

15. Area: UM 1. Area unit of measure; use the unit of measure associated with the category code selected in 11.

16. Total Quantity UM 1. The total area for the measure identified in Item 15. Use negative numbers for demolition.

17. Other: UM 2. Unit of Measure 2 is the capacity or other measurement unit (e.g., LF, MB, EA, etc.).

18. Total Quantity UM 2. The total capacity/other for the measure identified in Item 17.

19. Cost. Cost for each facility; for capital improvements to existing facilities, show amount of increase only. If there is no increase for the capital improvement, enter N/A.

20. Fund Source. Enter the Fund Source Code for this item.

21. Funding Organization. Enter the code for the organization responsible for acquiring this facility.

22. Interest Code. Enter the code that reflects government interest or ownership in the facility.

23. Item Remarks. Remarks pertaining only to the item number identified in Item 9; show cost sharing.

24. Statement of Completion. Typed name, signature, title, and date of signature by the responsible transferring individual or agent.

25. Accepted By. Typed name, signature, title, and date of signature by the RPAO or accepting official.

26. Property Voucher Number. Next sequential number assigned by the RPAO in voucher register.

27. Construction Deficiencies. List construction deficiencies in project during contractor turnover inspection.

28. Project Remakrs. Project level remarks and continuation of blocks.

DD Form 1354 Addendum

CLASS 2 PROPERTY RECORD DATA

ACTIVITY UIC: _____DD Form 1354, Item 6
ACTIVITY NAME: _____DD Form 1354, Item 5
SPEC AREA_____
PR NO _____
FACILITY NO: _____DD Form 1354, Item 11

LOCATION GENERAL INFO
COUNTRY: iNFADS fills this based on UIC and Special Area
RPTG-CLMT-UIC _____
ACTION TYPE _____(Acquisition, Capital Improvement, Disposal)
STATE: iNFADS fills this based on UIC and Special Area
COUNTY: iNFADS fills this based on UIC and Special Area
CITY: iNFADS fills this based on UIC and Special Area
FACILITY NAME: _____Completed by gaining installation
MAP GRID: _____Completed by gaining installation
FORMER ACTIVITY UIC: _____DD Form 1354, Item 1, Transfer only
FORMER PR NO.: _____Transfers within Dept of Navy only
FACILITY TYPE: _____Determined by Prime Use Category Code
FAMILY HOUSING INDICATOR: _____ Y/N

MEASUREMENTS
LENGTH_____
WIDTH_____
HEIGHT_____
DEPTH_____
AREA/UM_____
STORIES_____
IRREGULAR_____(Y or N)
ATTIC____ (Y or N)
BASEMENT____(Y or N)
MEZZANINE___(Y or N)
PENTHOUSE____(Y or N)

CONSTRUCTION
YEAR BUILT_____ (New Construction)
YEAR IMPROVED _____ (Capital Improvement)
CURR PROJ NO_____ (Capital Improvement)
ORIG PROJ NO_____ (New Construction)
CONSTRUCTION TYPE_____(P, S, T, or R)
HERITAGE ASSET DATA –_____ Transfers only

MAINTENANCE

PRIME USE CAT CODE_____ (Largest Category Code for facility on DD Form 1354, Item 12)
MAINT FUND CODE_____ (Supplied by gaining installation)
MAINT RESP_____ (Supplied by gaining installation)
COST REF DOCUMENT NUMBERS: _____DD Form 1354, Item 7

EXCESS/DISPOSAL (DISPOSAL DD FORM 1354 ONLY)

EXCESS ACTION CODE_____
EXCESS ACTION DATE_____
DISPOSAL METHOD_____
DISPOSAL DATE_____
EFD DISPOSAL CONTRACT_____
GSA DISPOSAL CONTRACT_____
DISP CONSOL PR_____

STATUS/UTILIZATION

USER UIC/OG ID_____ (Supplied by gaining installation)
CATEGORY CODE_____ DD Form 1354, Item 12
USE_____(Optional)
AREA/UM_____ DD Form 1354, Items 15 and 16
OTHER/UM_____ DD Form 1354, Items 17 and 18
ALT/UM _____ Must be put in Remarks section of DD Form 1354, where applicable.

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA
05/13

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.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors must compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor must compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section, Section 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI), and Section 01 33 00 SUBMITTAL PROCEDURES.

1.2.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.2.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Items without a specified data package requirement in the individual technical sections must use Data Package 3. Items with a Data Package 1 or 2 requirement must use instead Data Package 3.

1.2.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data must be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of

submitted data within 30 calendar days of the notification of this change requirement.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.3.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.3.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.3.1.2 Operator Prestart

Include procedures required to install, set up, and prepare each system for use.

1.3.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.3.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.3.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.3.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

1.3.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.3.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air

quality impacts of recommended maintenance procedures and materials.

1.3.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.3.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.3.2.3 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.

1.3.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.3.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.3.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.3.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.3.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.3.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.3.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.3.5.1 Product Submittal Data

Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

1.3.5.2 Manufacturer's Instructions

Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

1.3.5.3 O&M Submittal Data

Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

1.3.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice.

Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.3.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.3.5.6 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.3.5.7 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3.5.8 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

1.3.5.9 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.4 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

a. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Full as-built sequence of operations.

c. Copies of all checkout tests and calibrations performed by the Contractor.

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.5.1 Data Package 1

a. Safety precautions

b. Cleaning recommendations

c. Maintenance and repair procedures

d. Warranty information

e. Contractor information

f. Spare parts and supply list

1.5.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan and schedule

f. Cleaning recommendations

g. Maintenance and repair procedures

h. Removal and replacement instructions

i. Spare parts and supply list

j. Parts identification

k. Warranty information

l. Contractor information

1.5.3 Data Package 3

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Environmental conditions

g. Lubrication data

h. Preventive maintenance plan and schedule

i. Cleaning recommendations

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Product submittal data

p. O&M submittal data

q. Parts identification

r. Warranty information

s. Testing equipment and special tool information

t. Testing and performance data

u. Contractor information

1.5.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Cleaning recommendations

k. Troubleshooting guides and diagnostic techniques

l. Wiring diagrams and control diagrams

m. Maintenance and repair procedures

n. Removal and replacement instructions

o. Spare parts and supply list

p. Corrective maintenance man-hours

q. Product submittal data

r. O&M submittal data

s. Parts identification

t. Warranty information

u. Personnel training requirements

v. Testing equipment and special tool information

w. Testing and performance data

x. Contractor information

1.5.5 Data Package 5

a. Safety precautions

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Product submittal data

m. Manufacturer's instructions

n. O&M submittal data

o. Parts identification

p. Testing equipment and special tool information

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q. Warranty information

r. Testing and performance data

s. Contractor information

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

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SECTION 01 78 24.00 20

FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI)
05/13

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

This section provides the requirements for electronic operation and maintenance support information (eOMSI). eOMSI contains detailed as-built information describing the efficient, economical, safe operation, maintenance, and repair of the facility. eOMSI is required to be in electronic format divided into the eOMSI Data and eOMSI Document files.

a. Provide eOMSI Data files in the eOMSI Spreadsheet Workbook format that are uploaded by the Government into a Government computerized maintenance management system (CMMS). Maximo is the CMMS that will be used on this project.

b. Provide eOMSI Document files in Portable Document Format (PDF), Computer Assisted Design and Drafting (CADD), and MS Word formats that can be uploaded into a document management system. The eOMSI document information is to be factual, concise, comprehensive, and written to be easily used by maintenance personnel. Descriptive matter and theory must include technical details that are essential for a comprehensive understanding of the operation, maintenance and repair of the system. The eOMSI Preparer shall ensure that the eOMSI reflect changes to systems and equipment, made during construction.

1.2 DEFINITIONS

1.2.1 Component Inventory Management Unit (CIMU)

CIMU is an organization of like-kind real property into manageable maintenance units. CIMU is a building component, group of components or component assemblies, serving a specific purpose in a facility that can be expected to follow a common and predictable lifecycle behavior. This class of non-equipment will include items such as exterior walls, exterior windows, interior finish, and roofs. This class of equipment will include items such as fan coil units, air handling units, lighting, and water closets. CIMUs can include items of installed equipment typically subject to routine scheduled maintenance.

1.2.2 Real Property Inventory Equipment (RPIE)

RPIE is a Government owned or leased individual pieces of equipment, apparatus, or fixture that are essential to the function of the real property (i.e. plumbing, electrical, heating, cooling and elevators). It is physically attached to, integrated into, and built in or on the property. Individual RPIE's can be combined to make a CIMU to facilitate facilities management.

1.2.3 BOTH (Combined CIMU and RPIE)

A BOTH is a stand-alone piece of equipment that can be managed independently and therefore is a Component Inventory Management Unit and a Real Property Installed Equipment. (If a CIMU has a Quantity of "One", it

would be considered a BOTH)

1.2.4 Utility and Energy Management (UEM)

UEM is a part of the Government Public Works (PW) Organization that manages the operation and maintenance of the Base utilities.

1.2.5 Systems

The words "system", "systems", and "equipment", when used in this document refer to as-built systems and equipment.

1.2.6 Computer Assisted Design and Drafting (CADD)

Electronic Computer Assisted Design and Drafting graphic software program that is used to create facility design contract documents.

1.2.7 eOMSI Spreadsheet Workbook

The eOMSI Spreadsheet Workbook is a group of Excel spreadsheets that provide forms, samples, and tools to assist the Contractor in identifying equipment and non-equipment data for the project. Use these Excel spreadsheets to organize and record maintenance data for the project. Use the eOMSI Spreadsheet Workbook in conjunction with this specification section with the file title: "eOMSI_spreadsheet_wkbk_new_constr.xls" located inside the zip file at the following web link: http://www.wbdg.org/ccb/DOD/UFGS_SUPPLEMENTS/UFGS_01_78_24.00_20_eOMSI_spreadsheet.zip

1.2.8 Flat File

The flat file is the blank forms portion of the eOMSI Spreadsheet Workbook used to fill in the equipment and non-equipment data. These flat file forms are Excel templates with column headings that identify required information for equipment and non-equipment. The data placed on the flat file spreadsheets are organized by the Contractor into RPIE, and BOTH maintenance units.

1.2.9 KTR

KTR is an abbreviation for "Contractor."

1.3 ORGANIZATION of eOMSI

Prepare the eOMSI submittals in two components, eOMSI Data Files and eOMSI Document Files.

1.3.1 eOMSI Data Files

Provide facility specific information listed in the DESCRIPTION of WORK of this specification section and divide into Equipment Data and Non-Equipment Data on eOMSI Spreadsheet Workbook / Flat Files. The Government will use the completed eOMSI Spreadsheet Workbook to update information of the CMMS indicated above. The following tabs are included in the eOMSI Spreadsheet Workbook and serve the purpose stated:

a. Flat File - Equipment Data; This spreadsheet provides an organized format for the contractor to fill in required information about dynamic equipment (fans, pumps,…) that is part of the project.

b. Flat File - Non-Equipment Data; This spreadsheet provides an organized

format for the Contractor to fill in required information about non-equipment (doors, windows, etc.) that is part of the project.

c. New CONST - RENOVATION Schema; Provides information and instructions to explain the task of completing the Flat File - Equipment Data and Flat File - No-Equipment Data spreadsheets.

d. Facility and UEM Uniformat; Provides a Uniformat division of facility and utility systems and components of the project. This information is used to complete the Master-System-Subsystem portions of the Flat File - Equipment Data and Flat File - Non-Equipment Data spreadsheets.

e. UEM Asset Classification: Provides a list of critical Utility and Energy Management components that must be identified in the Flat File - Equipment Data spreadsheet.

f. Asset Identification List: List of items that require equipment tagging. Tag numbering must be entered in the Equipment Tag Number of the Flat File - Equipment Data spreadsheet.

g. Data Definitions; Provide definitions of terms used on the spreadsheet workbook.

1.3.2 eOMSI Document Files

Provide facility specific information, which was used to construct the project and provide information on operation and maintenance of the facility in a form that can be easily accessed and used. Organize the document files to facilitate storage in an electronic Government document file management system. Arrange the eOMSI Documents files in the following order and identify the document files as follows:

a. Product and Drawing Information

Cross-referencing within or between the eOMSI Document File parts must be specific.

1.3.3 Order of Precedence of eOMSI Requirements

This specification section takes precedence over the eOMSI Spreadsheet Workbook in the event of conflict between this specification section and the eOMSI Spreadsheet Workbook.

1.3.4 Sources of eOMSI Information

The sources of data needed to prepare the eOMSI include, but are not limited to, the design plans and specifications, field visits, approved construction submittals and manufacturer's catalog data for materials, products, systems, as-built drawings, contract modifications, and construction methods used in this contract. Ensure that the eOMSI reflect changes to systems and equipment made during construction as a result of contract modifications. Collect and input needed information to complete the data and document files

1.3.5 Unified Facility Guide Specifications (UFGS) Operation and Maintenance Data Packages

Provide information necessary to maintain the equipment and non-equipment of the facility by utilizing the SD-10 Operations and Maintenance Data

Packages as defined in Section 01 78 23 OPERATIONS AND MAINTENANCE DATA. Provide the SD-10 Data Packages required in the individual sections for each product, material, and system used on the project.

1.4 eOMSI MEETINGS

Organize, coordinate, and facilitate the meetings necessary to obtain the information to complete the eOMSI submittal.

1.4.1 eOMSI Start-Up Meeting

During the Pre Construction Meeting, discuss the following;

a. The eOMSI Development Meetings schedules and participants.

b. Processes and methods of gathering of facility eOMSI information during construction.

c. The qualifications of the eOMSI Preparer.

d. The eOMSI Submittals schedule. Place the eOMSI submittal schedule on the construction schedule.

1.4.2 eOMSI Development Meetings

Meet with key personnel to discuss the eOMSI requirements and the deliverables. These are a series of meetings that begin after the Preconstruction Meeting and conclude with the Contractor's first eOMSI submittal. Include the eOMSI Preparer and the Quality Control Manager to attend these meetings. Also include the Mechanical, Electrical and Fire Protection Sub Contractors as required. The purposes of these meetings are to:

a. Familiarize the Contractor with the Government PW maintenance processes.

b. Provide the Contractor with an understanding of the RPIE, CIMU, and BOTH to organize the facility into these information structures.

c. Obtain the "By KTR Using Government Info" information for the eOMSI Flat File Spreadsheets.

d. Review and identify the electronic format, units of measure, titles, and wording necessary to load the eOMSI data into the designated Government CMMS and eOMSI documents into the Government Document Management System.

e. Review progress of eOMSI development and discuss issues that need to be resolved.

f. Coordinate requirements for eOMSI training.

1.4.3 Facility Turnover Meetings

Refer to paragraph FACILITY TURNOVER PLANNING MEETINGS (NAVFAC Red Zone - NRZ) in Section 01 30 00, ADMINISTRATIVE REQUIREMENTS, for eOMSI facility turnover meeting requirements.

1.5 UNITS of MEASURE

Provide eOMSI utilizing the units of measure used in the Government created contract documents. Metric eOMSI shall be in SI (System International) metric units exclusively.

1.6 QUALIFICATIONS of eOMSI PREPARER

Submit Qualifications of eOMSI Preparer that meet the following:

a. Possess multidiscipline technical knowledge of the operations and maintenance of building systems.

b. Experience with the type of systems that are identified in this specification and capable of augmenting manufacturer's information to clarify operations instructions.

c. Experience preparing detailed Operations and Maintenance Manuals for facilities of equal size and complexity as required by this contract

d. Ability to prepare spreadsheets to be loaded into a CMMS.

e. Experience presenting training and coordinating a team of manufacturer's representatives to provide training of Facility Users and Maintenance Personnel.

1.7 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Qualifications of eOMSI Preparer; G

SD-11 Closeout Submittals

eOMSI, 100 percent, Prefinal Submittal; G

eOMSI, Final Submittal; G

1.8 SUBMITTAL FORMAT

1.8.1 eOMSI Data Files

Provide eOMSI data on compact disks (CD) or data digital versatile disk (DVD) disks in formats that are compatible with those used on the project. Provide eOMSI Data information by completing the eOMSI Spreadsheet Workbook / Flat File initial templates:

a. eOMSI Spreadsheet Workbook / Flat File - Equipment Data tab; Provide information to all spreadsheet fields. Obtain the information indicated to be supplied "By KTR using Government info" from the Contracting Officer and fill in this part of the Flat File. Typically identify individual pieces of equipment by RPIE. Group equipment with similar Uniformat classification, design life, install date, remaining service life, and direct condition rating - into manageable CIMUs. Except,

when the individual RPIE is complex enough to require its own management planning and in this case the individual RPIE is also a BOTH. Each CIMU shall be greater than $2,500 in value.

b. eOMSI Spreadsheet Workbook / Flat File - Equipment Data tab; Provide information to all spreadsheet fields. Group Non-equipment with similar Uniformat classification, design life, install date, remaining service life, and direct condition rating - into manageable CIMUs. Obtain the information indicated to be supplied "By KTR using Government info" from the Contracting Officer to complete that portion of the Flat File. Each CIMU shall be greater than $2,500 in value.

1.8.2 eOMSI Document Files

Provide eOMSI document files on CD or data DVD disks using the most current version of Adobe Acrobat or similar software capable of producing PDF files that can be used to upload the files into an electronic Government document management system. Bookmark the PDF files for easy access to the information. Bookmark Facility Information and Primary Systems Information to at least one level lower than the major system. Bookmark Product and Drawing Information documents using the current version of Masterformat and arrange submittals using the specification sections as a structure. Use Masterformat and UFGS numbers along with descriptive bookmarking titles that explain the content of the information that is being bookmarked.

Provide the following information on the compact disk label and disk holder/ case:

a. Project Title

b. Activity and Location

c. Construction Contract Number

d. Prepared For: (Contracting Agency)

e. Prepared By: (Name, title, phone number and email address)

f. Include the compact disk content on the disk label

g. Date

h. Virus scanning program used

1.9 SUBMITTAL SCHEDULE

Provide the following eOMSI submittals. Scan electronic files of eOMSI Data and eOMSI Documents for malicious viruses using a commercially available scanning program that is routinely updated to identify/remove current virus threats.

1.9.1 100 percent - Prefinal eOMSI Submittal

Submit four electronically formatted copies of the 100 percent submittal of the eOMSI Data File and eOMSI Document File to the Contracting Officer for approval. The eOMSI, 100 percent, Prefinal Submittal is due 60 calendar days prior to Beneficial Occupancy Date (BOD)/ Placed In Service Date. This submittal shall be a complete, working document that can be used to operate and maintain the facility. Any portion of the submittal that is

incomplete or inaccurate will require the entire submittal to be returned for correction. Incorporate all Government requested changes from the eOMSI Development Meetings comments into the Prefinal submission. Provide the same information required for each eOMSI document file CD/ DVD disk label, on the introductory page of each eOMSI submittal volume. Refer to paragraph titled "eOMSI Document Files" of this section for a list of this required introductory page information.

Submit Prefinal submittal when construction is approximately 90 percent complete that include;

a. eOMSI Data Files (Excel)

b. eOMSI Document Files (Bookmarked PDF) that include;

(1) Product and Drawing Information

1.9.1.1 Prefinal eOMSI Submittal Review Duration

Allow the Government a minimum of 30 calendar days to review and approve the submittal, from the time the Government receives the Prefinal eOMSI submittal. If the Prefinal submittal is required to be resubmitted, the Government review of subsequent submittals shall have the same review duration as the first submittal. No extension in project completion date will be granted due to resubmittal.

1.9.2 eOMSI, Final Submittal

Complete the eOMSI Data and Documents and provide Final submittal in Excel and bookmarked PDF format as required in the Prefinal Submittal. Deliver submittals to the Contracting Officer for approval. The Final submittal is due at BOD/ Placed in Service Date. Include all Government requested changes from the Prefinal submittal and the Project Closeout Meetings to complete the Final submittal.

In addition to the formats stated above, provide four electronic copies of the Final submittal in editable formats. Provide editable eOMSI Document drawing and diagram files in CADD and other editable eOMSI Document files in MS Word or Excel. Refer to Product and Drawing Information below to describe the format of the Record Drawings submission.

1.10 FACILITY SYSTEMS

The project is anticipated to include the following critical systems. Provide eOMSI data, eOMSI documents, and training for all products, materials, and equipment that make up these systems in the final constructed facility, including the following systems:

a. Site civil water utilities (including water, storm water collection, and treatment systems)

b. Site civil wastewater utilities (including pumping station, tanks, treatment and filters)

c. Potable water systems (including wells, tanks, pumps, back-flow preventers, filters, disinfection, and controllers)

d. Site electrical utilities (including substations, transformers, and pad mounted switchgear)

PART 2 PRODUCTS

2.1 DESCRIPTION OF WORK

2.1.1 eOMSI DATA FILES

Provide the following items of data in a format compatible with the CMMS used on the project. Enter all data in the eOMSI Spreadsheet Workbook / Flat File.

2.1.1.1 Equipment Information

a. Equipment Listing - Provide the following information for each piece of installed equipment and for each applicable item listed on the UEM Asset Classification tab of the eOMSI Spreadsheet Workbook. Enter all information on the Flat File - Equipment Data tab of the eOMSI Spreadsheet Workbook.

(1) Asset_ID

(2) Asset Description

(3) ORG_ID

(4) Site_ID

(5) Building Name

(6) Asset Type

(7) Inventory Category

(8) Location Code

(9) Design Life

(10) FCI

(11) Remaining Service Life

(12) DCR

(13) Work Center

(14) Belongs to (Parent Asset. ID)

(15) Contract number

(16) Task/delivery order number

(17) Drawing reference ID

(18) Location description

(19) Master system Uniformat

(20) System Uniformat

(21) Subsystem Uniformat

(22) Quantity

(23) Install date

(24) Replacement cost

(25) Manufacturer

(26) Model number

(27) Serial number

(28) Manufacturer Warranty end date

(29) Warranty Company Info

(30) Comment (Such as: Required information not to void warranty)

(31) Status Date

(32) Asset Status

(33) UEM Classification ID

(34) UEM Classification Description

(35) Job Plan Code (Preventive Maintenance)

The Job Plan List is provided by NAVFAC to identify applicable Job Plan Codes. If NAVFAC does not have a Job Plan for the equipment used, provide information in paragraph entitled Job Plan for Equipment NOT assigned a NAVFAC Job Plan below.

(36) Equipment Tag Number

b. Job Plan for Equipment NOT assigned a NAVFAC Job Plan - Preventive Maintenance Procedures, and Schedules. If the Government cannot provide a job plan for a specific piece of equipment, provide a detailed Job Plan (Preventive Maintenance Plan) using manufacturer's recommendations and sound engineering practice. Show associated frequencies when job plan is to be performed and include detailed preventive maintenance (PM) procedures such as inspections, tests, adjustments required to ensure proper and economical operation and minimize corrective maintenance. For periodic calibrations, provide manufacturer's specified frequency and procedures for each operation. Detailed Job Plans include the following:

(1) Safety instructions and precautions,

(2) Including lock out/tag out precautions,

(3) Required skill level,

(4) Number of personnel needed,

(5) Frequency of performing the job plan,

(6) Special tools needed,

(7) Parts needed

(8) Estimated time required to complete the task.

(9) Lubrication schedules indicating types, grades and capacities.

2.1.1.2 Non-Equipment Information

a. Provide the following information for each item of non-equipment. Enter all information on the eOMSI Spreadsheet Workbook - Flat File Non-Equipment Data tab.

(1) Asset ID

(2) Asset Description

(3) ORG_ID

(4) Site_ID

(5) Asset Type

(6) Inventory Category

(7) Design Life

(8) FCI

(9) DCR

(10) Building Name

(11) Location Code

(12) Contract Number

(13) Task/ Delivery Order Number

(14) Drawing Reference _ID

(15) Notes on CIMU Structure

(16) Master System Uniformat

(17) System Uniformat

(18) Subsystem Uniformat

(19) Quantity

(20) Install Date

(21) Remaining Service Life

(22) Replacement Cost

(23) Warranty End Date

(24) Warranty Company Info

(25) Comments (Such as: Required information not to void warranty)

2.1.2 eOMSI DOCUMENT FILES

2.1.2.1 Product and Drawing Information

This portion of the eOMSI provides a record of the facility products, materials, equipment, and minimum information necessary to operate the facility. Provide Product and Drawing Information for all systems in the final constructed facility, including the anticipated critical systems identified in this specification section.

a. O&M Data. Include, as a minimum O&M Data, required in the SD-10 Data Packages of the UFGS specifications. Provide the following for each product, material, and system on the project:

(1) Materials

(2) Equipment

(3) Data Sheets

(4) Test Reports

(5) Warranties

(6) Certificates

(7) Shop Drawings

b. Drawings. Provide original CADD drawings or original facility design drawings that have been edited to eliminate unneeded information and highlight eOMSI information in PDF format. Provide the following drawings at a large enough scale to be clear, legible, and able to differentiate designated isolation units from surrounding valves and switches.

(1) Utility Schematic Diagrams - Provide a one line schematic diagram for each utility system such as power, water, wastewater, and gas/ fuel. Schematic diagram must show from the point where the utility line is connected to the mainline up to the five-foot connection point to the facility. Indicate location or area designation for route of transmission or distribution lines; locations of duct banks, manholes/ handholes or poles; isolation units such as valves and switches; and utility facilities such as pump stations, lift stations, and substations.

(2) Enlarged Connection and Cutoff Plans - Provide enlarged floor plans that provide information between the five foot utility connection point and where utilities connect to facility distribution. Enlarge floor plans/ elevations of the rooms where the utility enters the building and indicate on these plans locations of the main interior and exterior connection and cutoff points for all utilities. Also enlarge floor plans/ elevations of the rooms where equipment is located. Include enough information to enable someone unfamiliar with the facility to locate the

connection and cutoff points. Indicate the room number, panel number, circuit breaker, valve number, etc., of each utility and equipment connection and cutoff point, and what that connection and cutoff point controls.

c. Equipment Tags. Provide equipment tags for all applicable items listed in eOMSI Spreadsheet Workbook/ Asset Identification List tab. Provide tags that are durable, oil and water-resistant and approved by the Contracting Officer. Attach tag with copper wire and spray with a clear silicone waterproof coating. Place tags on the equipment in a visible location that can be read by an inspector in a standing position. Provide tag information to include: Contract Number, Maximo Equipment Identification Numbers, and Equipment Tag Number that corresponds with the drawing. Only equipment with a value of greater than $2,500 or sized as noted in eOMSI Spreadsheet Workbook/ Asset Identification List tab, shall be tagged.

Provide tags for the items listed below in addition to the items listed in eOMSI Spreadsheet Workbook/ Asset Identification List tab:

(1) Control valves for heating, cooling, gas, fuel, water and wastewater for piping 1 1/2 inches or greater. Main interior and exterior utility cut off valves (no dollar value restriction).

d. Record Drawings. Provide an electronic copy of the Record Drawings for the project in PDF format, bookmarking all drawings using the sheet title and sheet number and in CADD format. Provide the Record Drawings on the same electronic media as used for the eOMSI submittal but on separate disks or files to allow simultaneous use of the eOMSI and Record Drawings.

PART 3 EXECUTION

NOT USED.

-- End of Section --

SECTION 01 78 30.00 22

DIGITAL DATA DELIVERABLES (GIS)
05/13

PART 1 GENERAL

1.1 OBJECTIVE

The primary objective of this section is to provide detailed specifications for the collection and creation of Geographic Information System (GIS) data to ensure that all GIS data delivered is compatible and will add value to MCB Camp Lejeune's Installation Geospatial Information and Services (IGI&S) repository.

1.1.1 Point of Contact for MCB Camp Lejeune

The Point of Contact (POC) for assistance in preparation of GIS deliverables is:

NAVFAC MIDLANT
Officer In Charge Of Construction
(Construction Manager)
1005 Michael Drive
Camp Lejeune, NC 28547-2521
(910) 451-2581

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-11 Closeout Submittals

GIS Data Deliverables; G

1.3 COLLECTION AND CREATION OF GEOSPATIAL DATA

Prior to data collection and creation the contractor shall provide the Government Project Manager a Technical Approach Plan for approval which describes the contractor's plan to collect and create GIS Data as specified in this section.

1.3.1 Technical Approach Plan

The Technical Approach Plan will contain the following:

a. How features will be collected utilizing Global Positioning System (GPS) technology

b. Which features, as specified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES", will be located, GPS and created

c. Source of attribute data

d. Steps taken to create personal Geodatabase

e. What GIS data will be delivered

1.3.2 Geospatial Data Collection

All questions regarding the Specification For Digital Data - GIS Deliverables shall be directed to MCB Camp Lejeune I&E, PWD GIS Section, via the Government Project Manager.

Specific Tasks are as follows:

a. Contractor is responsible for the collection and creation of geospatial data for newly constructed or replaced utilities and infrastructure features that fall within the realm of this specification.

b. Utilize GPS technology to locate and create GIS data and deliver only features that are relevant to this contract as specified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES".

c. Follow instructions in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" which defines the following:

    1. GIS feature requirements.

    2. The manner in which the data will be collected in GPS.

    3. The manner in which GIS data will be created.

    4. Required Attribute data.

    5. Other instructions pertaining to GIS data.

1.3.3 Data Collection requirements

Survey Grade and Sub-Foot GPS Geospatial Data Collection requirements:

a. GPS data shall be completed in accordance with the "Statewide Global Positioning System (GPS) Data Collection and Documentation Standards, Version 3" (or higher version if available at the time of this project) as prepared by the Statewide Mapping Advisory Committee and adopted by the North Carolina Geographic Coordinating Council in May 2006. Copies of these standards can be found on the Internet at: www.ncgicc.org.

b. Only bench marks included in the North Carolina Geodetic Survey Base Station Network shall be used for mapping grade GPS data collection.

c. Mission planning is essential and contractor should utilize lowest possible PDOP values.

d. Geographic data shall be collected and created into the Universal Transverse Mercator (UTM) coordinate system.

    1. North American Datum (NAD) 1983 / UTM Zone 18N.

e. Spatial accuracy requirements for Survey and Sub-Foot grade data collection are as follows:

    Sub-Foot requirements

1. All points shall be within + 12 inches

2. 95% accuracy rate for all points.

Survey Grade requirements

1. All points shall be within + 1 centimeter

2. 98% accuracy rate for all points

f. Every effort shall be made to capture feature locations without using offsets.

1. Offsets will be noted in final report and user_flag field for which each feature it applies, unless otherwise specified.

1.3.4 Geospatial Data Standards

The IGI&S repository model is based on the Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) with modifications.

a. Copies of the SDSFIE may be obtained from the Solutions and Technology for the Advancement and Refinement of SDSFIE (STARS) Team Internet homepage at http://www.sdsfieonline.org/.

b. Due to on-going government modifications to MCB Camp Lejeune's IGI&S repository the contractor shall ensure the schema of the final product is in compliance and all data will be created and delivered utilizing MCB Camp Lejeune's most current IGI&S repository schema.

1. The contractor shall request an additional template prior to delivery to be used for the final delivery of data.

2. Final report will include date of last data request for IGI&S schema and geospatial data.

1.3.5 Government Provided Geospatial Data

MCB Camp Lejeune's IGI&S repository's schema and geospatial data shall be obtained via the Government Project Manager before any data is collected or created. The Project Manager, upon request, shall furnish the contractor with a Geospatial data request package. The contractor shall:

a. Request only GIS data that is pertinent to the contract.

b. Request shall include the following information:

1. Contract Number and Title.

2. Contractor's Name, Address, Phone Number, Email and Point of Contact.

3. Summary of Project.

4. Contract Specification.

5. Expected Delivery date and features.

1.3.6 New Feature Class Requirements

When developing a new feature class, the Contractor shall develop the initial structure consistent with the most current version of SDSFIE.

a. If further modifications to the database structure are required, the Contractor will consult with the Government Project Manager for direction and final approval.

b. All new feature data class shall be noted on the final report.

1.3.7 Collection of Geospatial data

a. Utility data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" will be collected utilizing Survey Grade GPS data collection methods.

b. Prior to GPS efforts, buried underground utilities shall be located in order to GPS accurate location.

c. Other infrastructure data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" shall be collected utilizing Sub-Foot GPS data collection methods.

d. GPS data and collection data files shall be included with every phase of delivery.

1.3.8 Creation of Geospatial Data

Data will be created in a Personal Geodatabase using ArcGIS 9.3 or higher if a higher version is being used by the government at the time of this project.

Contractor shall verify the ArcGIS version, via the Government Project Manager, at the commencement of this contract.

Geodatabase Spatial Reference Properties shall include the following:

a. North American Datum (NAD) 1983 / UTM Zone 18N.

b. x,y domain precision of 1000.

1.3.9 Data Format and Structure

To ensure that all Geospatial data created can be loaded and add value to MCB Camp Lejeune's IGI&S repository; data will be created in such a way that the delivered file personal geodatabase mirrors the IGI&S repository. This includes, but is not limited to the following:

a. Geospatial database table structure.

b. Domain(s) configuration.

1. SDSFIE domains have been modified by MCB Camp Lejeune for operational purposes, it is the contractor's responsibility to request and utilize associated domain structure to ensure deliverable will load into the geodatabase.

c. Required attribute data as specified in paragraph "ATTRIBUTE DATA

COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" shall be obtained via contract specifications, plans and on as-built drawings.

1. Actual field data always supersedes drawings.

d. The contractor may have to research and verifying existing as-built data in the Technical Records Section located at the Public Works Building, MCB Camp Lejeune.

e. The GIS Data Deliverable does not replace the requirements for as-built drawings and or files for this contract.

1.3.10 GIS Topology Rules

All data must be created using GIS topology rules for polygons, points and lines, such as, but not limited to the following examples:

a. Polygons, Polylines and points rules, please reference illustrating topology rules in ArcGIS at www.esri.com.

b. Polygons must not have slivers.

c. All utility or infrastructure system data, which is, but not limited to, transportation system and electrical, water, steam distribution, and wastewater collection etc., will be created using GIS spatially connectivity rules which specifies that vertex, edge and endpoints be snapped to features within the system.

1. Features will be snapped to the appropriate item.

2. Data will be created to represent the real world, for example, direction of flow, i.e., water, sewer and transportations systems will be drawn and created in the direction of flow.

3. Utility systems will be created from source to sink, etc.

4. Abandoned In Place (AIP) utility lines will be located and updated in the current utility line feature data set and identified as AIP in the attribute table.

5. Polylines will be connected by nodes, i.e., fittings, valves, street connections and other natural occurring items within the data.

6. Demolished Lines are to be delivered in a feature data set, which appropriately reflects the utility.

1.3.11 Creation of Geographic Data Documentation (METADATA)

For each digital file delivered containing geographic information the Contractor shall provide documentation consistent with the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata (CSDGM). Both 'Mandatory' and 'Mandatory-if- Applicable' fields shall be completed for each geographic data set.

Metadata generation tools included in the ArcGIS suite of software shall be used in the production of the required metadata in XML format. If neither of these tools is used, the Contractor must insure that the metadata is delivered in a format that can be easily translated to the XML format.

Copies of the FGDC metadata standard can be obtained on the Internet at http://www.fgdc.gov.

The documentation shall include, but not be limited to, the following:

a. The name and description of the data set/data layer.

b. The source of the data and any related data quality information such as positional accuracy and time period of content.

c. Descriptions of the receiver and other equipment used during collection and processing, base stations used for differential corrections, software used for performing differential corrections, estimated horizontal and vertical accuracies obtained, and conversion routines used to translate the data into final geographic data delivery format.

d. Type of data layer (point, line, polygon, etc.)

e. Field names of all attribute data and a description of each field name.

f. Definition of all codes used in the data fields.

g. Ranges of numeric fields and the meaning of these numeric ranges.

h. The creation date of the data layer and the name of the person or company who created it.

i. A point of contact shall be provided to answer technical questions.

1.3.12 Final Report

Final report will also be required with the following supplement information:

a. Specific procedures and list of equipment, software and versions that was utilized for the GPS data collection and creation of geospatial data.

b. Any offsets.

c. Modifications to the geodatabase to include any new feature data class.

d. Source that was utilized for all required attributes.

e. Miscellaneous information that the contractor deems significant.

f. A Technical Point of Contact.

g. GPS data controller files.

1.3.13 GIS Submittals

Submit GIS data deliverables for review and approval by the MCB Camp Lejeune Public Works GIS section.

a. Reports will be submitted in the following formats and or versions. Contractor shall verify required version(s) of software, via the Government Project Manager, at the commencement of this contract.

1. Microsoft Office 2003 or higher upon verification.

2. Adobe Portable Document Format (PDF).

b. All GIS data will be provided in a ArcGIS file personal geodatabase as specified.

c. Media for Geospatial Data Deliverables: Geographic data shall be delivered on a compact disk read-only memory (CD-ROM) -or- digital versatile disk read-only memory (DVD-ROM).

d. Map submittals shall accompany each geospatial deliverable.

1. Include ANSI C map for each project / area.

2. Data should be labeled and attributed per specification.

1.3.14 Ownership

All digital files, final hard-copy products, GPS raw data, source data acquired for this project, and related materials, including that furnished by the Government, shall become the property of MCB Camp Lejeune and will not be issued, distributed, or published by the Contractor.

1.3.15 Geographic Data Review

a. The digital geographic maps, GPS collection files and related data, all working text and documents and file personal geodatabase shall be included for review in the draft and final contract submittals.

b. The contract shall submit a preliminary review of data between 15- 25 percent to ensure specifications are being met.

c. The data will be analyzed for discrepancies in subject content, correct format in accordance with these specifications, and compatibility with MCB Camp Lejeune's IGI&S repository schema.

d. Failure for non-compliance of the specifications outlined in this document will result in non-acceptance of data deliverables.

1.4 ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES

1.4.1 Infrastructure

GPS and collect attribute data as specified in the Collection and Creation of Geospatial data section for each feature listed with Sub-foot GPS accuracy and enter attribute data in compliance with the IGI&S database.

1.4.1.1 Structures: CLJN.structure_existing_area

GPS Structure and collect the following attributes:

a. Subtype ID
b. Building ID (building number)
c. Structure Status
d. Number of Levels
e. Structure Use 2: Populate "Residential" if structure is a residential unit

f. Building No (building number)
g. Facililty No (building number)
h. Material
i. Drawing Number
j. Contract Number
k. Date Acquired
l. Data Source

1.4.1.2 Floor Outline: CLJN.building.floor_outline

All new and renovated buildings will be required to have a "clean floor plan" for each floor level that will be delivered in GIS format. Each level will represent one feature and provide the following: walls, doors, windows, closet, crawlspace, head facility, stairwells, etc.

Create feature and update the following attributes:

a. Building ID (building number)
b. Floor Name
c. Drawing Number
d. Contract Number:
e. Data Source

1.4.1.3 Slabs: CLJN.slab_area

GPS and collect the following attributes:

a. Structure ID: (Facility Number, if applicable)
b. Feature Description
c. Structure Material
d. Structure Condition
e. Built Date
f. Drawing Number
g. Contract Number
h. Data Source

1.4.2 Transportation

Attribute data requirements for Transportation: The following attributes shall be collected for each infrastructure data class: Collect GPS data for all features listed with Sub-Foot accuracy.

1.4.2.1 Road Centerline: CLJN.road_centerline

GPS and collect the following attributes:

a. Category
b. Road Name
c. Paved: Paved/Unpaved
d. Date Acquired
e. Surface Type
f. Drawing Number
g. Contract Number
h. Data Source
i. Use

1.4.2.2 Road Area: CLJN.road_area

GPS and collect the following attributes:

a. Road Segment
b. Paved
c. Divided: Yes/No
d. Number of Lanes
e. Date Acquired
f. Surface Type
g. Drawing Number
h. Contract Number
i. Data Source
j. Road Name

1.4.2.3 Curb line: CLJN.curb_line

GPS and collect the following attributes:

a. Curb Material
b. Description
c. Drawing Number
d. Contract Number
e. Data Source

1.4.2.4 Driveways: CLJN.vehicle_driveway_area

GPS and collect the following attributes:

a. Paved or Unpaved
b. Surface Material
c. Date Acquired
d. Drawing Number
e. Contract Number
f. Data Source

1.4.2.5 Parking Lots: CLJN.vehicle_parking_area

GPS and collect the following attributes:

a. Parking ID: Building that is associated with this feature
b. Paved Description
c. Total Spaces
d. Lighting
e. Drawing Number
f. Contract Number
g. Data Source
h. Surface Type
i. Park Use
j. Feature Name
k. Striping

1.4.2.6 Bridge: CLJN.road_bridge_area

GPS and collect the following attributes:

a. Bridge ID: Facility Number
b. Number of Lanes
c. Bridge Material Type
d. Bridge Type
e. Capacity
f. Drawing Number

g. Contract Number
h. Data Source

1.4.2.7 Pedestrian Sidewalks: CLJN.pedestrian_sidewalk_area

GPS and collect the following attributes:

a. Material
b. Use
c. Status
d. Drawing Number
e. Contract Number
f. Data Source
g. Date Acquired

1.4.3 Improvement General

Attribute data requirements for Improvement General: The following attributes shall be collected for each infrastructure data class: Collect GPS data for all features listed with Sub-Foot accuracy.

1.4.3.1 Fence: CLJN.fence_line

GPS and collect the following attributes:

a. Material: Chain Link, Wood, etc.
b. Drawing Number
c. Contract Number
d. Data Source
e. RECLIN ID: Facility Number
f. Date Acquired

1.4.3.2 Gates: CLJN.gate_line

GPS and collect the following attributes:

a. Material
b. Feature Height
c. Drawing Number
d. Contract Number
e. Data Source
f. Gate ID: Facility ID
g. Date Acquired

1.4.3.3 Walls: CLJN.wall_line

GPS and collect the following attributes:

a. Material
b. Feature Height
c. Drawing Number
d. Contract Number
e. Data Source
f. Facility ID:
g. Date Acquired

1.4.3.4 Recreation Trails: CLJN.recreation_trail_centerline

GPS and collect the following attributes:

a. Subtype
b. Trail Description
c. Paved
d. Date Acquired
e. Drawing Number
f. Contract Number
g. Data Source
h. Trail ID
i. Trail Name

1.4.3.5 Miscellaneous Recreation Area Playground: CLJN.playground_area

GPS and collect the following attributes:

a. Playground ID: Facility Number
b. Feature Description:
c. Drawing Number
d. Contract Number
e. Data Source

1.4.3.6 Swimming Pool: CLJN.swimming_pool_area

GPS and collect the following attributes:

a. Swimming Pool ID
b. Feature Description
c. Drawing Number
d. Contract Number
e. Data Source

1.4.3.7 Athletic Court: CLJN.athletic_court_area

GPS and collect the following attributes:

a. Court ID
b. Court Type
c. Court Name
d. Date Acquired
e. Drawing Number
f. Contract Number
g. Data Source
h. Court Desc

1.4.3.8 Athletic Field: CLJN.athletic_field_area

GPS Structures and collect the following attributes:

a. Field ID: Facility Number
b. Field Description
c. Date Acquired
d. Field Type
e. Contract Number
f. Drawing Number
g. Data Source
h. Field Name

1.4.4 Environmental Storage Tanks

Attribute data requirements for Environmental Storage Tanks: The following attributes shall be collected for each infrastructure data class: Collect GPS data for all features listed with Survey Grade accuracy.

1.4.4.1 Underground Storage Tanks: CLJN.underground_storage_tank_point

GPS and collect the following attributes:

a. ENVUST ID for Under Ground Storage Tank
b. Hazsite ID
c. EH Tank: Fuel Type
d. Facility Number
e. X Coordinates
f. Y Coordinates
g. Installation Date
h. Drawing Number
i. Contract Number
j. Data Source
k. Product D
l. Narrative
m. Serial Number
n. Tank Sys D
o. Status
p. Regulated
q. Volume
r. Volume U D

1.4.4.2 Aboveground Storage Tanks: CLJN.aboveground_storage_tank_site

GPS and collect the following attributes:

a. ENVAST ID for Above Ground Storage Tank
b. Hazsite ID
c. EH Tank
d. Facility Number
e. X Coordinates
f. Y Coordinates
g. Installation Date
h. Drawing Number
i. Contract Number
j. Data Source
k. Product D
l. Narrative
m. Serial Number
n. Tank Sys D
o. Status
p. Regulated
q. Volume
r. Volume U D

1.4.5 Other Features

Other Infrastructure Features:

All newly constructed features require GIS deliverables. If a particular utility is being installed and has been omitted from this specification, the feature shall be deliverable under these guidelines. At a minimum the

following will be required;

a. Subtype ID
b. Facility ID
c. Installation Date
d. Type/Description
e. Material
f. Drawing Number
g. Contract Number
h. Data Source
g. Date Acquired

1.4.6 Utilities

Locate underground utilities, GPS and collect attribute data as specified in the Collection and Creation of Geospatial data section for each feature listed with survey grade accuracy and enter attribute data in compliance with the IGI&S database.

Please note: All utility lines that can be currently located in MCB Camp Lejeune's GIS geodatabase that are to be demolished/removed within the specifications of this contract will be used to update the demolished line feature data set for that class. The existing spatial and non-spatial data will be copied into the demolished feature class. This information does not include Abandoned in Place (AIP) lines. Abandoned lines shall remain the in the existing data feature class and be attributed AIP.

1.4.7 Electrical Distribution

Please Note: MCB, Camp Lejeune's Complete Circuit ID list is available. Please contract Government Project Manager for list which is provided by our Electrical Distribution shop in Public Works, MCB Camp Lejeune.

The following attributes shall be collected for each utility data class:

Collect GPS data for all features listed with survey grade accuracy.

1.4.7.1 Demolished Electrical Lines: CLJN.demolished_cable_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

a. Date
b. Drawing Number
c. Contract Number
d. Data Source

1.4.7.2 Electrical Lines: CLJN.electrical_cable_line

Locate all Electrical Line data and collect the following attributes:

a. Subtype Identifier
b. Disposition
c. Subtype
d. Date Acquired
e. Conduit Size
f. Number of Phases
g. Insulation Material
h. Voltage

i. Size of Units
j. Substation ID
k. Circuit ID
l. Contract Number
m. Drawing Number
n. Data Source

1.4.7.3 Electrical Meter: CLJN.electrical_meter_point

Locate, GPS and collect the following attributes:

a. Meter ID
b. Voltage
c. KW Rate
d. Number of Phases
e. Model Number
f. Date Acquired
g. Facility ID
h. Substation ID
i. Circuit ID
j. X Coordinates
k. Y Coordinates
l. Contract Number
m. Drawing Number
n. Data Source

1.4.7.4 Electrical Transformer: CLJN.elect_transformr_bank_point

Locate, GPS and collect the following attributes:

a. Subtype
c. Date Installed
d. Primary Voltage
e. Secondary Voltage
f. Number of Transformers
g. Total KVA
h. Substation ID
i. Circuit ID
j. KVA Information
k. X Coordinates
l. Y Coordinates
m. Contract Number
n. Drawing Number
o. Data Source

1.4.7.5 Electrical Poles: CLJN.utility_pole_tower_point

Locate, GPS and collect the following attributes:

a. Pole No
b. Date Acquired
c. Condition
d. Type
e. Material
f. Pole Height
g. Units of Measure
h. Circuit ID
i. X Coordinates
j. Y Coordinates

k. Contract Number
l. Drawing Number
m. Data Source

1.4.7.6 Exterior Lighting: CLJN.exterior_lighting_point

Locate, GPS and collect the following attributes:

a. Light Type
b. X Coordinates
c. Y Coordinates
d. Sensor
e. Watts
f. Voltage
g. Circuit ID
h. Contract Number
j. Drawing Number
k. Date Acquired
l. Data Source

1.4.7.7 Electrical Switch: CLJN.electrical_switch_point

Locate, GPS and collect the following attributes:

a. Subtype ID
b. Switch ID
c. Disposition
d. Installation Type
e. Switch Status
f. Voltage
g. Circuit ID
h. X Coordinates
i. Y Coordinates
j. Contract Number
k. Drawing Number
l. Data Source

1.4.7.8 Electrical Regulator: CLJN.electrical_regulator_point

Locate, GPS and collect the following attributes:

a. Electrical Regulator ID
b. Disposition
c. Regulator Type
d. Regulator Use
e. Primary Volts
f. Secondary Volts
g. Number of Taps
h. KV Rate
i. Fuse Type
j. Manufacturer
k. Model Number
l. Circuit ID
m. X Coordinates
n. Y Coordinates
o. Contract Number
p. Drawing Number
q. Data Source

1.4.7.9 Electrical Manholes: CLJN.electrical_junction_point

Locate, GPS and collect the following attributes:

a. Subtype ID
b. Type
c. Number of Cables
d. Rim Elevation
e. Units of Elevation
f. Diameter
g. Diameter Units
h. X Coordinates
i. Y Coordinates
j. Substation ID
k. Contract Number
l. Drawing Number
m. Data Source

1.4.7.10 Electrical Generators: CLJN.electrical_generator_point

Locate, GPS and collect the following attributes:

a. Generator ID
b. Disposition
d. KVA
e. KW Rate
f. Voltage
g. Fuel Type
h. Manufacturer
i. Model
j. Serial Number
k. Circuit ID
l. X Coordinates
m. Y Coordinates
n. Facility ID
o. Contract Number
p. Drawing Number
q. Data Source

1.4.7.11 Substation: CLJN.electrical_substation_point

Locate, GPS and collect the following attributes:

a. Disposition
b. Capacity Rate
c. Capacity Measure
d. Voltage In
e. Voltage Out
f. Voltage
g. Number of transformer
h. Number of Spares
i. Number of Circuits
j. X Coordinates
k. Y Coordinates
l. Contract Number
m. Drawing Number
n. Data Source
o. Date Acquired

1.4.8 Heating and Cooling Systems

The following attributes shall be collected for each utility data class: Collect GPS data for all features listed with survey grade accuracy.

1.4.8.1 Boiler: CLJN.heat_cool_boiler_site - If Required

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Type
d. Capacity Heat
e. Capacity Units
f. Building ID: Facility Number where Boiler Resides
g. X Coordinates
h. Y Coordinates
i. Contract Number
j. Drawing Number
k. Data Source

1.4.8.2 Fitting: CLJN.heat_cool_fitting_point

Georeference fitting data and collect the following attributes:

a. Subtype ID
b. Date Acquired
c. Material
d. Size
e. Units
f. Line Diameter
g. Diameter in Units
h. X Coordinates
i. Y Coordinates
j. Contract Number
k. Drawing Number
l. Data Source

1.4.8.3 Valves: CLJN.heat_cool_valve_point

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Size
c. Size Units
d. Elevation
e. Elevation Units
f. Project ID
g. X Coordinates
h. Y Coordinates
i. Contract Number
j. Drawing Number
k. Data Source

1.4.8.4 Manholes: CLJN.heat_cool_junction_point

Locate, GPS and collect the following attributes:

a. Subtype ID

b. Number of Valves
c. Number of Pipes
d. Width
e. Length
f. Diameter
g. Units for Measurements
h. Rim Elevations
i. Ground Elevation
j. Contract Number
k. Drawing Number
l. X Coordinates
m. Y Coordinates
n. Data Source

1.4.8.5 Chiller and Steam Line: CLJN.heat_cool_line

Locate, GPS and collect the following attributes:

a. Subtype ID: Condensate, Steam, Chiller
b. Date Acquired
c. Disposition
d. Use: Underground, Overhead, Abandoned
e. Material
f. Size
g. Length
h. Size Units
i. Ground Elevation
j. Invert Elevation
k. Units for Elevation
l. Taped: Yes/No
m. Building ID: If service line indicate Building
n. Insulation Material
o. Size of Insulation
p. Size Units
q. Contract Number
r. Drawing Number
s. Data Source

1.4.8.6 Demolished Steam Line: CLJN.demolished_heat_cool_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

a. Date
b. Drawing Number
c. Contract Number
d. Data Source

1.4.9 Storm Sewer

1.4.9.1 Storm Sewer Lines: CLJN.storm_sewer_line

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Use
c. Type
d. Material
e. Size

f. Diameter Units
g. Elevation
h. Elevation Units
i. Contract Number
j. Drawing Number
k. Data Source

1.4.9.2 Storm Sewer Drainage Line: CLJN.storm_sewer_open drainage_line

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Contract Number
d. Drawing Number
e. Data Source

1.4.9.3 Manhole: CLJN.storm_sewer_junction_point

Locate, GPS and collect the following attributes:

a. Subtype
b. X Coordinates
c. Y Coordinates
d. Contract Number
e. Drawing Number
f. Data Source

1.4.9.4 Inlet: CLJN.storm_sewer_inlet_point

Locate, GPS and collect the following attributes: Contract shall verify SWPPP GPS inlet and add to this feature.

a. Subtype
b. Date Acquired
c. X Coordinates
d. Y Coordinates
e. Contract Number
f. Drawing Number
g. Data Source

1.4.9.5 Outfall: CLJN.storm_sewer_outfall_point

Locate, GPS and collect the following attributes:

a. Subtype Domain
b. Date Acquired
c. Basin ID: Contractor shall utilize existing data and coordinate Basin_ID with data manager.
d. User Flag
e. X Coordinates
f. Y Coordinates
g. Contract Number
h. Drawing Number
i. Data Source

1.4.9.6 Ponds, Basins, & Treatment Measures: CLJN.storm_sewer_reservoir_areas

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Project ID
c. Permit ID: SW8 XXXXXX
d. Size
e. Facility ID
f. Installation ID
g. Drawing Number
h. Data Source

1.4.10 Wastewater Collection

The following attributes shall be collected for each utility data class: Collect GPS data for all features listed with survey grade accuracy.

1.4.10.1 Wastewater Lines: CLJN.wastewater_line

Locate, GPS and collect the following attributes:

a. Pipe ID: By Manhole Number
b. Date Acquired
c. Use
d. Material
e. Size of Diameter
f. Units
g. Invert Elevation 1
h. Invert Elevation 2
i. Elevation Units
j. Slope
k. Slope Units
l. Building ID: If building/facility service line indicate Building number that the line services
m. Contract Number
n. Drawing Number
o. Data Source
p. Subtype

1.4.10.2 Demolished Lines: CLJN.demolished_wastewater_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

a. Date
b. Drawing Number
c. Contract Number
d. Data Source

1.4.10.3 Fitting: CLJN.wastewater_fitting_point

Georeference Fitting data and collect the following attributes:

a. Subtype ID
b. Date Acquired
c. Type
d. Material

e. Size of Diameter
f. Units
g. User Flag: Named Area
h. Contract Number
i. Drawing Number
j. X Coordinates
k. Y Coordinates
l. Data Source

1.4.10.4 Valves: CLJN.wastewater_valve_point

Locate, GPS and collect the following attributes:

a. Valves ID: Manhole Number associated with valve
b. Date Acquired
c. Valve Style/Group
d. Valve Use
e. Size in Diameter
f. Valve Elevation
g. Units of Elevation
h. X Coordinates
i. Y Coordinates
j. Manhole ID
k. Contract Number
l. Drawing Number
m. Data Source

1.4.10.5 Manholes: CLJN.wastewater_junction_point

Locate, GPS and collect the following attributes:

a. Subtype ID: Manhole
b. Manhole ID: Each section of the base has a unique numbering system for manholes; please see Public Work, GIS office for details.
c. Use
d. Type
e. Material
f. Number of Pipes in manhole
g. Rim Elevation
h. Invert Elevation
i. Elevation Units
j. Manhole Diameter
k. Diameter Units
l. X Coordinates
m. Y Coordinates
n. Date Acquired
o. Contract Number
p. Drawing Number
q. Data Source

1.4.10.6 Vent: CLJN.wastewater_vent_point

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Valve Style/Type
c. Use
d. Size in Diameter
e. Units in Diameters

f. X Coordinates
g. Y Coordinates
h. Subtype ID
i. Containment Type
j. Contract Number
k. Drawing Number
l. Data Source

1.4.10.7 Pump Stations: CLJN.wastewater_pump_point

Locate, GPS and collect the following attributes:

a. Pump Station ID: Facility Number
b. Date Acquired
c. Use
d. Type
e. Cooling Method
f. Rated Outflow Volume
g. Flow Unit Measure Code
h. X Coordinates
i. Y Coordinates
j. Number of Pumps
k. Contract Number
l. Drawing Number
m. Data Source

1.4.10.8 Oil Water Separators: CLJN.wstewat_oil_wat_separatr_point

Locate, GPS and collect the following attributes:

a. Oil Water Separator ID: Facility Number
b. Date Acquired
c. Type
d. Separator Process
e. Separator Volume
f. Volume Units of Measure
g. Grit Chamber
h. Flow Capacity
i. Flow Units
j. X Coordinates
k. Y Coordinates
l. Contract Number
m. Drawing Number
n. Data Source

1.4.10.9 Grease Trap: CLJN.wastewater_grease_trap_point

Locate, GPS and collect the following attributes:

a. Trap Identification: Nearest Facility use Number
b. Type of Trap
c. Material
d. Capacity
e. Capacity Units
f. Manhole
g. Total Number of Laterals
h. Flow Rate
i. Flow Units
j. Building ID: Facility Number On Associated Building

k. X Coordinates
l. Y Coordinates
m. Contract Number
n. Drawing Number
o. Data Source

1.4.10.10 Septic Tank: CLJN.wastewater_septic_tank_point

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Tank capacity
d. Contract Number
e. Drawing Number
f. Data Source

1.4.11 Water Distribution

The following attributes shall be collected for each utility data class: Collect GPS data for all features listed with survey grade accuracy.

1.4.11.1 Water Lines: CLJN.water_line

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Use of Line
c. Disposition
d. Material
e. Size
f. Size Units
g. Pipe Length
h. Unit for Length Dimension
i. Taped
j. Source
k. All Invert Elevation information
l. Units of Measures
m. Contract Number
n. Drawing Number
o. Data Source
p. Subtype

1.4.11.2 Demolished Line: CLJN.demolished_water_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

a. Date
b. Drawing Number
c. Contract Number
d. Data Source

1.4.11.3 Water Meter: CLJN.water_meter_point

Locate, GPS and collect the following attributes:

a. Meter ID
b. Date Acquired

c. Type
d. Installation Type
e. Building ID: Facility Number - If attached to Building
f. X Coordinates
g. Y Coordinates
h. Contract Number
i. Drawing Number
j. Data Source

1.4.11.4 Water Tank: CLJN.water_tank_point

Locate, GPS and collect the following attributes:

a. Tank ID: Facility Number
b. Date Acquired
c. Disposition
d. Tank Use
e. Tank Status
f. Tank Width
g. Tank Length
h. Tank Diameter
i. Ground Elevation
j. Tank Volume
k. Unit of measure in Gallons
l. Top Elevation
m. Overflow Elevation
n. Pressure High
o. Pressure Low
p. X Coordinates
q. Y Coordinates
r. Contract Number
s. Drawing Number
t. Data Source

1.4.11.5 Water Valve: CLJN.water_valve_point

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Use: Valve
d. Valve Status
e. Size
f. Size Units
g. Valve Elevation
h. Ground Elevation
i. Size Unit
j. ID
k. X Coordinates
l. Y Coordinates
m. Contract Number
n. Drawing Number
o. Data Source
p. Subtype

1.4.11.6 Water Fitting: CLJN.water_fitting_point

Georeference and collect the following attributes:

a. Date Acquired
b. Disposition
c. Type
d. Material
e. Size
f. Size Units
g. Contract Number
h. Drawing Number
i. Data Source

1.4.11.7 Water Well: CLJN.potable_water_well_point

Locate, GPS and collect the following attributes:

a. Well ID: Facility Number
b. Use: Potable, Non-Potable
c. Well Status
d. Station ID: Building Number
e. Date Acquired
f. X Coordinates
g. Y Coordinates
h. Tank ID: Water Tank Facility Number for which well feeds
i. Contract Number
j. Drawing Number
k. Data Source

1.4.11.8 Water Manhole: CLJN.water_junction_point

Locate, GPS and collect the following attributes:

a. Subtype
b. Use
c. Type
d. Material
e. Number Valves
f. Number Pipes
g. Installation Date
h. Size Diameter
i. Unit Diameter
j. X Coordinates
k. Y Coordinates
l. Contract Number
m. Drawing Number
n. Data Source

1.4.11.9 Fire Hydrant: CLJN.water_fire_connection_point

Locate, GPS and collect the following attributes:

a. Hydrant ID: TBD by Fire Department
b. Date Acquired
c. Disposition
d. Valve Connector Type
e. Valve Size
f. Inlet Diameter
g. Units of measure
h. X Coordinates
i. Y Coordinates
j. Contract Number

k. Drawing Number
l. Data Source

1.4.11.10 NON Potable Water Well: CLJN.non-potable_water_well_point

Locate, GPS and collect the following attributes:

a. Well ID: Facility Number
b. Use
c. Well Status
d. Station ID: Building Number
e. Date Acquired
f. X Coordinates
g. Y Coordinates
h. Tank ID: Water Tank Facility Number
i. Contract Number
j. Drawing Number
k. Data Source

1.4.11.11 Other Utility Features

Failure to follow the specification outlined in this document will result in non-acceptance of data deliverable.

Geospatial data delivery does not replace as-built requirements.

All newly constructed features require GIS deliverables.

a. Facility ID
b. Installation Date
c. Type/Description
d. Material
e. Size
f. Drawing Number
g. Contract Number
h. Data Source

1.4.12 Natural Gas Distribution

The following attributes shall be collected for each utility data class. Collect GPS data for all features listed with survey grade accuracy.

1.4.12.1 Natural Gas Line: CLJN.natural_gas_line

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Material
d. Size
e. Size Units
f. Pipe Length
g. Taped
h. Source
i. All Invert Elevation Information
j. Units of Measures
k. Contract Number
l. Drawing Number
m. Data Source

n. Subtype

1.4.12.2 Natural Gas Valve: CLJN.natural_gas_valve

Locate, GPS and collect the following attributes:

a. Date Acquired:
b. Use:
c. Size
d. Size Units
e. Valve Elevation
f. Ground Elevation
g. Size Unit
h. X Coordinates
i. Y Coordinates
j. Contract Number
k. Drawing Number
l. Data Source
m. Subtype

1.4.13 Alternative Energy

1.4.13.1 Geothermal Wells CLJN.geothermal wells

Locate, GPS and collect the following attributes:

a. Bldg_ID
b. X Coordinates
c. Y Coordinates
d. Well_ID
e. Depth
f. Units
g. Status
h. Bentonite
i. Casing
j. Construction
k. Installation Contract #
l. Contract Number
m. Drawing Number
n. Data Source

1.4.13.2 Water Wells associated with Geothermal Pumping System CLJN.water wells associated with geothermal pumping system

Locate, GPS and collect the following attributes:

a. Well ID: Facility Number
b. Use:
c. Well Status
d. Station ID: Building Number
e. Date Acquired:
f. X Coordinates
g. Y Coordinates
h. Tank ID: Water Tank Facility Number
i. Contract Number
j. Drawing Number
k. Data Source:

1.4.13.3 Water Lines associated with Geothermal Pumping System (Hybrid Geothermal Loop) CLJN.water lines associated with geothermal pumping system

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Use of Line
c. Disposition
d. Material
e. Size
f. Size Units
g. Pipe Length
h. Unit for Length Dimension
i. Taped
j. Source
k. All Invert Elevation Information
l. Units of Measures
m. Contract Number
n. Drawing Number
o. Data Source
p. Subtype

1.4.13.4 Water Valve associated with Geothermal Pumping System CLJN.water valve associated with geothermal pumping system

Locate, GPS and collect the following attributes:

a. Date Acquired:
b. Disposition
c. Use: Valve
d. Valve Status
e. Size
f. Size Units
g. Valve Elevation
h. Ground Elevation
i. Size Unit
j. Manhole ID
k. X Coordinates
l. Y Coordinates
m. Contract Number
n. Drawing Number
o. Data Source
p. Subtype

1.4.13.5 Water Fitting associated with Geothermal Pumping System CLJN.water fitting associated with geothermal pumping system

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Type
d. Material
e. Size
f. Size Units
g. Contract Number
h. Drawing Number
i. Data Source

1.4.14 Non-Compliance

Failure to follow the specification outlined in this document will result in non-acceptance of data deliverable.

Geospatial data delivery does not replace as-built requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

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SECTION 02 41 00

DEMOLITION
05/10

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.

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6	(2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual

1.2 PROJECT DESCRIPTION

1.2.1 Demolition Plan

Prepare a Demolition Plan and submit proposed salvage, demolition, and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress and a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling with reference to paragraph Existing Facilities to be Removed. Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use. Coordinate with Waste Management Plan. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by the Contracting Officer prior to work beginning.

1.2.2 General Requirements

Do not begin demolition until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes salvage and recycling of materials. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer.

Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of existing work components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove debris from work areas daily.

1.3.2 Trees

Protect trees within the project site which might be damaged during demolition and which are indicated to be left in place. Erect and secure fence as indicated. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.3.3 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

1.3.4 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control

approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions; G

SD-07 Certificates

Demolition Plan; G

1.6 QUALITY ASSURANCE

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

1.6.1 Dust and Debris Control

Prevent the spread of dust and debris on pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.7 PROTECTION

1.7.1 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before and during the demolition work continuously evaluate the site conditions and take immediate action to protect all personnel working in and around the project site. No area, section, or component of, or work items immediately adjacent to, items to be demolished will be allowed to be left in place without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove material or perform other work in the immediate area.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.9 EXISTING CONDITIONS

Before beginning any demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. The Contractor shall take photographs sized 4 inch as a record of existing conditions. Include in the record the description

of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results to the Contracting Officer.

PART 2 PRODUCTS

2.1 FILL MATERIAL

a. Backfill voids, depressions or excavations resulting from demolition of structures. Materials procedures and compaction requirements shall be as specified in Section 31 23 00.00 20, EXCAVATION AND FILL.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled, removed and stored off Government property to prevent damage, and re-installed as the work progresses. The Contractor shall be responsible for safeguarding materials identified for re-use, and shall provide new materials in place of any damaged or missing from that inventoried prior to demolition.

3.1.1 Structures

a. Remove existing structures indicated to be removed to 3 feet below grade. Break up base slabs to permit drainage. Remove sidewalks, curbs, gutters and street light bases as indicated.

3.1.2 Utilities and Related Equipment

3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area.

3.1.3 Chain Link Fencing

Remove chain link fencing, gates, posts, foundations, and backfill post holes within limits of demolition.

3.1.4 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base to a depth as required to provide new work and remove from Government property. Provide neat sawcuts at limits of pavement removal as indicated.

3.1.5 Items With Unique/Regulated Disposal Requirements

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items indicated for re-use, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Materials identified for re-use that are determined to be in excess of that required for new work shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment indicated to be reused to prevent damage, and reinstall as the work progresses.

3.4 CLEANUP

Remove debris and rubbish and transport in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations in accordance with the Waste Management Plan. Storage of removed materials on the project site is prohibited.

3.5.2 Removal from Government Property

Transport waste materials removed from demolition from Government property for legal disposal.

3.6 REUSE OF SALVAGED ITEMS

Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --

SECTION 02 56 13

WASTE CONTAINMENT GEOMEMBRANE
02/10

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.

ASTM INTERNATIONAL (ASTM)

ASTM D1004	(2013) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1505	(2010) Density of Plastics by the Density-Gradient Technique
ASTM D1603	(2012) Carbon Black Content in Olefin Plastics
ASTM D3895	(2007) Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
ASTM D4218	(1996; R 2008) Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
ASTM D4833	(2007) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D5397	(2007; R 2012) Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
ASTM D5596	(2003; R 2009) Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
ASTM D5721	(2008; R 2013) Air-Oven Aging of Polyolefin Geomembranes
ASTM D5885	(2006; R 2012) Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry
ASTM D5994	(2010) Measuring Core Thickness of Textured Geomembrane
ASTM D6392	(2012) Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

ASTM D6497	(2002; R 2010) Mechanical Attachment of Geomembrane to Penetrations or Structures
ASTM D6693	(2004; 2010) Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polyproplene Geomenbranes
ASTM D7238	(2006; R 2012) Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
ASTM D7466	(2010) Standard Test Method for Measuring Asperity Height of Textured Geomembranes

GEOSYNTHETIC INSTITUTE (GSI)

GSI GRI GM7	(1995) Accelerated Curing of Geomembrane Test Strip Seams Made by Chemical Fusion Methods
GSI GRI GM9	(1995) Cold Weather Seaming of Geomembranes

1.2 SUBMITTAL REQUIREMENTS

Submit manufacturer's, and fabricator's qualification statements, including resumes of key personnel involved in the project, a minimum of 30 days prior to geomembrane shipment. Also submit installer's, QC Specialist's and QC laboratory's qualification statements including resumes of key personnel involved in the project a minimum of 30 days prior to geomembrane placement. The submittal from the QC laboratory shall include verification that the laboratory is accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform. The following shall also be submitted:

a. Furnish Geomembrane Panel Layout, Seam Location and Detail Drawings a minimum of 30 days prior to geomembrane placement. Identify any geomembrane existing from previous phases and method of field seaming.Prepare final as-built drawings of the geomembrane installation. These drawings shall include panel numbers, seam numbers, location of repairs, destructive seam samples, and penetrations.

b. Manufacturer's and fabricator's QC manuals, including a description of the quality control laboratory facilities, a minimum of 30 days prior to geomembrane shipment. Installer's QC manual, a minimum of 30 days prior to geomembrane placement. The QC manual shall contain procedures, techniques, equipment, and recommendations for geomembrane and overlying geotextile, aggregate, or geocomposite deployment, field panel placement, geomembrane field seaming, pipe penetration details, scan testing and repair of defects. The manual shall also address the placement of the overlying geotextile/aggregate or geocomposite in regards to maintaining the integrity of the installed geomembrane.

c. Geomembrane QA and QC samples.

d. Manufacturer's certified raw and sheet material test reports and a copy of the QC certificates, a minimum of 30 days prior to shipment of geomembrane to the site.

e. Certification from the QC Specialist and installer of the acceptability of the surface on which the geomembrane is to be placed, immediately prior to geomembrane placement.

f. QC Specialist certified test results on all field seams. Installer and certified QC laboratory test results on all destructively tested field seams. QC Specialist certified test results on all repaired seams. Certified QC test results.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Geomembrane Panel Layout, Seam Location and Detail Drawings; G
Penetrations; G
As-Built Drawings; G

SD-03 Product Data

Geomembrane Sheet Materials; G
Warranty; G
Manufacturer's Warranty Statement.
Tests, Inspections, and Verifications; G
Field Seaming; G
Qualifications; G

SD-04 Samples

Samples

SD-06 Test Reports

Materials; G
Surface Preparation; G
Geomembrane Seam Testing Log; G
Geomembrane Panel Placement Log; G
Geomembrane Seaming Record Log; G
Geomembrane Seam Destructive Sample Log; G
Non-Destructive Field Seam Continuity Testing; G
Destructive Field Seam Testing; G
Geomembrane Repair Log; G
Destructive Seam Test Repairs; G
Tests; G

SD-07 Certificates

QC Laboratory Accreditation
Samples
Materials; G

Surface Preparation; G
Destructive Field Seam Testing; G
Destructive Seam Test Repairs; G
Completed test logs with a statement certifying compliance with specified requirements herein; G

1.4 QUALIFICATIONS

1.4.1 Manufacturer

Manufacturer shall have produced the proposed geomembrane sheets for at least 5 completed projects having a total minimum area of 10 million square feet.

1.4.2 Fabricator

The fabricator is responsible for seaming geomembrane sheets into panels. Fabricator shall have fabricated the proposed geomembrane panels for at least 5 completed projects having a total minimum area of 2 million square feet.

1.4.3 Installer

The installer is responsible for field handling, deploying, seaming, anchoring, and field Quality Control (QC) testing of the geomembrane. The installer shall have installed the proposed geomembrane material for at least 5 completed projects having a total minimum area of 2 million square feet. At least one seamer shall have experience seaming a minimum of 500,000 square feet of the proposed geomembrane using the same type of seaming equipment and geomembrane thickness specified for this project.

1.4.4 QC Specialist

The QC Specialist is the person or corporation hired by the Contractor, who is responsible for monitoring and documenting activities related to the QC of the geomembrane from manufacturing through installation. The QC Specialist shall have provided QC inspection during installation of the proposed geomembrane material for at least 5 completed projects having a total minimum area of 2 million square feet.

1.4.5 QC Laboratory

The QC laboratory shall have provided QC and/or Quality Assurance (QA) testing of the proposed geomembrane and geomembrane seams for at least five completed projects having a total minimum area of 2 million square feet. The QC laboratory shall be accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP) for the tests the QC laboratory will be required to perform. Submit the Certificate of QC Laboratory Accreditation.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Delivery

The QC Specialist shall be present during delivery and unloading of the geomembrane. Each geomembrane roll/panel shall be labeled with the manufacturer's name, product identification number, roll/panel number, and roll dimensions.

1.5.2 Storage

Temporary storage at the project site shall be on a level surface, free of sharp objects where water cannot accumulate. The geomembrane shall be protected from puncture, abrasion, excessive heat or cold, material degradation, or other damaging circumstances. Storage shall not result in crushing the core of roll goods or flattening of the rolls. Rolls shall not be stored more than two high. Palleted materials shall be stored on level surfaces and shall not be stacked on top of one another. Ultraviolet sensitive materials (i.e., PVC) shall be covered with a sacrificial opaque and waterproof covering or placed in a temporary shelter. Damaged geomembrane shall be removed from the site and replaced with geomembrane that meets the specified requirements.

1.5.3 Handling

Rolls/panels shall not be dragged, lifted by one end, or dropped. A pipe or solid bar, of sufficient strength to support the full weight of a roll without significant bending, shall be used for all handling activities. The diameter of the pipe or solid bar shall be small enough to be easily inserted through the core of the roll. Chains shall be used to link the ends of the pipe or bar to the ends of a spreader bar. The spreader bar shall be wide enough to prevent the chains from rubbing against the ends of the roll. Alternatively, a stinger bar protruding from the end of a forklift or other equipment may be used. The stinger bar shall be at least three-fourths the length of the core and also must be capable of supporting the full weight of the roll without significant bending. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.

1.6 AMBIENT CONDITIONS

Geomembrane shall not be deployed or field-seamed in the presence of excess moisture (i.e., rain, fog, dew), in areas of ponded water, or in the presence of excess wind. Unless authorized by the Contracting Officer, no placement or seaming shall be attempted at ambient temperatures below 32 degrees F or above 104 degrees F. Ambient temperature shall be measured at a height no greater than 6 inches above the ground or geomembrane surface. If seaming is allowed below 32 degrees F, the procedures outlined in GSI GRI GM9 shall be followed. In marginal conditions, seaming shall cease unless destructive field seam tests, conducted by the QC laboratory, confirm that seam properties meet the requirements listed in Table 1 and 2. Tests shall be conducted in accordance with paragraph Destructive Field Seam Testing.

1.7 WARRANTY

The manufacturer's warranty shall state that the installed material meets all requirements of the contract documents and that under typical local atmospheric conditions, the sheet material is warranted for 20 years from the date of installation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Raw Materials

Resin used in manufacturing geomembrane sheets shall be made of virgin

uncontaminated ingredients. No more than 10 percent regrind, reworked, or trim material in the form of chips or edge strips shall be used to manufacture the geomembrane sheets. All regrind, reworked, or trim materials shall be from the same manufacturer and exactly the same formulation as the geomembrane sheet being produced. No post consumer materials or water-soluble ingredients shall be used to produce the geomembrane. For geomembranes with plasticizers, only primary plasticizers that are resistant to migration shall be used. Submit a copy of the test reports and QC certificates for materials used in the manufacturing of the geomembrane shipped to the site.

2.1.2 Sheet Materials

Geomembrane sheets shall be unreinforced and manufactured as wide as possible to minimize factory and field seams. Geomembrane sheets shall be uniform in color, thickness, and surface texture. For slopes greater than or equal to 1V on 3 H, sheets shall be textured on both faces. The textured surface features shall consist of raw materials identical to that of the parent sheet material and shall be uniform over the entire face of the geomembrane. The sheets shall be free of and resistant to fungal or bacterial attack and free of cuts, abrasions, holes, blisters, contaminants and other imperfections. Geomembrane sheets and factory seams shall conform to the requirements listed in Tables 1 and 2 for Manufacturing Quality Control (MQC).

TABLE 1 - TEXTURED HDPE GEOMEMBRANE PROPERTIES

PROPERTY	TEST VALUE	MQC TESTING FREQUENCY (MIN.)	TEST METHOD
Nominal Thickness	60 mils		
Thickness (min ave)	-5 percent of nominal	per roll	ASTM D5994
Lowest individual for 8 out of 10 values	-10 percent of nominal	per roll	ASTM D5994
Lowest individual of 10 values	-15 percent of nominal	per roll	ASTM D5994
Asperity Height (min ave) (10)	10 mils	every second roll	ASTM D7466 (11)
Density (min)	0.940 g/cc	per 200,000 lb	ASTM D1505
Tensile Properties(1)(min ave)		per 20,000 lb	ASTM D6693 Type IV
yield stress	126 lb/in		
break stress	90 lb/in		
yield elong	12 percent		
break elong	100 percent		

TABLE 1 - TEXTURED HDPE GEOMEMBRANE PROPERTIES			
PROPERTY	TEST VALUE	MQC TESTING FREQUENCY (MIN.)	TEST METHOD
Tear Resistance (min ave)	42 lb	per 45,000 lb	ASTM D1004
Puncture Resistance(min ave)	90 lb	per 45,000 lb	ASTM D4833
Stress Crack Resistance (2)	300 hr	per 200,000 lb	ASTM D5397 (Appendix)
Carbon Black Content	2.0-3.0 percent	per 20,000 lb	ASTM D1603 (3)
Carbon Black Dispersion	Note (4)	per 45,000 lb	ASTM D5596
Oxidative Induction Time (OIT)(min ave)(5)		per 200,000 lb	
Std OIT	100 min		ASTM D3895
or High Pres OIT	400 min		ASTM D5885
Oven Aging at 185 deg F (min ave) (5), (6)		per year and change in formulation	ASTM D5721
Std OIT	55 percent at 90 days		ASTM D3895
or High Pres OIT	80 percent at 90 days		ASTM D5885
UV Resistance (min ave) (7)		per year and change in formulation	ASTM D7238
High Pres OIT(8)(9)	50 percent at 1600 hours		ASTM D5885

TABLE 1 NOTES	
MQC	Manufacturing Quality Control

TABLE 1 NOTES	
Note (1)	Minimum average machine direction and minimum average cross machine direction values shall be based on 5 test specimens in each direction. For HDPE geomembrane, yield elongation is calculated using a gauge length of 1.3 inches. For HDPE geomembrane, break elongation is calculated using a gauge length of 2.0 inches.
Note (2)	For HDPE geomembrane, the yield stress used to calculate the applied load for test method ASTM D5397 (Appendix), shall be the manufacturer's mean value.
Note (3)	Other methods such as ASTM D4218 or microwave methods are acceptable if an appropriate correlation to ASTM D1603 can be established.
Note (4)	Carbon black dispersion for 10 different views: - minimum 9 of 10 in Categories 1 or 2 - all 10 in Categories 1,2, or 3
Note (5)	The manufacturer has the option to select either one of the OIT methods to evaluate the antioxidant content.
Note (6)	Evaluate samples at 30 and 60 days and compare with the 90 day response.
Note (7)	The condition of the test shall be a 20 hour UV cycle at 167 degrees F followed by a 4 hour condensation cycle at 140 degrees F.
Note (8)	The standard OIT test (ASTM D3895) shall not be used in determining UV resistance.
Note (9)	UV resistance is based on percent retained value regardless of the original HP-OIT value.
Note (10)	Textured Geomembrane Only: Of 10 readings; 8 out of 10 must be 7 mil, and lowest individual reading must be 5 mil.
Note (11)	Textured Geomembrane Only: Alternate the measurement side for double sided textured sheet.

TABLE 2 - HDPE SEAM PROPERTIES		
PROPERTY	TEST VALUE	TEST METHOD
Seam Shear Strength (min) (1)	120 lb/in	ASTM D6392
Seam Peel Strength (min) (1) (2)	91 lb/in (fusion weld); 78 lb/in (extrusion weld)	ASTM D6392
Note (1): Seam tests for peel and shear must fail in the Film Tear Bond mode. This is a failure in the ductile mode of one of the bonded sheets by tearing or breaking prior to complete separation of the bonded area.		

TABLE 2 - HDPE SEAM PROPERTIES		
PROPERTY	TEST VALUE	TEST METHOD
Note (2): Where applicable, both tracks of a double hot wedge seam shall be tested for peel adhesion.		

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Manufacturing, Sampling, and Testing

2.2.1.1 Raw Materials

Raw materials shall be tested in accordance with the approved MQC manual. Any raw material which fails to meet the geomembrane manufacturer's specified physical properties shall not be used in manufacturing the sheet. Seaming rods and pellets shall be manufactured of materials which are essentially identical to that used in the geomembrane sheet. Seaming rods and pellets shall be tested for density, melt index and carbon black content in accordance with the approved MQC manual. Seaming rods and pellets which fail to meet the corresponding property values required for the sheet material, shall not be used for seaming.

2.2.1.2 Sheet Material

Geomembrane sheets shall be tested in accordance with the approved MQC manual. As a minimum, MQC testing shall be conducted at the frequencies shown in Table 1. Sheets not meeting the minimum requirements specified in Table 1 shall not be sent to the site.

2.3 EQUIPMENT

Equipment used in performance of the work shall be in accordance with the geomembrane manufacturer's recommendations and shall be maintained in satisfactory working condition.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Surface Preparation

Surface preparation shall be performed in accordance with Section 02 56 15 GEOSYNTHETIC CLAY LINER (GCG). Slip a sheet (such as a 20 mil smooth HDPE) over the GCL first in order to allow the geomembrane to slide into position. Once the overlying geomembrane is properly positioned, carefully remove the slipsheet without moving the geomembrane. Any other material which could damage the geomembrane shall be removed from the surface to be covered with the geomembrane. Construction equipment tire or track deformations beneath the geomembrane shall not be greater than 1.0 inch in depth. Each day during placement of geomembrane, the QC Specialist and installer shall inspect the surface on which geomembrane is to be placed and certify in writing that the surface is acceptable. Repairs to the subgrade shall be performed at no additional cost to the Government.

3.1.2 Anchor Trenches

Where an anchor trench is required, it shall be placed as indicated. If

the anchor trench is excavated in cohesive soil susceptible to desiccation, only the amount of anchor trench required for placement of geomembrane in a single day shall be excavated. Ponded water shall be removed from the anchor trench while the trench is open. Trench corners shall be slightly rounded to avoid sharp bends in the geomembrane. Loose soil, rocks larger than 1/2 inch in diameter, and any other material which could damage the geomembrane shall be removed from the surfaces of the trench. The geomembrane shall extend down the front wall and across the bottom of the anchor trench. Backfilling and compaction of the anchor trench shall be in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

3.2 GEOMEMBRANE DEPLOYMENT

The Installer shall label each field panel with an "identification code" consistent with the layout plan and acceptable to the Contracting Officer and CQA Consultant. It is the responsibility of the Installer to verify that each field panel placed can be tracked to the original roll number. The identification code shall be marked at a location agreed upon by the Contracting Officer, Installer and CQA Consultant. Thee procedures and equipment used shall not elongate, wrinkle, scratch, or otherwise damage the geomembrane, other geosynthetic layers, or the underlying subgrade. Geomembrane damaged during installation shall be replaced or repaired, at the QC Specialist's discretion. Only geomembrane panels that can be anchored and seamed together the same day shall be deployed. Adequate ballast (i.e., sand bags) shall be placed on the geomembrane, without damaging the geomembrane, to prevent uplift by wind. No equipment shall be operated on the top surface of the geomembrane without supporting documentation from the manufacturer and installer supporting the use of the equipment proposal, subject to permission from the Contracting Officer. The supporting documentation shall consist of evidence of the equipment being used on previous projects of similar conditions and a list of guidelines/restrictions for equipment operation. If proposed for use, only smooth oversized rubber-tired equipment, with a maximum tire inflation pressure of 7 lb per square inch, may be used directly on the geomembrane.

Other restrictions for equipment proposed for use include the following -

The equipment can be operated on the geomembrane only when deploying materials.

There shall be no sudden stops or starts.

There shall be no spinning of tires or sliding at any time.

Vehicle tires must be smooth and clean of mud, dirt, and debris that could potentially puncture or damage the geomembrane.

All entering and exiting on the geomembrane shall be done at 90-degree angles to the material.

There shall be no excessive turning while driving on the geosynthetic material. Movement should be primarily forward and backward while deploying, and turning shall be minimized to the greatest extent possible.

There shall be no driving over wrinkles in geosynthetics.

There shall be no more than one person riding on vehicle.

The rubber-tired equipment shall not operate on slopes steeper than 1 H on 5 V and the tires shall be inspected for rocks lodged in the treads prior to and during use on top of the geomembrane.

Seams shall be oriented parallel to the line of maximum slope. Where seams can only be oriented across the slope, the upper panel shall be lapped over the lower panel. Horizontal seams should be greater than 5 feet from the toe of slopes, or areas of potential stress concentrations, unless otherwise authorized. A seam numbering system compatible with the panel numbering system shall be agreed upon with the Contracting Officer, Installer and CQA Consultant. Field joints shall be made by overlapping adjacent sheets a minimum of 4 inches. Document daily work progress by maintaining a Geomembrane Panel Placement Log, a Geomembrane Seaming Record Log, a Geomembrane Repair Log, and Geomembrane Seam Testing Log. Make logs available for inspection by the Contracting Officer within 24 hours of work being performed. The methods used to deploy and backfill over the geomembrane shall minimize wrinkles and tensile stresses in the geomembrane. The geomembrane shall have adequate slack to prevent the creation of tensile stress. The wrinkle height to width ratio for installed geomembrane shall not exceed 0.5. In addition, geomembrane wrinkles shall not exceed 6 inches in height. Wrinkles that do not meet the above criteria shall be cut out and repaired in accordance with the installer's approved QC manual.

3.3 FIELD SEAMING

3.3.1 Trial Seams

Trial seams shall be made under field conditions on strips of excess geomembrane. Trial seams shall be made each day prior to production seaming, whenever there is a change in seaming personnel or seaming equipment and at least once every four hours, by each seamer and each piece of seaming equipment used that day. Trial seam samples shall be collected and tested in accordance with ASTM D6392. One sample shall be obtained from each trial seam. This sample shall be at least 36 inches long by 12 inches wide with the seam centered lengthwise. Ten random specimens 1 inch wide shall be cut from the sample. Five seam specimens shall be field tested for shear strength and 5 seam specimens shall be field tested for peel adhesion using an approved quantitative tensiometer. Where necessary, accelerated curing of trial seams made by chemical methods shall be conducted in accordance with GSI GRI GM7. To be acceptable, 4 out of 5 replicate test specimens shall meet seam strength requirements specified in Table 2. If the field tests fail to meet these requirements, the entire operation shall be repeated. If the additional trial seam fails, the seaming apparatus or seamer shall not be used until the deficiencies are corrected by the installer and 2 consecutive successful trial seams are achieved.

3.3.2 Field Seams

Panels shall be seamed in accordance with the geomembrane manufacturer's recommendations. In sumps, corners and odd-shaped geometric locations, the number of field seams shall be minimized. Seaming shall extend to the outside edge of panels. Soft subgrades shall be compacted and approved prior to seaming. The seam area shall be free of moisture, dust, dirt, and foreign material at the time of seaming. Fish mouths in seams shall be repaired.

3.3.2.1 Polyethylene Seams

Polyethylene geomembranes shall be seamed by thermal fusion methods. The QC Specialist shall log ambient temperatures, sheet temperatures, seaming apparatus temperatures, and speeds. Extrusion welding shall only be used for patching and seaming in locations where thermal fusion methods are not feasible. The Installer shall provide documentation regarding the extrudate to the Contracting Officer and the CQA Consultant, and shall certify that the extrudate is compatible with the permit specifications, and is composed of the same resin as the geomembrane sheeting. The QC Specialist shall log apparatus temperatures, ambient temperatures, extrudate temperatures, and sheet temperatures at appropriate intervals. Seam overlaps that are to be attached using extrusion welds shall be ground prior to welding. Grinding marks shall be oriented perpendicular to the seam direction and no marks shall extend beyond the extrudate after placement. Extrusion welding shall begin within 10 minutes after grinding. Where extrusion welds are temporarily terminated long enough to cool, they shall be ground prior to applying new extrudate over the existing seam. The total depth of the grinding marks shall be no greater than 10 percent of the sheet thickness.

3.3.2.2 Field Seam to Existing Geomembrane

The Installer shall provide documentation on the proposed method of field seaming the geomembrane to the existing smooth geomembrane from Phase III. The Installer shall certify that the proposed geomembrane and field seaming method are compatible.

3.4 SAMPLES

One QC sample, 18 inches in length, for the entire width of a roll, shall be obtained for every 100,000 square feet of material delivered to the site. Samples shall not be obtained from the first three feet of the roll. For accordion folded geomembranes, samples of equivalent size shall be collected from approved locations. The samples shall be identified by manufacturer's name, product identification, lot and roll/panel number. The date, a unique sample number, and the machine direction shall also be noted. In addition, a 12 inch by 12 inch QA sample shall be collected, labeled, and submitted to the Contracting Officer each time QC samples are collected.

3.5 TESTS

Maintain written logs of panel placement and seam locations, and all sampling and testing performed on panels and seams, including trial seams, field seams (destructive and non-destructive field continuity). Make results available for inspection by the Contracting Officer within 24 hours of testing. Submit completed test logs with a statement certifying compliance with specified requirements herein within 72 hours of geomembrane placement completion within a cell.

Provide all QC samples to the QC laboratory to determine density, thickness, tensile strength at break, and elongation at break in accordance with the methods specified in Table 1. Samples not meeting the specified requirements shall result in the rejection of applicable rolls/panels. As a minimum, rolls/panels produced immediately prior to and immediately after the failed roll/panel shall be tested for the same failed parameter. Testing shall continue until a minimum of three successive rolls/panels on both sides of the original failing roll/panel pass the failed parameter.

3.5.1 Non-Destructive Field Seam Continuity Testing

Field seams shall be non-destructively tested for continuity over their full length in accordance with the installer's approved QC manual. Seam testing shall be performed as the seaming work progresses, not at the completion of field seaming. Any seams which fail shall be documented and repaired in accordance with the installer's approved QC manual.

3.5.2 Destructive Field Seam Testing

A minimum of one destructive test sample per 500 feet of field seam shall be obtained at locations specified by the QC Specialist. This initial interval can be increased for good seaming practices in accordance with GSI GRI GM-14 after obtaining approval from the Contracting Officer and CQA Consultant. Sample locations shall not be identified prior to seaming. Samples shall be a minimum of 12 inches wide by 42 inches long with the seam centered lengthwise. Each sample shall be cut into 3 equal pieces, with one piece retained by the installer, one piece given to the CQA consultant, and the remaining piece given to the Contracting Officer for QA testing and/or permanent record. Each sample shall be numbered and cross referenced to a field log which identifies: (1) panel number; (2) seam number; (3) date and time cut; (4) ambient temperature within 6 inches above the geomembrane; (5) seaming unit designation; (6) name of seamer; and (7) seaming apparatus temperature and pressures (where applicable). Ten 1 inch wide replicate specimens shall be cut from the installer's sample. Five specimens shall be tested for shear strength and 5 for peel adhesion using an approved field quantitative tensiometer. Jaw separation speed shall be in accordance with the approved QC manual. To be acceptable, 4 out of 5 replicate test specimens shall meet the seam strength requirements specified in Table 2. If the field tests pass, 5 specimens shall be tested at the QC laboratory for shear strength and 5 for peel adhesion in accordance with the QC laboratory's approved procedures. To be acceptable, 4 out of 5 replicate test specimens shall meet the seam strength requirements specified in Table 2. A maximum of one non-FTB failure is acceptable provided that strength requirements are met on the sample. Strength requirements are 100% of the sheet strength in shear. If the field or laboratory tests fail, the seam shall be repaired in accordance with paragraph Destructive Seam Test Repairs. Holes for destructive seam samples shall be repaired the same day they are cut. Maintain a Geomembrane Seam Destructive Sample Log.

3.6 DEFECTS AND REPAIRS

3.6.1 Destructive Seam Test Repairs

Seams that fail destructive seam testing may be overlaid with a strip of new material and seamed (cap stripped). Alternatively, the seaming path shall be retraced to an intermediate location a minimum of 10 feet on each side of the failed seam location. At each location a 12 by 18 inch minimum size seam sample shall be taken for 2 additional shear strength and 2 additional peel adhesion tests using an approved quantitative field tensiometer. If these tests pass, then the remaining seam sample portion shall be sent to the QC laboratory for 5 shear strength and 5 peel adhesion tests in accordance with the QC laboratory's approved procedures. To be acceptable, 4 out of 5 replicate test specimens must meet specified seam strength requirements. If these laboratory tests pass, then the seam shall be cap stripped or repaired using other approved methods between that location and the original failed location. If field or laboratory tests

fail, the process shall be repeated. After repairs are completed, the repaired seam shall be non-destructively tested in accordance with paragraph Non-Destructive Field Seam Continuity Testing. All acceptable seams must be bounded by two locations from which destructive samples passing laboratory tests have been taken. In cases of reconstructed seams exceeding 150 feet, a sample must be taken and pass destructive testing from within the zone in which the seam has been reconstructed. This sample must pass destructive testing or the procedure outlined here must be repeated. Maintain a Geomembrane Repair Log.

3.6.2 Patches

Tears, holes, blisters and other defects shall be repaired with patches. Patches shall have rounded corners, be made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. Minor localized flaws shall be repaired by spot welding or seaming as determined by the QC Specialist. Repairs shall be non-destructively tested. The Contracting Officer or the QC Specialist may also elect to perform destructive seam tests on suspect areas. The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the Contracting Officer and the Installer. Each repair shall be numbered and logged by the CQA consultant and the Installer.

3.7 VISUAL INSPECTION AND EVALUATION

Immediately prior to covering, the geomembrane, seams, and non-seam areas shall be visually inspected by the QC Specialist and Contracting Officer for defects, holes, or damage due to weather conditions or construction activities. At the Contracting Officer's or the QC Specialist's discretion, the surface of the geomembrane shall be brushed, blown, or washed by the installer if the amount of dust, mud, or foreign material inhibits inspection or functioning of the overlying material. Each suspect location shall be non-destructively tested in accordance with paragraph Non-Destructive Field Seam Continuity Testing. Each location that fails non-destructive testing shall be repaired in accordance with paragraph Patches and non-destructively retested. When seaming of the geomembrane is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying material, the CQA Consultant shall observe the geomembrane wrinkles. The CQA Consultant will indicate to the Installer which wrinkles should be cut and reseamed. The seam thus produced shall be tested like any other repair.

3.8 PENETRATIONS

Geomembrane penetration details shall be in accordance with ASTM D6497 or as recommended by the geomembrane manufacturer. Factory fabricated boots shall be used wherever possible. Polyethylene pipe sleeves shall be used for pipe sleeves penetrating through the lined area. When the pipe composition is polyethylene the sleeve should be extrusion welded directly to the pipe if space permit. For dissimilar materials, the sleeve should be fastened by mechanical means and sealant applied between the pipe and sleeve. Field seams for penetrations shall be non-destructively tested in accordance with the installer's approved QC manual. Seams that fail non-destructive testing shall be repaired in accordance with the installer's approved QC manual and non-destructively tested prior to acceptance.

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3.9 PROTECTION AND BACKFILLING

The deployed and seamed geomembrane shall be covered with the specified material within 14 calendar days of acceptance. Wrinkles in the geomembrane shall be prevented from folding over during placement of cover materials.

3.10 AS-BUILT GEOMEMBRANE PANEL LAYOUT AND DETAIL DRAWINGS

Final as-built drawings of the geomembrane installation shall be prepared. The drawings shall include location of sheets, seams, repairs, and penetrations; sheet numbers, seam numbers, sample/test locations, and repairs. Repair sizes and date of repair shall be noted.

-- End of Section --

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SECTION 02 56 14

CLAY BARRIER LAYER
02/10

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.

ASTM INTERNATIONAL (ASTM)

ASTM D1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1587	(2008; E 2012; R 2012) Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
ASTM D2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2216	(2010) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2488	(2009a) Description and Identification of Soils (Visual-Manual Procedure)
ASTM D3740	(2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D4220	(1995; R 2007) Preserving and Transporting Soil Samples
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4767	(2011) Standard Test Method for

	Consolidated Undrained Triaxial Compression Test for Cohesive Soils
ASTM D5084	(2010) Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D698	(2012) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D854	(2010) Specific Gravity of Soil Solids by Water Pycnometer

1.2 SUBMITTAL REQUIREMENTS

Submit Materials Handling Plan describing the following: processing and placement of the clay; type, model number, weight and critical dimensions of equipment to be used for soil processing, compaction, scarification, and smooth rolling; method of protecting clay from contamination changes in moisture content and freezing prior to and after placement. The following shall also be submitted:

a. Borrow Source Assessment Report at least 30 days prior to clay placement. No clay shall be placed until the Borrow Source Assessment Report is approved. The report shall include the following: location of each borrow source; plan view and estimated available quantity of clay; locations and logs of subsurface explorations; laboratory test results; moisture-density curves showing the "Acceptable Zone" of moisture contents and densities which achieve the required hydraulic conductivity for each principal type of material or combination of materials.

b. A minimum of 100 pounds of each principal type of material or combination of materials to the Government's designated laboratory at least 30 days prior to placement.

c. Name and qualifications of the proposed commercial testing laboratory.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

EquipmentCommercial Testing Laboratory

SD-04 Samples

Clay

Quality Assurance Samples

SD-06 Test Reports

Borrow Source Assessment; G
Assessment Tests; G
Clay Material Properties Tests; G
Moisture Content and Density Tests of In-Place Clay; G
Hydraulic Conductivity Tests of In-Place Clay; G

SD-07 Certificates

Completed test logs with a statement certifying compliance with specified requirements herein; G

PART 2 PRODUCTS

2.1 CLAY

Clay shall be free of roots, debris, organic or frozen material, and shall have a maximum clod size of 2 inches at the time of compaction. Clay material shall comply with the criteria listed in Table 1.

TABLE 1 REQUIRED PHYSICAL PROPERTIES OF CLAY

Property	Test Value	Test Method
Max. particle size (inches)	1	ASTM D422
Min. percent passing No. 4 sieve	80	ASTM D422
Min. percent passing No. 200 sieve	50	ASTM D1140
Min. liquid limit	35	ASTM D4318
Min. plasticity index	10	ASTM D4318
Max. plasticity index	40	ASTM D4318
Soil Classification	CH or CL	ASTM D2488
Hydraulic Conductivity	1 x 10-5 cm/s, Max.	ASTM D5084
Friction Angle	18 Degrees Minimum	ASTM D4767

Potential Sources (subject to meeting requirements specified herein) of clay liner material include the following:

Martin Marietta Onslow Quarry	Phone No:	910.324.7430
Morton Trucking	Phone No:	910.946.9068
Durwood Humphrey Construction	Phone No:	910.346.4727
C. M. Mitchell Construction	Phone No:	910.327.2907
Sunland Development	Phone No:	252.393.2504

The Contractor shall be responsible for verifying that potential sources listed material meets specified requirements.

2.2 EQUIPMENT

The Contractor shall provide equipment meeting the minimum requirements specified herein, and in Section 31 23 00.00 20EXCAVATION AND FILL suited to the site conditions, and able to place and compact the material. Equipment used to place the clay barrier layer shall not brake suddenly, turn sharply, or be operated at speeds exceeding 5.0 miles per hour.

Submit a description of equipment to be used during construction of the test liner pad for evaluation purposes.

2.2.1 Compaction Equipment

Compaction equipment shall consist of tamping foot rollers which have a minimum weight of 40,000 pounds. At least one tamping foot shall be provided for each 110 square inches of drum surface. The length of each tamping foot, from the outside surface of the drum, shall be equal to or greater than the loose lift thickness. During compaction operations, the spaces between the tamping feet shall be maintained clear of materials which would impair the effectiveness of the tamping foot rollers.

2.2.2 Scarification Equipment

Disks, rotor tillers, or other approved means shall be provided to scarify the surface of each lift of clay prior to placement of the next lift. The scarification equipment shall be capable of uniformly disturbing the upper 1 inch of the clay surface to provide good bonding between lifts.

2.2.3 Steel Wheeled Rollers

A smooth, non-vibratory steel wheeled roller shall be used to produce a smooth compacted surface on the clay barrier layer. Steel wheeled rollers shall weigh a minimum of 20,000 pounds.

2.2.4 Hand Operated Tampers

Hand operated tampers shall consist of rammers or other impact type equipment. Vibratory type equipment will not be allowed.

PART 3 EXECUTION

3.1 BORROW SOURCE ASSESSMENT

Borrow source assessment tests shall be performed on each principal type or combination of materials proposed for use in the clay barrier layer to assure compliance with specified requirements and to develop compaction requirements for placement. A minimum of one set of borrow assessment tests shall be performed for each borrow source proposed. A set of borrow source assessment tests shall consist of classification testing,

moisture-density (compaction) testing, and hydraulic conductivity testing.Samples from the clay source shall be taken by the Contractor. Sample sizes shall be at least 100 pounds of each principal type of material or combination of materials. Conduct the following tests at the following frequencies:

a. Soil classification tests in accordance with ASTM D2487 and grain size distribution tests in accordance with ASTM D422 shall be performed for every 6,500 cubic yards of material.

b. Natural moisture content tests in accordance with ASTM D2216 shall be performed for every 2,000 cubic yards of material.

c. Atterberg limits tests in accordance with ASTM D4318 and moisture-density tests in accordance with ASTM D698 shall be performed for every 6,500 cubic yards of material. Specific gravity tests in accordance with ASTM D854 shall be performed for every 6,500 cubic yards of material.

d. A laboratory hydraulic conductivity test in accordance with ASTM D5084 for remolded sample, modified as specified in Paragraph 'Hydraulic Conductivity Testing', shall be performed for every 13,000 cubic yards of material.

e. One internal friction test for every type of soil (CL or CH).

3.1.1 Hydraulic Conductivity Testing

A set of tests shall consist of one hydraulic conductivity test run on a representative sample corresponding to each point from each compaction curve at or above ASTM D698 optimum moisture content. Hydraulic conductivity testing referenced in this section shall be conducted in accordance with ASTM D5084. In addition, the following procedures shall be adhered to when performing the hydraulic conductivity testing:

a. Saturation of test specimens shall be verified by determination of the B coefficient. The B coefficient shall be at least 0.95. The B coefficient is defined as the change in pore water pressure divided by the change in confining pressure.

b. During consolidation of the test specimens, outflow volumes versus time shall be recorded on a semi-log graph to confirm primary consolidation has been completed prior to permeation of the specimens.

c. The permeant used for back pressure saturation and permeation shall be 0.01 molar calcium chloride solution created from deaired, distilled water as specified in ASTM D5084.

d. The average effective confining pressure shall be 3 psi.

3.1.2 Acceptable Zone Development

An "Acceptable Zone" of moisture contents and densities shall be developed and displayed with the compaction curve graphs for each principal type of borrow material or combination of borrow materials. The "Acceptable Zone" shall consist of moisture-density values that meet the following requirements:

a. Maximum Allowable Hydraulic Conductivity = 1 x 10 to the -5 cm per second.

b. The minimum allowable moisture content shall be no less than optimum moisture content based on ASTM D1557.

c. The minimum allowable density shall be no less than 90 percent of maximum dry density based on ASTM D698.

3.1.3 Chemical Contamination Testing

Borrow used for the clay barrier layer shall be free of contamination. Each proposed borrow source shall be sampled and analyzed for chemical contamination in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

3.1.4 Commercial Testing Laboratory

Tests for the clay barrier layer shall be performed by an approved testing laboratory furnished by the Contractor. No testing will be permitted until the facilities have been inspected and approved. The inspection will be performed to determine if the laboratory has a quality system in place for personnel, equipment, reporting procedures, record keeping, and equipment calibration that ensures the laboratory is capable of accurately performing the specified testing. The quality system shall be in accordance with ASTM D3740 or as approved by the Government Inspector. The first inspection will be at the Government's expense. Cost incurred for subsequent inspections required because of deficiencies found during the first inspection will be charged to the Contractor.

3.2 LANDFILL LINER SUBGRADE PREPARATION

As specified in Section 31 23 00.00 20, EXCAVATION AND FILL.

3.3 TEST LINER PAD

3.3.1 General

Contractor shall construct a test liner pad prior to constructing the landfill liner and whenever there is a significant change in soil material properties. The test liner pad shall be constructed using similar borrow material; placement methods and testing procedures as are to be used in the actual landfill liner. The equipment, liner thickness, and subgrade slope and conditions shall be representative of full scale construction.

If the initial test liner pad does not give the specified results, additional test pads shall be performed until the specified results are obtained at the Contractor's cost (including Construction Quality Assurance (CQA) Consultant and laboratory costs).

3.3.2 Size

The test liner pad shall be a minimum plan size of 50 x 100 feet x 18 inches thick and shall be constructed with the Contracting Officer present. The test liner pad shall be constructed on a section on the bottom foundation grades of the interior landfill. The Contractor shall compact the test clay liner within the moisture content range approved in the Conformance Testing.

3.3.3 Compaction

The clay materials shall be uniformly compacted to no less than 95 percent of the Standard Proctor maximum dry density (ASTM D698) within the specified moisture content range. This minimum density shall be uniformly obtained throughout the entire thickness of the liner. The liner shall be constructed in lifts with a maximum compacted thickness of 6 inches per lift.

3.3.4 Moisture Content

Soil moisture should be adjusted during the mixing or placement process. The placement moisture content shall be at a minimum of 2 percent wet of the Standard Proctor (ASTM D698) optimum moisture content and no greater than 5 percent wet of the Standard Proctor optimum moisture content.

3.3.5 Testing

For each lift, a minimum of three test locations shall be established for testing moisture content, density, and a composite sample for recompacted lab permeability. In addition, a minimum of one relatively undisturbed shelby tube sample shall be obtained by the CQA Consultant from each lift for lab permeability testing. These permeability tests shall be used to verify the soil moisture content and density requirements to be used to construct the landfill liner and demonstrate the in-place soil permeabilities obtained by the constructed test liner pad.

3.3.6 Documentation

The Contractor shall observe and document the equipment type and construction methodology used while the test liner pad is being constructed. This will allow the Contractor to determine the relationship among density, moisture content, and permeability. Field variables that can affect this relationship shall be carefully measured and controlled in the test liner pad. The Contractor shall be responsible for accommodating these variables to achieve the required results at no additional cost to the Government. The Contractor shall utilize and adhere to the same equipment and construction methodology during construction of the landfill liners.

3.4 INSTALLATION

3.4.1 Clay Liner Placement

Clay shall be placed to the lines and grades shown on the drawings. The clay shall be placed in loose lifts not to exceed 6 inches in thickness. In areas where hand operated tampers must be used, the loose lift thickness shall not exceed 4 inches. Grade stakes shall not be driven into the clay layer. Clay materials shall be disked, harrowed, and kneaded as necessary to break down all clods and produce a uniform material that is free of clods exceeding 2 inches. Clay materials which have been contaminated with clusters of rock or gravel, sand lenses or other deleterious material shall be removed and replaced with uncontaminated clay materials. The Contractor shall remove all rocks 1 inch or larger. Work shall be limited to an area where a clay liner lift can be completed in one working day. Completion shall be defined as soil moisture adjustment, soil mixing, soil spreading, and compaction of the clay liner layer. The area shall be left in a manner to promote surface water run-off. Work on the slopes shall be undertaken prior to work on the bottom grades to permit drainage in the event of

rainfall. If a clay lift is not to receive a subsequent clay lift within 16 hours of its completion, the clay lift shall be sealed with a smooth wheel compactor, at the end of each day's work to protect the liner from desiccation. Should desiccation cracks develop, the clay liner shall be scarified, disked, rewetted, rehomogenized, and recompacted in accordance with the Specifications to the depth of any such cracks. During construction, the Contractor shall make all necessary provisions to deal with inclement weather conditions. The Contractor shall be fully responsible for control of stormwater during installation of the liner system and for moisture control and protection of the clay liner.

3.4.2 Moisture Control

Clay shall be placed and compacted within the moisture content range determined in the test liner pad. The moisture content shall be maintained uniform throughout each lift. Water added shall be thoroughly incorporated into the clay to ensure uniformity of moisture content prior to compaction.

3.4.3 Compaction

Clay shall be compacted to meet the density requirements in the test liner pad and by at least 5 passes of the approved compaction equipment over all areas of each lift. Rubber tired rollers and vibratory rollers will not be allowed for use in compaction of the clay materials. In no case shall the clay material be compacted to less than 95 percent of the Standard Proctor maximum dry density (ASTM D698). For self-propelled compactors, one pass is defined as one pass of the entire vehicle. For towed rollers, one pass of the drum constitutes a pass. Hand operated tampers shall be used in areas where standard compaction equipment cannot be operated.

3.4.4 Scarification

Scarification shall be performed on all areas of the upper surface of each clay lift prior to placement of the next lift. Scarification shall be accomplished with approved equipment. The final lift of clay shall not be scarified.

3.4.5 Repair of Voids

Voids created in the clay barrier layer during construction (including, but not limited to, penetrations for test samples, grade stakes, and other penetrations necessary for construction) shall be repaired by removing sand or other non-clay material, placing clay backfill in lifts no thicker than 3 inches and tamping each lift with a steel rod. Each lift shall be tamped a minimum of 25 times altering the location of the rod within the void for each blow. Other ruts and depressions in the surface of the lifts shall be scarified, filled, and then compacted to grade.

3.4.5.1 Final Surface

A smooth wheel roller shall be used with sufficient number of passes to smooth the upper surface of the liner. All ridges, depressions, and detectable rocks or clods 1 inch or larger shall be removed. This type of compactor shall be used only for final smoothing of the surface. It shall not be used for achieving the specified compaction.

3.5 CONSTRUCTION TOLERANCES

The top surface of the clay barrier layer shall be no greater than 3 inches

above the lines and grades shown on the drawings. No minus tolerance will be permitted.

3.6 CONSTRUCTION TESTS

Maintain written logs of all sampling and testing performed and make available for inspection by the Contracting Officer within 24 hours of test completion. Submit completed test logs with a statement certifying compliance with specified requirements herein within 72 hours of the clay liners completion within a cell.

3.6.1 Clay Material Properties Tests

During construction of the clay barrier layer, representative samples shall be taken for testing at the frequencies listed in Table 2 after a loose lift of clay has been placed. Test results shall meet the requirements listed in Table 1.

TABLE 2
CLAY MATERIAL PROPERTIES

Property	Frequency	Test Method
Particle size analysis (Note 1)	1,000 cubic yards	ASTM D422
Atterberg limits (Note 1)	1,000 cubic yards	ASTM D4318
Compaction (Note 2)	5,200 cubic yards	ASTM D698

Note 1: At least one test shall be performed each day that soil is placed.
Note 2: Compaction test results shall be compared to previous results on the same material type to verify the compaction characteristics have remained the same.

3.6.2 Moisture Content and Density Tests of In-Place Clay

Moisture content and density tests, for clay in-place, shall be performed in a grid pattern staggered for successive lifts, so that sampling points are not at the same location in each lift. Moisture content and density tests shall be performed in accordance with Table 3.

TABLE 3
MOISTURE CONTENT AND DENSITY TESTS OF IN-PLACE CLAY

Property	Frequency Per Lift	Test Method

TABLE 3 MOISTURE CONTENT AND DENSITY TESTS OF IN-PLACE CLAY		
Rapid Moisture Content	8,500 square feet	ASTM D6938
Standard Moisture Content	1 for every 10 rapid tests	ASTM D2216
Rapid Density	8,500 square feet	ASTM D6938
Standard Density	1 for every 20 rapid tests	ASTM D1556 or ASTM D2167

3.6.2.1 Rapid Tests

Each day that clay is compacted, a minimum of one set of moisture content and density tests shall be performed using standard procedures. Rapid tests shall be checked at the frequencies shown in Table 3. Standard tests shall be performed at locations which are as close as possible to the location of the rapid tests being checked.

3.6.2.2 Nuclear Density and Moisture Content Tests

Nuclear density readings shall be taken by the CQA Consultant in the direct transmission mode. When ASTM D6938 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D1556. ASTM D6938 results in a wet unit weight of soil and when using this method ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.

3.6.2.3 Test Results

The field moisture content and density test results shall be plotted on the "Acceptable Zone" plot that corresponds to the appropriate material type being tested. If test results are not within the "Acceptable Zone" for moisture content or density, 3 additional tests shall be performed near the location of the failed parameter. If all retests pass, no additional action shall be taken. If any of the retests fail, the lift of soil shall be repaired out to the limits defined by passing tests for that parameter. The area shall then be retested as directed. Repairs to the clay layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.6.3 Hydraulic Conductivity Tests of In-Place Clay

Undisturbed samples shall be taken from the in-place clay for hydraulic conductivity testing at a frequency of once per 40,000 square feet for each lift of clay placed. Samples shall be cut from the lift in accordance with ASTM D1587 and transported in the vertical position in accordance with ASTM D4220, Group C. Each undisturbed sample shall be tested for hydraulic conductivity in accordance with ASTM D5084, moisture content in accordance

with ASTM D2216, particle size analysis in accordance with ASTM D422, and liquid and plastic limits in accordance with ASTM D4318. Hydraulic conductivity testing shall be conducted in accordance with the requirements in paragraph Hydraulic Conductivity Testing. If any test result is greater than the "Maximum Allowable Hydraulic Conductivity", modifications shall be proposed and approved for future placement of clay of that type. If the hydraulic conductivity of any test is more than one-half of one order of magnitude greater than the "Maximum Allowable Hydraulic Conductivity", 3 additional tests shall be performed near the location of the original failed test. If all retests pass, no additional action shall be taken. If any of the retests fail, the area shall be repaired out to the limits defined by passing hydraulic conductivity tests. The area shall then be retested as directed. Repairs to the clay layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.6.4 Quality Assurance Samples

Quality assurance samples shall be taken at locations as directed. Samples shall be cut from the lift in accordance with ASTM D1587 and shipped in the vertical position in accordance with ASTM D4220, Group C.

3.7 PROTECTION

3.7.1 Moisture Content

After placement, moisture content shall be maintained or adjusted to meet the acceptable zone criteria.

3.7.2 Erosion

Erosion that occurs in the clay layer shall be repaired and grades re-established.

3.7.3 Freezing and Desiccation

Freezing and desiccation of the clay layer shall be prevented. If freezing or desiccation occurs, the affected soil shall be removed or reconditioned as directed.

3.7.4 Retests

Areas that have been repaired shall be retested as directed. Repairs to the clay layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

-- End of Section --

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SECTION 02 56 15

GEOSYNTHETIC CLAY LINER (GCL)
02/10

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.

ASTM INTERNATIONAL (ASTM)

ASTM D4643	(2008) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D5261	(2010) Measuring Mass Per Unit Area of Geotextiles
ASTM D5887	(2009) Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter
ASTM D5888	(2006; R 2011) Storage and Handling of Geosynthetic Clay Liners
ASTM D5889	(2011) Quality Control of Geosynthetic Clay Liners
ASTM D5890	(2011) Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
ASTM D5891	(2002; R 2009) Fluid Loss of Clay Component of Geosynthetic Clay Liners
ASTM D5993	(1999; R 2009) Measuring Mass Per Unit of Geosynthetic Clay Liners
ASTM D6072/D6072M	(2009) Obtaining Samples of Geosynthetic Clay Liners
ASTM D6243	(2013) Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method
ASTM D6496	(2004a; R 2009) Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners
ASTM D6768	(2004; R 2009) Tensile Strength of Geosynthetic Clay Liners

1.2 SUBMITTAL REQUIREMENTS

Submit manufacturer's certified raw and roll material data sheets. If needle punching or stitch bonding is used in construction of GCL, the certification shall indicate that the GCL has been continuously inspected for broken needles using an in-line metal detector and all broken needles have been removed. The certified data sheets shall be attested to by a person having legal authority to bind the GCL manufacturing company. Certified test results shall be submitted at least 30 working days prior to delivery of the GCL. The following shall also be submitted as specified:

a. GCL panel layout and detail drawings, for approval, a minimum of 30 days prior to deployment. Final as-built drawings of the GCL installation shall be prepared. These drawings shall include panel number, seam numbers, location of repairs, destructive seam samples and penetrations.

b. Manufacturer's warranty statement.

c. Manufacturer's quality control (QC) manual which describes testing procedures, frequency of testing and acceptance/rejection criteria for QC testing at least 30 days prior to delivery of the GCL. QC samples shall be delivered at the specified frequencies.

d. Manufacturer's, installer's, QC Specialist's, and QC laboratory's qualification statements including resumes of key personnel involved in this project.

e. Mid-plane and interface shear strength test results at least 30 days prior to deployment.

f. Independent QC laboratory test results including description of equipment and test methods.

g. Certificate of subgrade inspection.

h. Certificate from the QC Specialist and installer of the acceptability of the surface on which the GCL is to be placed, immediately prior to GCL placement.

i. Certified QC test results.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

GCL Panel Layout and Detail Drawings; G
As Built GCL Panel Layout and Detail Drawings; G

SD-03 Product Data

GCL Properties; G
Warranty; G
Tests, Inspections, and Verifications; G
Qualifications; G

SD-04 Samples

Samples

SD-06 Test Reports

Daily QC Checklist; G
Tests, Inspections, and Verifications Friction Testing; G
Conformance Tests; G
Clay Liner Preparation
GCL Repair Log; G

SD-07 Certificates

Completed test logs with a statement certifying compliance with specified requirements herein; G

1.4 QUALIFICATIONS

1.4.1 Manufacturer

Geosynthetic clay liner shall be the product of a GCL Manufacturer who has produced the proposed GCL using the same bentonite, polyethylene geomembrane, geotextiles, sewing thread, and adhesive for at least 5 completed projects and shall have produced a minimum of 2,000,000 square feet of the proposed GCL.

1.4.2 Installer

The installer shall have installed GCL at a minimum of 5 projects of comparable scope and complexity and shall have installed a minimum of 2,000,000 square feet of the proposed GCL.

1.4.3 QC Specialist

The QC Specialist is responsible for monitoring and documenting activities related to the QC of the GCL from manufacturing through installation. The QC Specialist shall have provided QC and/or QA inspection during installation of GCL material for at least 5 projects and shall have performed QC and/or QA inspection on a minimum of 2 million square feet of GCL.

1.4.4 QC Laboratory

An independent QC laboratory is responsible for QC GCL testing. The QC laboratory shall have provided QC and/or QA testing of GCL for at least 5 completed projects and shall have performed QC and or QA testing for a minimum of 2 million square feet of GCL. The QC laboratory shall be accredited via the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP).

1.5 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling of GCL shall be in accordance with ASTM D5888.

1.5.1 Delivery

The Contracting Officer shall be present during unloading of the GCL. Rolls shall be packaged in an opaque, waterproof, protective covering and wrapped around a central core. Tears in the packaging shall be repaired to restore a waterproof protective barrier around the GCL. Unloading of rolls from the delivery vehicles shall be done in a manner that prevents damage to the GCL and its packaging.

1.5.2 Storage

Field storage shall be in flat dry areas where water cannot accumulate and the GCL rolls can be protected from damage. Storage of the rolls on blocks or pallets will not be allowed unless the GCL rolls are fully supported as approved by the Contracting Officer. Stacks of GCL rolls shall be no greater than three high. Rolls shall be covered with a water proof tarpaulin or plastic sheet if stored outdoors.

1.5.3 Handling

During handling, rolls shall not be dragged, lifted by one end, dropped to the ground, or otherwise damaged. A pipe or solid bar of sufficient strength to support the full weight of the roll without significant bending shall be used for all unloading and handling activities. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.

1.6 WARRANTY

The manufacturer's warranty shall state that the GCL materials meet all requirements of the contract documents and that for the intended use, the GCL is warranted for 20 years against deterioration. The installer's warranty shall state that the GCL shall not fail due to improper installation within 2 years.

PART 2 PRODUCTS

2.1 GCL PROPERTIES

GCL shall be a manufactured product consisting of a sodium montmorillonite clay (bentonite) layer evenly distributed between two geotextiles. GCL shall conform to the property requirements listed in Table 1 and shall be free of tears, holes, or other defects that may affect its serviceability. Encapsulating geotextiles shall be mechanically bonded together using a needle punch or stitch bonding process. Needle punched and stitch bonded GCLs shall be continuously inspected for broken needles using an in-line metal detector and broken needles shall be removed. The minimum manufactured GCL sheet width shall be 13.5 feet and the minimum manufactured GCL sheet length shall be 98 feet.

TABLE 1 - GCL PROPERTIES		
	TEST METHOD	TEST VALUE
BENTONITE		
Swell Index Test, minimum	ASTM D5890	24 mL/2 mg

TABLE 1 - GCL PROPERTIES		
	TEST METHOD	TEST VALUE
Fluid Loss, maximum	ASTM D5891	18 mL
UPPER GEOTEXTILE PROPERTIES		
Material Type		Nonwoven
Mass per Unit Area, min.	ASTM D5261	6 ounces/square yard
LOWER GEOTEXTILE PROPERTIES		
Material Type		Nonwoven
Mass per Unit Area, min.	ASTM D5261	6 ounces/square yard
COMPOSITE		
Bentonite Mass/Unit Area, minimum, Note 1	ASTM D5993	0.75 lbs/sq foot
Moisture Content, maximum	ASTM D4643	12 percent
Tensile Strength, minimum, (MD and CD)	ASTM D6768	45 lbs/in

TABLE 1 - GCL PROPERTIES		
	TEST METHOD	TEST VALUE
Internal Shear Strength (hydrated), minimum at a normal stress of 200 psf	ASTM D6243	500 psf
Index Flux, maximum	ASTM D5887	0.00000001 cubic m/sq m-sec
Hydraulic Conductivity, maximum	ASTM D5887	0.000000005 cm/sec
Peel Strength, MARV MD Note 2	ASTM D6496	2.5 lbs/inch
Note 1: Bentonite mass/unit area shall be computed at 0 percent moisture content. Bentonite mass/unit area is exclusive of glues added to the bentonite.		

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Manufacturing Sampling and Testing

GCL and its components shall be sampled and tested in accordance with the manufacturer's approved QC manual. The manufacturer's QC procedures shall be in accordance with ASTM D5889. Test results not meeting the requirements specified in Table 1 shall result in the rejection of applicable rolls. The manufacturer's QC manual shall describe procedures used to determine rejection of applicable rolls. As a minimum, rolls produced immediately prior to and immediately after the failed roll shall be tested for the same failed parameter. Testing shall continue until a minimum of three successive rolls on both sides of the original failing roll pass the failed parameter.

GCL not meeting the requirements shall not be sent to the site. The QC certificates shall include roll identification numbers and test results.

2.2.2 Shear Strength Testing

Internal and interface shear strength testing shall be performed in accordance with ASTM D6243. The hydration fluid to be used for both Internal and interface shear strength testing shall be tap water. The final moisture content of the GCL at the center of each specimen shall be included with the test results. GCL and adjacent geosynthetics shall be oriented such that the shear force is parallel to the down slope orientation of the geosynthetics in the field. Modifications to the test procedures described in this section shall be submitted and approved prior

to use.

2.2.2.1 Interface Shear Strength Testing

One set of interface direct shear tests shall be performed. Specimens shall be allowed to hydrate prior to shearing for a minimum of 24 hours. Free drainage shall be provided along both sides of the GCL to aid in hydration. Specimens shall be allowed to consolidate prior to shearing for a minimum of 24 hours. A normal stress of 8, 11.4 and 15 psi shall be used during hydration, consolidation, and shearing. The normal stresses shall not be relieved prior to or during shearing of the specimens. The shear rate shall be 0.04 in/min. Tests shall be run until peak strength is determined.

2.2.2.2 Interface Shear Strength Testing

One set of interface direct shear tests shall be performed on both interfaces of the GCL. The interface materials shall be samples of the proposed geomembrane and clay liner. Specimens shall be allowed to hydrate prior to shearing at a normal load of 1 psi for 48 hours. Free drainage shall be provided along one side of the GCL to aid in hydration. The other side of the GCL shall be placed against the interface material on which the test will be run. This interface material shall remain in place during hydration, consolidation, and shearing. Specimens shall be allowed to consolidate prior to shearing for a minimum of 24 hours. Normal stresses of 8, 11.4, and 15 psi shall be used during hydration, consolidation, and shearing. The normal stresses shall not be relieved prior to or during shearing of the specimens. The shear rate shall be 0.04 in/min. Tests shall be run until a minimum total displacement of 2 inches is reached.

PART 3 EXECUTION

3.1 SAMPLES AND TESTS

Maintain written logs of GCL panel and seam locations and all sampling and testing performed. Make results available for inspection by the Contracting Officer within 24 hours of test completion. Submit completed test logs with a statement certifying compliance with specified requirements herein within 72 hours of GCL placement completion within a cell.

3.1.1 Samples

Collect QC samples at approved locations upon delivery to the site at a frequency of one test sample per 40,000 square feet. Samples shall be collected, packaged, and transported in accordance with ASTM D6072/D6072M. Samples shall be identified with a waterproof marker by manufacturer's name, product identification, lot and roll number. The date, a unique sample number, the machine direction, and the top surface of the GCL shall also be noted on the sample. The outer layer of the GCL roll shall be discarded prior to sampling a roll. Samples shall then be collected by cutting the full-width of the GCL sheet a minimum of 3 feet wide in the machine direction. After cutting, the GCL sample shall be manually rolled around a core at least 3 inches in diameter. The GCL shall be wound on the core without slack. Strapping tape a minimum of 2 inches in width shall then be wound around the sample in at least two places to secure the loose end. A minimum of two layers of plastic sheeting shall be used to wrap the GCL sample roll for shipment. A thin cellophane material which covers the entire sample a minimum of three times shall be used as the

inner wrapping. The outer wrapping shall be at least 6 mils in thickness and shall be wrapped and fastened to minimize the amount of GCL shifting within the wrapping. An additional 12 by 12 inch QA sample shall be collected, labeled, and submitted to the Contracting Officer each time QC samples are collected.

3.1.2 Conformance Tests

Provide QC samples to the QC laboratory to determine bentonite mass per unit area (ASTM D5993) peel strength (ASTM D6496), flux (ASTM D5887) and tensile strength (ASTM D6768) at a frequency of once per 40,000 square feet of GCL placed. All test results shall meet, or exceed, the property values listed in Table 1. In case of failing test results, the Manufacturer may request that another sample be retested by the independent laboratory with the Manufacturer's technical representative present during the testing procedures. The retesting shall be at no cost to the Government. The Manufacturer may also have the sample retested at two different laboratories approved by the Government. If both laboratories do not report passing results, all liner material representing the failing sample will be considered out of specification and rejected. Determination of applicable rolls shall be as described in paragraph Tests, Inspections and Verifications.

3.2 INSTALLATION

3.2.1 Clay Liner Preparation

The clay liner shall be compacted in accordance with Section 02 56 14 CLAY BARRIER LINER. The subgrade surface shall be smooth and free of vegetation, standing water, and angular stones or other foreign matter that could damage the GCL. All protrusions extending more than 0.5 inches from the subgrade surface (or less if recommended by the manufacturer) shall be removed. Each day during placement, the QC Specialist the Contracting Officer and installer shall inspect the surface on which GCL is to be placed and certify in writing that the surface is acceptable.

3.2.2 Placement

The Installer shall label each field panel with an "identification code" consistent with the layout plan and acceptable to the Contracting Officer and CQA Consultant. It is the responsibility of the Installer to verify that each field panel placed can be tracked to the original roll number. The identification code shall be marked at a location agreed upon by the Contracting Officer, Installer and CQA Consultant. A seam numbering system compatible with the panel numbering system shall be agreed upon with the Contracting Officer, Installer and CQA Consultant.

GCL shall be installed as soon as practical after completion and approval of the subgrade; but, GCL shall not be deployed if it is frozen. It is the Installer's responsibility to protect the subgrade after it has been accepted. After the subgrade has been accepted by the Installer, it shall be the Installer's responsibility to indicate to the Contracting Officer any change in the supporting clay liner that may require repair work. If the CQA Consultant, representing the Contracting Officer, concurs with the Installer, then the Contractor shall arrange for the clay liner to be repaired at no cost to the Government.

Rolls shall be delivered to the work area in their original packaging. Immediately prior to deployment, the packaging shall be carefully removed

without damaging the GCL. GCL which has been hydrated prior to being covered by an overlying geomembrane or a minimum of 12 inches of cover soil shall be removed and replaced. Hydrated GCL is defined as having become soft as determined by squeezing the material with finger pressure or material which has exhibited swelling. Construction equipment may be used to deploy GCL. On side slopes, GCL shall be anchored at the top and deployed down the slope to minimize wrinkles. Dragging of GCL panels over the ground surface shall be minimized. The Contracting Officer has the option of requiring the use of a slip sheet. Deployed GCL panels shall lie flat on the subgrade surface, with no wrinkles or folds. Each field panel shall be labeled with an identification code consistent with the layout plan that can track the panel to its roll number. Complete the Daily QC Checklist.

3.2.3 Anchor Trench

The front edge of the trench shall be rounded so as to eliminate sharp corners that could damage the GCL. The GCL shall extend down the front wall and across the bottom of the anchor trench. Soils used for backfill shall have a maximum particle size of 1.0 inch and shall be placed in two lifts. Compaction and testing requirements are described in Section 31 23 00.00 20 EXCAVATION AND FILL.

3.2.4 Seams

On side slopes, GCL shall be placed with seams oriented parallel to the line of maximum slope and shall be free of tension or stress upon completion of installation. In corners and odd shaped geometric locations, the number of seams should be minimized. Horizontal seams should be greater than 5 feet from the toe of slopes, or areas of potential stress concentrations, unless otherwise authorized. Panels shall be positioned with the overlap recommended by the manufacturer, but not less than 6 inches for panel sides or 24 inches after shrinkage for panel ends. Soil or other foreign matter shall be removed from the overlap area immediately prior to seaming. If recommended by the manufacturer, granular bentonite of the same type as the bentonite used for the GCL shall be placed along the entire overlap width at a minimum rate of 0.25 lbs/linear foot or as recommended by the manufacturer. Construction adhesive or other approved seaming methods recommended by the manufacturer shall be used for horizontal seams on slopes. Overlaps which occur on slopes shall be constructed with the up slope GCL shingled over the down slope GCL. Alternate seaming methods may be approved if recommended by the manufacturer.

3.2.5 Protection

Only those GCL panels which can be anchored and covered in the same day shall be unpackaged and installed. If exposed GCL cannot be permanently covered before the end of a working day, it shall be temporarily covered with plastic or other waterproof material to prevent hydration. Prevent uplift by wind.

3.3 REPAIRS

Holes or tears in GCL shall be repaired by placing a patch of GCL extending a minimum of 12 inches beyond the edges of the hole or tear on all sides. If recommended by the manufacturer, granular bentonite or bentonite mastic shall be applied in the overlap area. Patches shall be secured with a construction adhesive or other approved methods as recommended by the

manufacturer.

The QC Specialist, Contracting Officer or CQA Consultant shall notify the Installer which panels or portions of panels are rejected, in need of repair, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by the CQA Consultant.

Maintain a GCL Repair Log, with location and size of repairs, and corrective action taken noted.

3.4 PENETRATIONS

Penetration details shall be as recommended by the GCL manufacturer. As a minimum, pipe penetrations shall incorporate a collar of GCL wrapped around the pipe and securely fastened. Dry bentonite or bentonite paste shall be placed around the penetration as recommended by the GCL manufacturer.

3.5 AS BUILT GCL PANEL LAYOUT AND DETAIL DRAWINGS

Final as built drawings of GCL installation shall be prepared. These drawings shall include locations of panels, seams, repairs, and penetrations; identification of panel numbers, seam numbers, sample/test locations, and repairs. Repair sizes and date of repair shall be noted.

-- End of Section --

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS
05/10

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.

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2012) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2013) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

1.2 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, G90, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.3 GUARD POSTS (BOLLARDS/PIPE GUARDS)

Provide 4 inch galvanized standard weight steel pipe as specified in ASTM A53/A53M. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 2500 psi. Provide plastic bollard covers, 1/8 inch wall thickness sized to fit pipe bollard, color shall be yellow.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 FINISHES

3.3.1 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

3.3.2 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.4 INSTALLATION OF GUARD POSTS (BOLLARDS/PIPE GUARDS)

Set pipe guards vertically in concrete.

3.5 FIELD QUALITY CONTROL

Perform field inspection, and provide labor, equipment, and incidentals required for inspections. The Contracting Officer shall be notified in writing of any defects within 7 working days of the date of inspection.

-- End of Section --

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SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS
07/06

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 in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012; Errata 2012; INT 1 2012; INT 2 2012; INT 3 2012) National Electrical Safety Code
IEEE C57.12.28	(2005; INT 3 2011) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.29	(2005) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections. This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 12 19.10 THREE-PHASE PAD MOUNTED TRANSFORMERS
Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM
Section 26 56 00.00 22 EXTERIOR LIGHTING
Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 12,470 kV primary, three phase, four wire, 60 Hz, and 480Y/277 volts secondary, three phase, four wire. Final connections to the power distribution system at the existing overhead service shall be made by the Contractor as directed by the Contracting Officer.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings (SD-02)

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.8 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.

c. Safety precautions.

d. The procedure in the event of equipment failure.

e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.9 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.10 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.11 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment including pad-mounted transformers having a nominal rating exceeding 600 volts.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28 or IEEE C57.12.29, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPSO710D72 or approved equal.

b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 3 inch high white letters on a red and black field.

1.12 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.13 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements specified in the technical sections.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

-- End of Section --

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SECTION 26 08 00

APPARATUS INSPECTION AND TESTING
08/08

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.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Acceptance tests and inspections; G

SD-07 Certificates

Qualifications of organization, and lead engineering technician; G

Acceptance test and inspections procedure; G

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Contractor shall engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and generation equipment listed in paragraph entitled "Acceptance Tests and Inspections" herein. Organization shall be independent of the supplier, manufacturer, and installer of the equipment. The organization shall be a first tier subcontractor. No work required by this section of the specification shall be performed by a second tier subcontractor.

a. Submit name and qualifications of organization. Organization shall have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The organization shall have a calibration program, and test instruments

used shall be calibrated in accordance with NETA ATS.

b. Submit name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments shall be performed by an engineering technician, certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

1.4.2 Acceptance Tests and Inspections Reports

Submit certified copies of inspection reports and test reports. Reports shall include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind test reports to form a part of the final record. Submit test reports documenting the results of each test not more than 10 days after test is completed.

1.4.3 Acceptance Test and Inspections Procedure

Submit test procedure reports for each item of equipment to be field tested at least 45 days prior to planned testing date. Do not perform testing until after test procedure has been approved.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 ACCEPTANCE TESTS AND INSPECTIONS

Testing organization shall perform acceptance tests and inspections. Test methods, procedures, and test values shall be performed and evaluated in accordance with NETA ATS, the manufacturer's recommendations, and paragraph entitled "Field Quality Control" of each applicable specification section. Tests identified as optional in NETA ATS are not required unless otherwise specified. Equipment shall be placed in service only after completion of required tests and evaluation of the test results have been completed. Contractor shall supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing. Contracting Officer shall be notified at least 14 days in advance of when tests will be conducted by the testing organization. Perform acceptance tests and inspections on applicable equipment and systems specified in the following sections:

a. Section 26 32 13.00 20 SINGLE OPERATION GENERATOR SETS. Functional engine shutdown tests, vibration base-line test, and load bank test shall not be performed by the testing organization. These tests shall be performed by the start-up engineer.

b. Section 26 12 19.10 THREE-PHASE PAD-MOUNTED TRANSFORMERS

c. Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION

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d. Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION

e. Section 26 36 23.00 20 AUTOMATIC TRANSFER SWITCHES

3.2 SYSTEM ACCEPTANCE

Final acceptance of the system is contingent upon satisfactory completion of acceptance tests and inspections.

3.3 PLACING EQUIPMENT IN SERVICE

A representative of the approved testing organization shall be present when equipment tested by the organization is initially energized and placed in service.

-- End of Section --

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SECTION 26 12 19.10

THREE-PHASE PAD-MOUNTED TRANSFORMERS
02/12

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 in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M	(2012a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM D1535	(2012a) Specifying Color by the Munsell System
ASTM D877	(2002; R 2007) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes
ASTM D92	(2012a) Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D97	(2012) Pour Point of Petroleum Products

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 386	(2006; INT 1 2011) Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V
IEEE C2	(2012; Errata 2012; INT 1 2012; INT 2 2012; INT 3 2012) National Electrical Safety Code
IEEE C37.47	(2011) Standard for High Voltage Current-Limiting Type Distribution Class Fuses and Fuse Disconnecting Switches
IEEE C57.12.00	(2010) Standard General Requirements for

	Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.28	(2005; INT 3 2011) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.34	(2009) Standard for Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 5 MVA and Smaller; High Voltage, 34.5 kV Nominal System Voltage and Below; Low Voltage, 15 kV Nominal System Voltage and Below
IEEE C57.12.90	(2010) Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.98	(2011) Guide for Transformer Impulse Tests
IEEE C62.11	(2005; Amd 1 2008) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203	(1992) Fish Acute Toxicity Test

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 712-C-98-075	(1996) Fate, Transport and Transformation Test Guidelines - OPPTS 835.3100- "Aerobic Aquatic Biodegradation"
EPA 821-R-02-012	(2002) Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pad-mounted transformer drawings; G

SD-03 Product Data

Pad-mounted transformers; G

Submittal shall include manufacturer's information for each component, device, insulating fluid, and accessory provided with the transformer.

SD-06 Test Reports

Acceptance checks and tests; G

Submittal shall include acceptance criteria and limits for each test in accordance with NETA ATS "Test Values".

SD-07 Certificates

Transformer Efficiencies; G

Submit certification, including supporting calculations, from the manufacturer indicating conformance with the paragraph entitled "Specified Transformer Efficiencies."

SD-09 Manufacturer's Field Reports

Pad-mounted transformer design tests; G

Pad-mounted transformerroutine and other tests; G

SD-10 Operation and Maintenance Data

Transformer(s), Data Package 5; G

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein.

SD-11 Closeout Submittals

Transformer test schedule; G

Submit report of test results as specified by paragraph entitled "Field Quality Control."

1.4.1 Government Submittal Review

Code CI47, NAVFAC LANT, Naval Facilities Engineering Command will review and approve all submittals in this section requiring Government approval.

1.4.2 Reduced Submittal Requirements

Transformers designed and manufactured by ABB in Jefferson City, MO; by Cooper Power Systems in Waukesha, WI; by ERMCO in Dyersburg, TN; or by Howard Industries in Laurel, MS need not submit the entire submittal package requirements of this contract. Instead, the following items shall be submitted:

a. A certification, signed by the manufacturer, stating that the technical requirements of this specification shall be met.

b. An outline drawing of the transformer with devices identified (paragraph entitled "Pad-Mounted Transformer Drawings", item a).

c. ANSI nameplate data of the transformer (paragraph entitled "Pad-Mounted Transformer Drawings", item b).

d. Manufacturer's published time-current curves (properly overlaid on one full size logarithmic paper) of the transformer high side fuses (paragraph entitled "Pad-Mounted Transformer Drawings", item e) with transformer damage curve, inrush curve, and thru fault current indicated.

e. Routine and other tests (in PART 2, see paragraph entitled "Source Quality Control", subparagraph entitled "Routine and Other Tests"), shall be conducted by the manufacturer and may be witnessed by the government. Provide transformer test schedule required by submittal item "SD-11 Closeout Submittals". Provide certified copies of the tests.

f. Provide acceptance test reports required by submittal item "SD-06 Test Reports".

g. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data".

1.5 QUALITY ASSURANCE

1.5.1 Pad-Mounted Transformer Drawings

Drawings shall indicate, but not be limited to the following:

a. An outline drawing, with front, top, and side views.

b. ANSI nameplate data.

c. Elementary diagrams and wiring diagrams with terminals identified of watthour meter and current transformers.

d. One-line diagram, including switch(es), current transformers, meters, and fuses.

e. Manufacturer's published time-current curves (on full size logarithmic paper) of the transformer high side fuses.

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.5.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6 MAINTENANCE

1.6.1 Additions to Operation and Maintenance Data

In addition to requirements of Data Package 5, include the following on the actual transformer(s) provided:

a. An instruction manual with pertinent items and information highlighted

b. An outline drawing, front, top, and side views

c. Prices for spare parts and supply list

d. Routine and field acceptance test reports

e. Fuse curves for primary fuses

f. Information on watthour demand meter, CT's, and fuse block

g. Actual nameplate diagram

h. Date of purchase

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION,.

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

IEEE C57.12.34, IEEE C57.12.28 and as specified herein.

2.2.1 Compartments

The high- and low-voltage compartments shall be separated by steel isolating barriers extending the full height and depth of the compartments. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

2.2.1.1 High Voltage, Dead-Front

High-voltage compartment shall contain the incoming line, insulated high-voltage load-break connectors, bushing well inserts, six high-voltage bushing wells configured for loop feed application, load-break switch handle(s), access to oil-immersed bayonet fuses, tap changer handle, connector parking stands protective caps, and ground pad.

a. Insulated high-voltage load-break connectors: IEEE 386, rated 15 kV, 95 kV BIL. Current rating: 200 amperes rms continuous. Short time rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector shall have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.

b. Bushing well inserts: IEEE 386, 200 amperes, 15 kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise.

c. Load-break switch

Radial-feed oil-immersed type rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 12,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

ARRANGEMENT NO.	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION					
		LINE A SW.		LINE B SW		XFMR. SW	
		OPEN	CLOSE	OPEN	CLOSE	OPEN	CLOSE
1	Line A connected to Line B and both lines connected to transformer		X		X		X
2	Transformer connected to Line A only		X	X			X
3	Transformer connected to Line Bonly	X			X		X
4	Transformer open and loop closed		X		X	X	
5	Transformer open and loop open	X		X		X	

d. Provide bayonet type, oil-immersed, expulsion fuses in series with oil-immersed, partial-range, current-limiting fuses. Bayonet fuse links shall sense both high currents and high oil temperature in order to provide thermal protection to the transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond the interrupting rating of the expulsion fuse. In order to eliminate or minimize oil spills, the bayonet fuse assembly shall include an oil retention valve inside the housing which closes when the fuse holder is removed and an external drip shield. Warning shall be conspicuously displayed within the high-voltage compartment cautioning against removing or inserting fuses unless the load-break switch is in the open position and the tank pressure has been released.

   Bayonet fuse assembly: 150 kV BIL.

   Oil-immersed current-limiting fuses: IEEE C37.47; 50,000 rms amperes symmetrical interrupting rating at the system voltage specified. Connect current-limiting fuses ahead of the radial-feed load-break switch.

e. Surge arresters: IEEE C62.11, rated 9 kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap. Provide three arresters for radial feed circuits.

f. Parking stands: Provide a parking stand near each bushing.

g. Protective caps: IEEE 386, 200 amperes, 15 kV Class. Provide insulated protective caps (not shipping caps) for insulating and sealing out moisture from unused bushings.

2.2.2 Transformer

a. Less-flammable liquid-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.

b. Transformer shall be rated 150 kVA.

c. Transformer voltage ratings: 12,470 V Delta - 480/277 V GrdY.

d. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Tap changers shall clearly indicate which tap setting is in use.

e. Minimum tested percent impedance at 85 degrees C shall not be less than the following values:

2.50 for units rated 75kVA and below
2.87 for units rated 112.5kVA to 300kVA
4.03 for 500kVA rated units
5.32 for units rated 750kVA and above

f. Audible sound levels shall comply with the following:

kVA	DECIBELS (MAX
75	51
112.5	55
150	55
225	55
300	55
500	56
750	57
1000	58
1500	60
2000	61
2500	62

g. Transformer shall include lifting lugs and provisions for jacking under base. The transformer base construction shall be suitable for using rollers or skidding in any direction. Provide transformer top with an access handhole. Transformer shall have its kVA rating conspicuously displayed using 3 inch high yellow letters on its enclosure. The transformer shall have an insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

2.2.2.1 Specified Transformer Efficiencies

Provide transformer efficiency calculations utilizing the actual no-load and load loss values obtained during the routine tests performed on the actual transformer(s) prepared for this project. No-load losses (NLL) shall be referenced at 20 degrees C. Load losses (LL) shall be referenced at 55 degrees C and at 50 percent of the nameplate load. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in the "KVA / Efficiency" table below. That table is based on requirements contained within 10 CFR 431, Subpart K.

kVA	EFFICIENCY (percent)
15	98.36
30	98.62
45	98.76
75	98.91
112.5	99.01
150	99.08
225	99.17
300	99.23
500	99.25
750	99.32
1000	99.36
1500	99.42
2000	99.46
2500	99.49
above 2500	99.50

2.2.3 Insulating Liquid

a. Less-flammable transformer liquids: NFPA 70 and FM APP GUIDE for less-flammable liquids having a fire point not less than 300 degrees C tested per ASTM D92 and a dielectric strength not less than 33 kV tested per ASTM D877. Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate.

The fluid shall be a biodegradable electrical insulating and cooling liquid classified by UL and approved by FM as "less flammable" fluids. The fluid shall meet the following fluid properties:

1. Pour point: ASTM D97, less than -15 degree C

2. Aquatic biodegradation: EPA 712-C-98-075, 100 percent

3. Trout toxicity: OECD Test 203, zero mortality of EPA 821-R-02-012, pass

2.2.3.1 Liquid-Filled Transformer Nameplates

Distribution transformers shall be provided with nameplate information in accordance with IEEE C57.12.00 and as modified or supplemented by this section.

2.2.4 Corrosion Protection

Bases and cabinets of transformers shall be corrosion resistant and shall be fabricated of stainless steel conforming to ASTM A240/A240M, Type 304 or 304L. Base shall include any part of pad-mounted transformer that is within 3 inches of concrete pad.

Paint entire transformer assembly Munsell 7GY3.29/1.5 green. Paint coating system shall comply with IEEE C57.12.28 regardless of base, cabinet, and tank material. The Munsell color notation is specified in ASTM D1535.

2.3 WARNING SIGNS

Provide warning signs for the enclosures of pad-mounted transformers having a nominal rating exceeding 600 volts.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPSO710D72 or approved equal.

b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 14 by 10 inches with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 3 inch high white letters on a red and black field.

2.4 Arc Flash Warning Label

Provide warning label for the enclosure of pad-mounted transformers. Locate this self-adhesive warning label on the outside of the high voltage compartment door warning of potential electrical arc flash hazards and appropriate PPE required. The label format shall be as indicated.

2.5 GROUNDING AND BONDING

UL 467. Provide grounding and bonding as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.6 CAST-IN-PLACE CONCRETE

Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength

unless specified otherwise. All concrete shall conform to the requirements of Section 32 13 13.06 PORTLAND CEMENT CONCRETE FOR PAVEMENT AND SITE FACILITIES.

Shall be composed of fine aggregate, coarse aggregate, portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture. Fine aggregate shall be of hard, dense, durable, clean, and uncoated sand. The coarse aggregate shall be reasonably well graded from 3/16 inch to 1 inch. The fine and coarse aggregates shall be free from injurious amounts of dirt, vegetable matter, soft fragments or other deleterious substances. Water shall be fresh, clean, and free from salts, alkali, organic matter, and other impurities. Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength unless specified otherwise. Slump shall not exceed 4 inches. Retempering of concrete will not be permitted. Exposed, unformed concrete surfaces shall be given a smooth, wood float finish. Concrete shall be cured for a period of not less than 7 days, and concrete made with high early strength portland cement shall be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed by the Contracting Officer. Air entrain concrete exposed to weather using an air-entraining admixture conforming to ASTM C260/C260M. Air content shall be between 4 and 6 percent.

2.7 SOURCE QUALITY CONTROL

2.7.1 Transformer Test Schedule

The Government reserves the right to witness tests. Provide transformer test schedule for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

1. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.

3. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.

4. Dated calibration labels shall be visible on all test equipment.

5. Calibrating standard shall be of higher accuracy than that of the instrument tested.

6. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

   (a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.7.2 Design Tests

IEEE C57.12.00 states that "design tests are made only on representative apparatus to substantiate the ratings assigned to all other apparatus of basically the same design." Submit design test reports (complete with test data, explanations, formulas, and results), in the same submittal package as the catalog data and drawings for the specified transformer(s). Design tests shall have been performed in accordance with IEEE C57.12.90 prior to the award of this contract.

a. Tests shall be certified and signed by a registered professional engineer.

b. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (ONAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.

c. Lightning impulse: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests shall include the primary windings only of that transformer.

   1. IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.

   2. State test voltage levels.

   3. Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.

d. Lifting and moving devices: "Basically the same design" requirement for the lifting and moving devices test means a test report confirming that the lifting device being used is capable of handling the weight of the specified transformer in accordance with IEEE C57.12.34.

e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

f. Short circuit: "Basically the same design" for the short circuit test means a pad-mounted transformer with the same kVA as the transformer specified.

2.7.3 Routine and Other Tests

IEEE C57.12.00. Routine and other tests shall be performed in accordance with IEEE C57.12.90 by the manufacturer on the actual transformer(s) prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence shall be as follows:

a. Phase relation

b. Ratio

c. No-load losses (NLL) and excitation current

d. Load losses (LL) and impedance voltage

e. Dielectric

1. Impulse

2. Applied voltage

3. Induced voltage

f. Leak

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Pad-Mounted Transformer Grounding

Provide separate copper grounding conductors and connect them to the ground loop as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.4 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.5 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

3.6 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on concrete slab. Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade shall have 1/2 inch chamfer. Slab shall be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.6.1 Cast-In-Place Concrete

Cast-in-place concrete work shall conform to the requirements of Section 32 13 13.06 PORTLAND CEMENT CONCRETE FOR PAVEMENT AND SITE FACILITIES.

3.6.2 Sealing

When the installation is complete, the Contractor shall seal all entries into the equipment enclosure with an approved sealing method. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7 FIELD QUALITY CONTROL

3.7.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.7.1.1 Pad-Mounted Transformers

a. Visual and mechanical inspection

   1. Compare equipment nameplate data with specifications and approved shop drawings.

   2. Inspect physical and mechanical condition. Check for damaged or

cracked insulators and leaks.

3. Inspect anchorage, alignment, and grounding.

4. Verify the presence of PCB content labeling.

5. Verify the bushings and transformer interiors are clean.

6. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

7. Verify correct liquid level in tanks and bushings.

8. Verify that positive pressure is maintained on gas-blanketed transformers.

9. Perform specific inspections and mechanical tests as recommended by manufacturer.

10. Verify de-energized tap changer position is left as specified.

11. Verify the presence of transformer surge arresters.

b. Electrical tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter.

2. Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

3. Perform turns-ratio tests at all tap positions.

4. Perform insulation power-factor or dissipation-factor tests on all windings in accordance with test equipment manufacturer’s published data.

5. Perform power-factor or dissipation-factor tests on each bushing equipped with a power-factor/capacitance tap. In the absence of a power-factor/capacitance tap, perform hot-collar tests.

6. Measure the resistance of each high-voltage winding in each de-energized tap-changer position. Measure the resistance of each low-voltage winding in each de-energized tap-changer position, if applicable.

7. Remove and test a sample of insulating liquid for the following: Dielectric breakdown voltage, Acid neutralization number, Specific gravity, Interfacial tension, Color, Visual Condition, Water in insulating liquids (Required on 25 kV or higher voltages and on all silicone-filled units.), and Power factor or dissipation factor.

8. Perform dissolved-gas analysis (DGA) on a sample of insulating liquid.

3.7.1.2 Grounding System

a. Visual and mechanical inspection

1. Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

1. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

2. Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.7.1.3 Surge Arresters, Medium- and High-Voltage

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Inspect anchorage, alignment, grounding, and clearances.

4. Verify the arresters are clean.

5. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

6. Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

b. Electrical tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

2. Perform an insulation-resistance test on each arrester, phase terminal-to-ground.

3. Test grounding connection.

3.7.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

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SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM
08/08

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 in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2012; Errata 2012; INT 1 2012; INT 2 2012; INT 3 2012) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.3	(2005) American National Standard for Electrical Metallic Tubing (EMT)
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA FU 1	(2002; R 2007) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2010) Terminal Blocks

NEMA ICS 6	(1993; R 2011) Enclosures
NEMA KS 1	(2001; R 2006) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2011; Errata 2012) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2004) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA Z535.4	(2011) American National Standard for Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code
NFPA 70E	(2012; Errata 1) Standard for Electrical Safety in the Workplace

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Reprint Jul 2012) Standard for Flexible Metal Conduit
UL 1063	(2006; Reprint Jul 2012) Machine-Tool Wires and Cables
UL 1242	(2006; Reprint Jul 2012) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 198M	(2003; Reprint Oct 2007) Standard for Mine-Duty Fuses
UL 360	(2009; Reprint Jun 2009) Liquid-Tight Flexible Steel Conduit
UL 4248	(2007) UL Standard for Safety Fuseholders
UL 44	(2010) Thermoset-Insulated Wires and Cables
UL 467	(2007) Grounding and Bonding Equipment

UL 486A-486B	(2003; Reprint Feb 2010) Wire Connectors
UL 486C	(2004; Reprint Feb 2010) Splicing Wire Connectors
UL 489	(2009; Reprint Jun 2011) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 50	(2007; Reprint Apr 2012) Enclosures for Electrical Equipment, Non-environmental Considerations
UL 506	(2008; Reprint Mar 2010) Specialty Transformers
UL 508	(1999; Reprint Apr 2010) Industrial Control Equipment
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514B	(2012) Conduit, Tubing and Cable Fittings
UL 651	(2011; Reprint Mar 2012) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 67	(2009; Reprint Sep 2010) Standard for Panelboards
UL 797	(2007) Electrical Metallic Tubing -- Steel
UL 83	(2008) Thermoplastic-Insulated Wires and Cables
UL 869A	(2006) Reference Standard for Service Equipment
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards; G

Marking strips drawings; G

SD-03 Product Data

Circuit breakers; G

Switches; G

Enclosed circuit breakers; G

Motor controllers; G
Submittals shall include performance and characteristic curves.

SD-06 Test Reports

600-volt wiring test; G

Grounding system test; G

SD-07 Certificates

Fuses; G

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable

if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2,UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Flexible Metal Conduit

UL 1.

2.2.5.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.6 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.6.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.6.2 Fittings for EMT

Die cast compression type.

2.2.7 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.3 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.3.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and capacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.3.1.1 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2.3.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

2.3.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW or RHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.3.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.4 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.5 SWITCHES

2.5.1 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 3R, enclosure as indicated per NEMA ICS 6.

2.6 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Time-current characteristics curves of fuses serving motors or connected in series with circuit breakers shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

2.6.1 Fuseholders

Provide in accordance with UL 4248.

2.6.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 198M, Class RK-1. Associated fuseholders shall be Class R only.

2.7 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating as indicated. Panelboards for use as service disconnecting means shall additionally conform to UL 869A. Panelboards shall be circuit breaker-equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Main breaker shall be "separately" mounted "above" or "below" branch breakers. Where "space only" is indicated, make provisions for future installation of breakers. Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to panelboard (e.g., Panel PA served from Panel MDP). Type directories and mount in holder behind transparent protective covering. Panelboard shall have nameplates in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.7.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than No. 10 gauge if flush-mounted or mounted outdoors with full seam-welded box ends. Cabinets mounted outdoors shall be hot-dipped galvanized after fabrication. Cabinets shall be painted in accordance with paragraph PAINTING. Outdoor cabinets shall be of NEMA 4X raintight with a removable steel plate 1/4 inch thick in the bottom for field drilling for conduit connections. Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 1/8 inch. Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface. Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 24 inches long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets.

2.7.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

2.7.3 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.7.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.8 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral.

2.9 MOTORS

NEMA MG 1 hermetic-type sealed motor compressors shall also comply with

UL 984. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits shall have terminal voltage rating of 460 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating. Unless otherwise indicated, motors rated 1 HP and above shall be continuous duty type.

Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.9.1 Premium Efficiency Polyphase Motors

Polyphase motors shall be selected based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10. In addition, continuous rated, polyphase squirrel-cage medium induction motors shall meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.9.2 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.9.3 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment as specified herein. Power wiring and conduit shall conform to the requirements specified herein. Control wiring shall be provided under, and conform to the requirements of the section specifying the associated equipment.

2.10 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar

automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. Selector switch shall have means for locking in any position. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

2.10.1 Control Wiring

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Power wiring for 480-volt circuits and below shall be of the same type as control wiring and the minimum size shall be No. 12 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.10.2 Control Circuit Terminal Blocks

NEMA ICS 4. Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four (4) spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. The Contractor shall submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.10.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and shall have

provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.10.3 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side.. One secondary lead shall be fused; other shall be grounded. Provide for automatic switchover and alarm upon failure of primary control circuit.

2.10.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.11 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 23, "Mechanical."

2.12 GROUNDING AND BONDING EQUIPMENT

2.12.1 Ground Rods

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

2.13 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.14 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the

drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.15 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. The marking shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.16 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray, and equipment located outdoors shall be ANSI Light Gray. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.17 SOURCE QUALITY CONTROL

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid

nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches.

3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.4.1 Restrictions Applicable to EMT

a. Do not install underground.

b. Do not encase in concrete, mortar, grout, or other cementitious materials.

c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.

d. Do not use in hazardous areas.

e. Do not use outdoors.

f. Do not use in fire pump rooms.

g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.2 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40 and PVC Schedule 80

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in fire pump rooms.

(4) Do not use in penetrating fire-rated walls or partitions, or

fire-rated floors.

(5) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

(6) Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.4 Service Entrance Conduit, Underground

PVC, Type-EPC 40, galvanized rigid steel or steel IMC. Underground portion shall be encased in minimum of 3 inches of concrete and shall be installed minimum 18 inches below slab or grade.

3.1.4.5 Conduit for Circuits Rated Greater Than 600 Volts

Rigid metal conduit or IMC only.

3.1.4.6 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

3.1.4.7 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

3.1.4.8 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.9 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both

(a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.10 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.11 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.12 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.5 Mounting Heights

Mount panelboards, circuit breakers, and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Measure mounting heights of wiring devices and outletsto center of device or outlet.

3.1.6 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves.

3.1.6.1 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.7 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.8 Grounding and Bonding

Provide In accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems. Make ground connection to driven ground rods on exterior of building.

3.1.8.1 Ground Rods

Provide cone pointed ground rods. The resistance to ground shall be measured using the fall-of-potential method described in IEEE 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 6 feet on centers. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

3.1.8.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to

provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.8.3 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.9 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.5.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.5.3 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

SECTION 26 32 13.00 20

SINGLE OPERATION GENERATOR SETS
04/07

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.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 115	(2009) Guide for Test Procedures for Synchronous Machines: Part I Acceptance and Performance Testing; Part II Test Procedures and Parameter Determination for Dynamic Analysis
IEEE C2	(2012; Errata 2012; INT 1 2012; INT 2 2012; INT 3 2012) National Electrical Safety Code
IEEE C50.12	(2005; R 2010) Standard for Salient Pole 50 HZ and 60 Hz Synchronous Generators and Generation/Motors for Hydraulic Turbine Applications Rated 5 MVA and above

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 3046	(1986; Am. 1) Reciprocating Internal Combustion Engines - Performance
ISO 8528	(1993; R 2005) Reciprocating Internal Combustion Engine Driven Alternating Current Generator Sets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C50.10	(1990) Rotating Electrical Machinery - Synchronous Machines
NEMA MG 1	(2011; Errata 2012) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2012; Errata 2011; Errata 2011) Flammable and Combustible Liquids Code
NFPA 37	(2010; TIA 10-1) Standard for the

	Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 70	(2011; Errata 2 2012) National Electrical Code

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-52557	(Rev A; Notice 1) Fuel Oil, Diesel; for Posts, Camps and Stations

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, and Section 26 08 00 APPARATUS INSPECTION AND TESTING apply to this section except as modified herein.

1.3 SYSTEM DESCRIPTION

1.3.1 Engine-Generator Set Data

Submit data pertaining to the diesel engine-generator set and to the auxiliary equipment including but not limited to the following:

a. Make of engine.

b. Type or model of engine.

c. Gross bhp rating of engine shall be the total rated power output before deducting power requirements of electric motor-driven equipment or engine driven radiator fan.

d. Net brake power rating of engine shall include deductions for the total power requirements of electric motor-driven or engine-driven accessories as defined in ISO 3046. Net ratings shall include a deduction in power output for cooling media system power requirements including radiator fans and any other power consuming devices required to provide cooling as specified.

e. Strokes per cycle.

f. Number of cylinders.

g. Bore and stroke, inches.

h. Engine speed, rpm.

i. Piston speed, fpm.

j. kW power rating of engine-generator set as defined in the paragraph entitled "Engine-Generator Set Ratings and Performance."

k. Induction method (naturally aspirated, turbocharged).

l. Intercooler type (air-to-air or jacket water).

m. Governor type, make, and model.

n. Make and model of turbochargers.

1.3.2 Engine-Generator Set Efficiencies

Submit data pertaining to the diesel engine-generator set including but not limited to the following: Loads shall be calculated on basis of rated engine-generator set power.

a. Fuel consumption at 0.80 power factor, gallons per hr.

1. 1/2 load

2. 3/4 load

3. Full load

b. Generator efficiency at 0.80 power factor (percent).

1. 1/2 load

2. 3/4 load

3. Full load

c. Radiator capacity at design conditions.

1. Coolant shall be antifreeze mixture as specified under paragraph entitled "Cooling System."

2. gpm of coolant

3. cfm of air through radiator

4. Btu per hr of heat exchange based on optimum coolant temperature to and from engine.

1.3.3 Diesel Engine Data

Submit data certified by the engine manufacturer including but not limited to the following: Loads shall be calculated on basis of rated engine-generator set power.

a. Approximate exhaust temperature degrees F at full load

b. Weight of exhaust gas at full load lb per hr

c. Weight of intake air at full load lb per hr

d. Total heat rejected at full load Btu per hr

1. To jacket coolant system

2. To fuel oil cooling system

e. Emissions (Lbs/hr)(kg/hr) at full load

1. Total Suspended Particulate

2. Particulate matter with an average aerodynamic diameter of 10 microns (PM-10)

3. Sulfur dioxides

4. Nitrogen Oxides (as N02)

5. Carbon Monoxide

6. Volatile Organic Compounds

f. Visible Emissions (percent opacity) at full load

1.3.4 Generator and Exciter Data

Submit data certified by the generator manufacturer including but not limited to the following:

a. Make and model number of generator

b. kW rating of generator

c. Generator reactances

1. Synchronous reactance, Xd

2. Transient reactance, X'd

3. Subtransient reactance, X"d

4. Negative sequence reactance, X2

5. Zero sequence reactance, Xo

1.3.5 Capacity Calculations for Engine-Generator Set

Calculations shall verify that the engine-generator set power rating is adequate for the load described in the paragraph entitled "Load Profile."

1.3.6 Calculations for Brake Mean Effective Pressure (BMEP)

Calculation shall verify that the diesel engine meets the specified maximum BMEP as follows:

a. kW: Minimum power rating of engine-generator set as defined in the paragraph entitled "Engine-Generator Set Ratings and Performance."

b. rpm: Engine revolutions per minute.

c. cu. in.: Total engine piston displacement in cubic inches.

d. GEN.EFF.: Generator efficiency.

e. x: Multiplication sign.

f. bhp': Brake horsepower required from diesel engine by generator loaded to full power rating.

g. bhp': kW/(GEN.EFF. times 0.746).

h. bhp": Brake horsepower required by diesel engine driven fan for cooling radiator or motor driven fan for cooling radiator.

i. bhp: bhp' plus bhp".

j. BMEP psi: (792,000 times bhp) /(rpm times cu. in.).

1.3.7 Torsional Vibration Stress Analysis Computations

Torsional vibrational stresses in the crankshaft and generator shaft of assembled diesel engine and driven generator shall not exceed 5000 psi when engine is driving generator at rated speed while assembled unit is loaded to rated engine-generator set power. Computations shall be based on a mathematical model of the assembled generator set provided or based on calculations using measured values from tests on a unit identical to the one provided. Calculations based on models of, or measured data from, the unassembled engine and generator will not be acceptable. Calculations shall include:

a. A description of the system relating information pertinent to analysis such as operating speed range and identification plate data.

b. A mass elastic assembly drawing, showing the arrangement of the units in the generator set and dimensions of shafting, including minimum diameters (or section moduli) of shafting in the system.

c. A labeled line diagram of the mass elastic system indicating values of masses, stiffness, equivalent lengths, and equivalent diameters including basic assumptions and definition of terms.

d. Sample computations showing procedures used to obtain resulting stress values.

e. Computations indicating assembled engine-generator speed of 1800 rpm with assembly loaded to rated generator power and the resulting computed critical torsional stress values in the assembled engine crankshaft and generator shaft.

1.3.8 Capacity Calculations for Batteries

Calculation shall verify that the engine starting battery capacity exceeds dc power requirements.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Engine-Generator set and auxiliary equipment; G

SD-03 Product Data

Engine-generator set data; G

Engine-generator set efficiencies; G

Diesel engine data; G

Generator and exciter data; G

Diesel engine-generator set; G

SD-05 Design Data

Capacity calculations for engine-generator set; G

Calculations for brake mean effective pressure; G

Torsional vibration stress analysis computations; G

Capacity calculations for batteries; G

SD-06 Test Reports

Acceptance checks and tests; G

Functional acceptance tests; G

Functional acceptance test procedure; G

SD-07 Certificates

Vibration isolation system certification; G

Fuel system certification; G

Start-up engineer qualification resume; G

Instructor's qualification resume; G

SD-09 Manufacturer's Field Reports

Engine tests; G

Generator tests; G

Assembled engine-generator set tests; G

SD-10 Operation and Maintenance Data

Diesel engine-generator set, Data Package 4; G

Preliminary assembled operation and maintenance manuals; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and the paragraph entitled "Assembled Operation and Maintenance Manuals."

SD-11 Closeout Submittals

Posted operating instructions; G

Training plan; G

1.5 QUALITY ASSURANCE

1.5.1 Drawing Requirements

1.5.1.1 Engine-Generator Set and Auxiliary Equipment

Submit drawings pertaining to the engine-generator set and auxiliary equipment, including but not limited to the following:

a. Certified outline, general arrangement (setting plan), and anchor bolt details. Show total weight and center of gravity of assembled equipment on the steel subbase.

b. Detailed elementary, schematic wiring, and interconnection diagrams of the engine starting system, jacket coolant heating system, engine protective devices, engine alarm devices, engine speed governor system, generator and excitation system, and other integral devices.

c. Detailed elementary, schematic wiring; and interconnection diagrams of the diesel fuel system, starting battery system, engine-generator control panel, generator circuit breaker.

d. Dimensional drawings or catalog cuts of exhaust silencers, radiator, diesel fuel day tanks, fuel oil cooler, valves and pumps, intake filters, vibration isolators, and other auxiliary equipment not integral with the engine-generator set.

1.5.2 Vibration Isolation System Certification

Submit certification from the manufacturer that the vibration isolation system will reduce the vibration to the limits specified in the paragraph entitled "Vibration Isolation System."

1.5.3 Fuel System Certification

When the diesel fuel system requires a fuel oil cooler as described in the paragraph entitled "Fuel Oil Cooler," submit certification from the engine manufacturer that the fuel system design is satisfactory.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver equipment on pallets or blocking wrapped in heavy-duty plastic, sealed to protect parts and assemblies from moisture and dirt. Plug piping, conduit, exhaust, and air intake openings. Protect and prepare batteries for shipment as recommended by the battery manufacturer. Store auxiliary equipment at the site in covered enclosures, protected from atmospheric moisture, dirt, and ground water.

1.7 SITE CONDITIONS

Protect the components of the engine-generator set, including cooling system components, pumps, fans, and similar auxiliaries when not operating and provide components capable of the specified outputs in the following environment:

a. Site Location: latitude N 34,40 and longitude W 77,21

b. Site Elevation: 25 feet above mean sea level

c. Ambient Temperatures:

1. Maximum 93 degrees F dry bulb, 80 degrees F wet bulb.

2. Minimum 20 degrees F dry bulb.

1.8 MAINTENANCE

1.8.1 Extra Materials

1.8.1.1 Paint

Furnish one gallon of identical paint used on engine-generator set in manufacturer's sealed container with each engine-generator set.

1.8.1.2 Filters

Furnish four spare replacement elements in their original containers for each filter with each unit.

1.8.2 Posted Operating Instructions

Provide proposed operating instructions for the engine-generator set and auxiliary equipment laminated between matte-surface thermoplastic sheets and suitable for placement adjacent to corresponding equipment. After approval, install operating instructions where directed.

PART 2 PRODUCTS

2.1 DIESEL ENGINE-GENERATOR SET

Provide diesel engine-generator sets consisting of a water cooled diesel engine direct connected to an ac generator with a brushless excitation system and accessories. Equipment and materials shall be the manufacturer's standard products offered in catalogs for commercial or industrial use.

2.1.1 Engine-Generator Set Ratings and Performance

ISO 8528. Each engine-generator set shall have a power rating of not less than 150 kW at 0.8 power factor and supply 480Y/277 -volt, three-phase, 60-Hz ac output. Coordinate the engine-generator set to ensure an installed rating in the environment described in paragraph entitled "Site Conditions." The power of the engine-generator set is defined as the power output available at the generator terminals excluding the electrical power absorbed by the essential independent auxiliaries. Essential independent auxiliaries are items of equipment which are essential for the continued or repeated operation of the engine which uses power supplied from a source other than the engine.

2.1.1.1 Diesel Engine Capacity

The diesel engine shall meet the specified maximum BMEP requirements at rated speed as calculated in accordance with the paragraph entitled "Calculations for BMEP." The engine capacity shall be based on the

following:

a. Engine burning diesel fuel conforming to CID A-A-52557, Grade DF-2, at an ambient temperature of 85 degrees F.

b. Engine cooled by a radiator fan mechanically driven by the diesel engine or remote with a motor driven fan.

c. Engine cooled by coolant mixture of water and ethylene glycol, 50 percent by volume of each.

Maximum BMEP, psi

	Naturally Aspirated	Turbocharged	Turbocharged and Intercooled
Four-cycle engines	_____		
Engine speed, rpm:	1800		

2.1.1.2 Performance Class

The voltage and frequency behavior of the generator set shall be in accordance with ISO 8528 operating limit values for performance Class G2.

2.1.1.3 Load Profile

The diesel engine-generator set shall be of adequate capacity necessary for the following load profile:

a. Other load: 150 kW at 0.8 p.f.

2.1.2 Diesel Engines and Accessories

ISO 3046. Diesel engines shall be four-cycle naturally aspirated, or turbocharged, or turbocharged and intercooled; vertical in-line or vertical Vee type; designed for stationary service. Engines shall be capable of immediate acceleration from rest to normal speed without intermediate idle/warm up period or prelubrication to provide essential electrical power. Two-cycle engines are not acceptable.

2.1.2.1 Subbase Mounting

Mount each engine-generator set on a structural steel subbase sized to support the engine, generator, and necessary accessories, auxiliaries and control equipment to produce a complete self-contained unit as standard with the manufacturer. Design the structural subbase to properly support the equipment and maintain proper alignment of the engine-generator set in the specified seismic zone. In addition, provide subbase with both lifting rings and jacking pads properly located to facilitate shipping and installation of the unit. Factory align engine and generator on the subbase and securely bolt into place in accordance with the manufacturer's standard practice. Crankshaft shall have rigid coupling for connection to the generator.

2.1.2.2 Assembly

Completely shop assemble each engine-generator set on its structural steel

subbase. Paint entire unit with manufacturer's standard paints and colors. After factory tests and before shipping, thoroughly clean and retouch painting as necessary to provide complete protection.

2.1.2.3 Intercooler

Provide manufacturer's standard intercooler for engine size specified.

2.1.2.4 Crankcase Protection

Provide manufacturer's standard method of preventing crankcase explosions and standard method of crankcase ventilation.

2.1.2.5 Engine Lubricating Oil System

Provide each engine with the manufacturer's standard full pressure lubricating oil system arranged to cool the pistons and to distribute oil to moving parts of the engine. Provide oil type and oil filters as recommended by the engine manufacturer.

2.1.2.6 Engine Cooling System

Provide each engine with the manufacturer's standard jacket water pump. Provide a thermostatic control valve in the jacket coolant system for each engine-generator set to maintain a constant jacket coolant temperature to the engine.

2.1.2.7 Engine Fuel System

Provide each engine with the manufacturer's standard fuel system integral with the engine, complete with necessary piping, fittings, and valves for connecting items of equipment which are a part of the system. Provide engine manufacturer's standard hand priming pump. Provide manufacturer's standard simplex filter for each engine, of the throwaway filter element type, consisting of shell filter elements, drains, and necessary connections and fittings.

2.1.2.8 Engine Intake Filter

Provide intake filter assemblies for each engine of the oil bath or dry type, as standard with the manufacturer. Filters shall be capable of removing a minimum of 92 percent of dirt and abrasive 3 microns and larger from intake air. Size filters to suit engine requirements at 100 percent of rated full load. Design unit for field access for maintenance purposes.

2.1.2.9 Engine Starting System

Starting shall be accomplished using an adequately sized dc starter system with a positive shift solenoid to engage the starter motor and to crank the engine continuously for 60 seconds without overheating.

2.1.2.10 Jacket Coolant Heating System

Provide a factory-installed,480 volts ac, jacket coolant heating system to ensure rapid starting. Thermostatically control heater at the temperature recommended by engine manufacturer. Include necessary equipment, piping, controls, wiring, and accessories.

2.1.2.11 Engine Protective (Shutdown) Devices

Equip each engine with devices to shut down the engine by shutting off the fuel supply to the engine via a fuel shutoff solenoid. Auxiliary contacts shall be suitable for activating a remote alarm system. Shutdown shall open the associated generator circuit breaker. Provide the following shutdown devices:

a. Overspeed device which operates when engine speed exceeds normal synchronous speed by 18 percent or as recommended by manufacturer. Device shall require manual reset.

b. Pressure switch which operates when lubricating oil pressure to engine drops below a preset value.

c. Temperature switch which operates when jacket coolant temperature exceeds a preset value.

d. Device which operates when the coolant level in the radiator drops below a preset level.

e. Other shutdown devices as recommended by the engine manufacturer.

2.1.2.12 Engine Alarm Devices

Equip each engine with alarm devices. Auxiliary contacts shall be suitable for activating a remote alarm system. Alarm devices shall have factory-fixed set points. Provide the following alarm contact devices:

a. Pressure switch which operates when lubricating oil pressure drops below a preset value.

b. Temperature switch which operates when jacket coolant temperature exceeds a preset value.

c. Temperature switch which operates when jacket coolant temperature is too low.

d. Other alarm devices as recommended by the engine manufacturer.

2.1.2.13 Miscellaneous Engine Accessories

Provide the following engine accessories where the manufacturer's standard design permits:

a. Piping on engine to inlet and outlet connections, including nonstandard companion flanges.

b. Structural steel subbase and vibration isolators, foundation bolts, nuts, and pipe sleeves.

c. Level jack screws or shims, as required.

d. Rails, chocks, and shims for installation of subbase on the foundation.

e. Removable guard, around fan. Support guard, on engine subbase, to suit manufacturer's standard.

2.1.2.14 Engine Speed Governor System

Provide a forward acting type engine speed governor system. Steady-state frequency band and frequency regulation (droop) shall be in accordance with the operating limit values of the performance class specified in the paragraph entitled "Performance Class."

2.1.3 Generator and Excitation System

2.1.3.1 Generator

Provide salient-pole type, ac, brushless-excited, revolving field, air-cooled, self-ventilated, coupled type, synchronous generator conforming to NEMA MG 1, Part 16, NEMA C50.10, and IEEE C50.12. Generator shall be rated for standby duty at 100 percent of the power rating of the engine-generator set as specified in paragraph entitled "Engine-Generator Set Ratings and Performance." Temperature rise of each of the various parts of the generator shall not exceed 130 degrees C as measured by resistance, based on a maximum ambient temperature of 40 degrees C. Winding insulation shall be Class H.

a. Stator: Stator windings shall be with VPI insulated coils.

b. Rotor: The rotor shall have connected amortiser windings.

c. Generator Space Heater: Provide 480 volt ac heaters. Heater capacity shall be as recommended by the generator manufacturer to aid in keeping the generator insulation dry.

d. Grounding: Provide non-corrosive steel grounding pads located at two opposite mounting legs.

e. Filters: Provide manufacturer's standard generator cooling air filter assembly.

2.1.3.2 Excitation System

Provide a brushless excitation system consisting of an exciter and rotating rectifier assembly integral with the generator and a voltage regulator. Insulation class for parts integral with the generator shall be as specified in paragraph entitled "Generator." System shall provide a minimum short circuit of 300 percent rated engine-generator set current for at least 10 seconds. Steady state voltage regulation shall be in accordance with the operating limit values of the performance class specified in the paragraph entitled "Performance Class."

a. Exciter and Rotating Rectifier Assembly: Rectifiers shall be provided with surge voltage protection.

b. Voltage Regulator: Voltage regulator shall be solid state or digital, automatic, three-phase sensing, volts per hertz type regulator. Voltage variation for any 40 degree C change over the operating temperature range shall be less than plus or minus 1.0 percent. Operating temperature shall be minus 40 degree C to plus 70 degree C. Voltage adjust range shall be plus to minus 5.0 percent of nominal. Inherent regulator features shall include overexcitation shutdown.

2.2 SPECIAL WRENCHES AND TOOLS

Wrenches and tools specifically designed and required to work on the new equipment, which are not commercially available as standard mechanic's tools, shall be furnished to the Contracting Officer.

2.3 IDENTIFICATION OF EQUIPMENT

Provide plates and tags sized so that inscription is readily legible to operating or maintenance personnel and securely mounted to or attached in proximity of their identified controls or equipment. Lettering shall be normal block lettering, a minimum of 0.25 inch high.

2.3.1 Materials

Construct ID plates and tags of 16 gage minimum thickness bronze or stainless steel sheet metal engraved or stamped with inscription. Construct plates and tags not exposed to the weather or high operational temperature of the diesel engine of laminated plastic, 0.125 inch thick, matte white finish with black center core, with lettering accurately aligned and engraved into the core.

2.3.2 Control Devices and Operation Indicators

Provide ID plates or tags for control devices and operation indicators, including valves, off-on switches, visual alarm annunciators, gages and thermometers, that are required for operation and maintenance of provided mechanical systems. Plates or tags shall be minimum of 0.5 inch high and 2 inches long and shall indicate component system and component function.

2.3.3 Equipment

Provide ID plates of a minimum size of 3 inches high and 5 inches long on provided equipment indicating the following information:

a. Manufacturer's name, address, type and model number, and serial number;

b. Contract number and accepted date;

c. Capacity or size;

d. System in which installed; and

e. System which it controls.

2.4 ASSEMBLED OPERATION AND MAINTENANCE MANUALS

The contents of the assembled operation and maintenance manuals shall include the manufacturer's O&M information required by the paragraph entitled "SD-10, Operation and Maintenance Data" and the manufacturer's O&M information specified in Section 26 36 23.00 20 AUTOMATIC TRANSFER SWITCHES.

a. Manuals shall be in separate books or volumes, assembled and bound securely in durable, hard covered, water resistant binder, and indexed by major assembly and components in sequential order.

b. A table of contents (index) shall be made part of the assembled O&M. The manual shall be assembled in the order noted in table of contents.

c. The cover sheet or binder on each volume of the manuals shall be identified and marked with the words, "Operation and Maintenance Manual."

2.5 SOURCE QUALITY CONTROL

Perform and report on factory tests and inspections prior to shipment. Provide certified copies of manufacturer's test data and results. Test procedures shall conform to ASME, IEEE, and ANSI standards, and to ISO requirements on testing, as appropriate and applicable. The manufacturer performing the tests shall provide equipment, labor, and consumables necessary for tests and measuring and indicating devices shall be certified to be within calibration. Tests shall indicate satisfactory operation and attainment of specified performance. If satisfactory, equipment tested will be given a tentative approval. Equipment shall not be shipped before approval of the factory test reports for the following tests.

2.5.1 Engine Tests

Perform customary commercial factory tests in accordance with ISO 3046 on each engine and associated engine protective device, including, but not limited to the following:

a. Perform dynamometer test at rated power. Record horsepower at rated speed and nominal characteristics such as lubricating oil pressure, jacket water temperature, and ambient temperature.

b. Test and record the values that the low oil pressure alarm and protective shutdown devices actuate prior to assembly on the engine.

c. Test and record values that the high jacket water temperature alarm and protective shutdown devices actuate prior to assembly on the engine.

2.5.2 Generator Tests

Tests shall be performed on the complete factory assembled generator prior to shipment. Conduct tests in accordance with IEEE 115, NEMA C50.10, and NEMA MG 1.

2.5.2.1 Routine Tests

Perform the following routine tests on the generators and their exciters:

a. Resistance of armature and field windings

b. Mechanical balance

c. Phases sequence

d. Open circuit saturation curve and phase (voltage) balance test

e. Insulation resistance of armature and field windings

f. High potential test

2.5.2.2 Design Tests

Submit the following design tests made on prototype machines that are physically and electrically identical to the generators specified.

a. Temperature rise test

b. Short circuit saturation curve and current balance test

2.5.3 Assembled Engine-Generator Set Tests

Perform the following tests on the assembled engine-generator set.

2.5.3.1 Initial Stabilization Readings

Operate the engine-generator set and allow the set to stabilize at rated kW at rated power factor, rated voltage, and rated frequency. During this period record instrument readings for output power (kW), terminal voltage, line current, power factor, frequency (rpm) generator (exciter) field voltage and current, lubricating oil pressure, jacket water temperature, and ambient temperature at minimum intervals of 15 minutes. Adjust the load, voltage, and frequency to maintain rated load at rated voltage and frequency. Adjustments to load, voltage, or frequency controls shall be recorded on the data sheet at the time of adjustment. Stabilization shall be considered to have occurred when four consecutive voltage and current recorded readings of the generator (or exciter) field either remain unchanged or have only minor variations about an equilibrium condition with no evident continued increase or decrease in value after the last adjustment to the load, voltage, or frequency has been made.

2.5.3.2 Regulator Range Test

Remove load and record instrument readings (after transients have subsided). Adjust voltage to the maximum attainable value or to a value just prior to actuation of the overvoltage protection device. Apply rated load and adjust voltage to the minimum attainable value or a value just prior to activation of the undervoltage protection device. The data sheets shall indicate the voltage regulation as a percent of rated voltage and the maximum and minimum voltages attainable. Voltage regulation shall be defined as follows:

$$\text{Percent Regulation} = \frac{((\text{No-Load Voltage}) - (\text{Rated-Load Voltage})) \times 100}{(\text{Rated-Load Voltage})}$$

2.5.3.3 Frequency Range Test

Adjust the engine-generator set frequency for the maximum attainable frequency at rated load. Record instrument readings. Adjust the engine-generator set frequency for the specified minimum attainable frequency at rated load. Record instrument readings. Reduce the load to zero and adjust the engine-generator set frequency for the maximum attainable frequency. Record instrument readings. Adjust the engine-generator set frequency for the minimum attainable frequency. Record instrument readings. The data sheet shall show the maximum and minimum frequencies attained at rated load, and at no load.

2.5.3.4 Transient Response Test

Drop the load to no load and re-apply rated load three times to ensure that the no load and rated load voltage and frequency values are repeatable and that the frequency and voltage regulation is within the limits specified. Record generator terminal voltage and frequency using a high speed strip chart recorder. The data sheet shall show the following results:

a. Frequency

1. Stability bandwidth or deviation in percent of rated frequency.

2. Recovery time.

3. Overshoot and undershoot.

b. Voltage

1. Stability bandwidth or deviation in percent of rated voltage.

2. Recovery time.

3. Overshoot and undershoot.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall conform to the applicable requirements of IEEE C2 NFPA 30, NFPA 37, and NFPA 70.

3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Engine-Generator Set Grounding

Provide separate copper grounding conductors and connect them to the ground system as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Connections

Make joints in grounding conductors by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION paragraph entitled "Grounding."

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 START-UP ENGINEER

Provide the services of a qualified factory trained start-up engineer, regularly employed by the engine-generator set manufacturer. The start-up services shall include conducting preliminary operations and functional

acceptance tests. The start-up engineer shall be present at the engine generator set installation site, full-time, while preliminary operations and functional acceptance tests are being conducted.

3.4 PREREQUISITES FOR FUNCTIONAL ACCEPTANCE TESTING

Completion of the following requirements is mandatory prior to scheduling functional acceptance tests for the engine-generator set and auxiliary equipment.

3.4.1 Performance of Acceptance Checks and Tests

The acceptance checks and tests shall be accomplished by the testing organization as described in Section 26 08 00 APPARATUS INSPECTION AND TESTING.

3.4.1.1 Generator Sets

Complete as specified in the paragraph entitled "Acceptance Checks and Tests."

3.4.1.2 Automatic Transfer Switches

Complete acceptance checks and tests as specified in Section 26 36 23.00 20 AUTOMATIC TRANSFER SWITCHES.

3.4.2 Preliminary Operations

The start-up engineer shall conduct manufacturer recommended start-up procedures and tests to verify that the engine-generator set and auxiliary equipment are ready for functional acceptance tests. Give the Contracting Officer 15 days' advance notice that preliminary operations will be conducted. After preliminary operation has been successfully conducted, the start-up engineer will notify the Contracting Officer in writing stating the engine-generator set and auxiliary equipment are ready for functional acceptance tests.

3.4.3 Preliminary Assembled Operation and Maintenance Manuals

Preliminary assembled operation and maintenance manuals shall have been submitted to and approved by the Contracting Officer. Manuals shall be prepared as specified in the paragraph entitled "Assembled Operation and Maintenance Manuals."

3.4.4 Functional Acceptance Test Procedure

Test procedure shall be prepared by the start-up engineer specifically for the engine-generator set and auxiliary equipment. The test agenda shall cover the requirements specified in the paragraph entitled "Functional Acceptance Tests." The test procedure shall indicate in detail how tests are to be conducted. A statement of the tests that are to be performed without indicating how the tests are to be performed is not acceptable. Indicate what work is planned on each workday and identify the calendar dates of the planned workdays. Specify what additional technical support personnel is needed such as factory representatives for major equipment. Specify on which testing workday each technical support personnel is needed. Data recording forms to be used to document test results are to be submitted with the proposed test procedure. A list of test equipment and instruments shall also be included in the test procedure.

3.4.5 Test Equipment

Test equipment and instruments shall be on hand prior to scheduling field tests or, subject to Contracting Officer approval, evidence shall be provided to show that arrangements have been made to have the necessary equipment and instruments on site prior to field testing.

3.5 FIELD QUALITY CONTROL

Give Contracting Officer NAVFAC North Carolina IPT, 30 days notice of dates and times scheduled for tests which require the presence of the Contracting Officer. The Contracting Officer will coordinate with the using activity and schedule a time that will eliminate or minimize interruptions and interference with the activity operations. The Contractor shall be responsible for costs associated with conducting tests outside of normal working hours and with incorporating special arrangements and procedures, including temporary power conditions. The Contractor shall provide labor, equipment, diesel fuel, test load, and consumables required for the specified tests. The test load shall be a cataloged product. Calibration of measuring devices and indicating devices shall be certified. Refer to Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, for requirements for a cataloged product. Perform the following field tests.

3.5.1 Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.5.1.1 Circuit Breakers - Low Voltage Insulated Case/Molded Case

a. Visual and mechanical inspection

1. Compare nameplate data with specifications and approved shop drawings.

2. Inspect circuit breaker for correct mounting.

3. Operate circuit breaker to ensure smooth operation.

4. Inspect case for cracks or other defects.

5. Verify tightness of accessible bolted connections and cable connections by calibrated torque-wrench method. Thermographic survey is not required.

6. Inspect mechanism contacts and arc chutes in unsealed units.

b. Electrical Tests

1. Perform contact-resistance tests.

2. Perform insulation-resistance tests.

3. Adjust Breaker(s) for final settings in accordance with engine-generator set manufacturer's requirements.

3.5.1.2 Current Transformers

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify correct connection.

4. Verify that adequate clearances exist between primary and secondary circuit.

5. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method. Thermographic survey is not required.

6. Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests

1. Perform insulation-resistance tests.

2. Perform polarity tests.

3. Perform ratio-verification tests.

3.5.1.3 Metering and Instrumentation

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify tightness of electrical connections.

b. Electrical Tests

1. Determine accuracy of meters at 25, 50, 75, and 100 percent of full scale.

2. Calibrate watthour meters according to manufacturer's published data.

3. Verify all instrument multipliers.

4. Electrically confirm that current transformer secondary circuits are intact.

3.5.1.4 Battery Systems

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method. Thermographic survey is not required.

4. Measure electrolyte specific gravity and temperature and visually check fill level.

5. Verify adequacy of battery support racks, mounting, anchorage, and clearances.

b. Electrical tests

1. Set charger float and equalizing voltage levels.

2. Verify all charger functions and alarms.

3. Measure each cell voltage and total battery voltage with charger energized and in float mode of operation.

4. Perform a capacity load test.

3.5.1.5 Engine-Generator Set

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Inspect for correct anchorage and grounding.

b. Electrical and mechanical tests

1. Perform an insulation-resistance test on generator winding with respect to ground. Calculate polarization index.

2. Perform phase rotation test to determine compatibility with load requirements.

3.5.1.6 Grounding System

a. Visual and mechanical inspection

1. Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

1. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to

test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

3.5.2 Functional Acceptance Tests

The tests shall be performed by the start-up engineer. Upon successful test completion, the start-up engineer shall provide the Contracting Officer with a written test report within 15 calendar days showing the tests performed and the results of each test. The report shall include the completed approved test data forms and certification from the start-up engineer that the test results fall within the manufacturer's recommended limits and meet the specified requirements performance. The report shall be dated and signed by the start-up engineer, and submitted for approval by the Contracting Officer. The Contracting Officer and NAVFAC North Carolina IPT, The Contracting Officer will witness final acceptance tests. Testing shall include but not be limited to:

a. Verify proper functioning of each engine protective shutdown device and pre-shutdown alarm device. Testing of the devices shall be accomplished by simulating device actuation and observing proper alarm and engine shutdown operation.

b. Verify proper functioning of the engine overspeed trip device. Testing of the overspeed trip device shall be accomplished by raising the speed of the engine-generator set until an overspeed trip is experienced.

c. Verify proper functioning of the crank cycle/terminate relay. Testing of the relay shall be accomplished by engaging the starter motor with the engine being prevented from running. Observe the complete crank/rest cycle as described in the paragraph entitled "Crank Cycle/Terminate Relay."

d. Verify proper functioning of the following automatic and manual operations. Testing shall include but not be limited to:

    1. Loss of Utility: Initiate a normal power failure with connected test load of rated kW at 1.0 power factor. Record time delay on start, cranking time until engine starts and runs, time to come up to operating speed, voltage and frequency overshoot, and time to achieve steady state conditions with all switches transferred to emergency position.

    2. Return of Utility: Return normal power and record time delay on retransfer for each automatic transfer switch, and time delay on engine cooldown and shutdown.

    3. Manual starting

    4. Emergency stop

e. Operate the engine-generator set at rated current (amperes) until the jacket water temperature stabilizes. Stabilization will be considered to have occurred when three consecutive temperature readings remain unchanged. Continue to operate the generator set for an additional 2 hours. Record instrument readings for terminal voltage, line current, frequency (Hz), engine speed rpm, lubricating oil pressure, jacket water temperature, and ambient temperature at 5 minute intervals for

first 15 minutes and at 15 minute intervals thereafter.

3.6 DEMONSTRATION

Upon completion of the work and at a time approved by the Contracting Officer, the Contractor shall provide instructions by a qualified instructor to the Government personnel in the proper operation and maintenance of the equipment. Government personnel shall receive training comparable to the equipment manufacturer's factory training. The duration of instruction shall be for not less than one 8 hour working day for instruction of operating personnel and not less than one 8 hour working day for instruction of maintenance personnel.

3.6.1 Instructor's Qualification Resume

Instructors shall be regular employees of the engine-generator set manufacturer. The instruction personnel provided to satisfy the requirements above shall be factory certified by the related equipment manufacturer to provide instruction services. Submit the name and qualification resume of instructor to the Contracting Officer for approval.

3.6.2 Training Plan

Submit training plan 30 calendar days prior to training sessions. Training plan shall include scheduling, content, outline, and training material (handouts). Content shall include but not limited to the following:

3.6.2.1 Operating Personnel Training

This instruction includes operating the engine-generator set, auxiliary equipment including automatic transfer switches in all modes, and the use of all functions and features specified.

3.6.2.2 Maintenance Personnel Training

Shall include mechanical, hydraulic, electrical, and electronic instructions for the engine-generator set and auxiliary equipment including automatic transfer switches.

a. Mechanical Training: Shall include at least the following:

1. A review of mechanical diagrams and drawings.

2. Component location and functions.

3. Troubleshooting procedures and techniques.

4. Repair procedures.

5. Assembly/disassembly procedures.

6. Adjustments (how, when, and where).

7. Preventive maintenance procedures.

8. Review of flow diagram.

9. Valve locations and function.

10. Valve and hydraulic equipment adjustment and maintenance procedures.

11. Hydraulic system maintenance and servicing.

12. Lubrication points, type, and recommended procedures and frequency.

b. Electrical and Electronic Maintenance Training: Shall include at least the following:

1. A review of electrical and electronic systems including wiring diagrams and drawings.

2. Troubleshooting procedures for the machine and control systems.

3. Electrical and electronic equipment servicing and care.

4. Use of diagnostics to locate the causes of malfunction.

5. Procedures for adjustments (locating components, adjustments to be made, values to be measured, and equipment required for making adjustments).

6. Maintenance and troubleshooting procedures for microprocessor or minicomputer where applicable.

7. Circuit board repair procedures where applicable (with schematics provided).

8. Use of diagnostic tapes.

9. Recommended maintenance servicing and repair for motors, switches, relays, solenoids, and other auxiliary equipment and devices.

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SECTION 26 36 23.00 20

AUTOMATIC TRANSFER SWITCHES
04/06

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.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1008	(2012) Transfer Switch Equipment
UL 508	(1999; Reprint Apr 2010) Industrial Control Equipment

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, and Section 26 08 00 APPARATUS INSPECTION AND TESTING, apply to this section, with the additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Automatic Transfer Switch Drawings; G

SD-03 Product Data

Automatic Transfer Switches; G

SD-06 Test Reports

Acceptance Checks and Tests; G

Functional Acceptance Tests; G

SD-07 Certificates

Proof of Listing; G

SD-10 Operation and Maintenance Data

Automatic Transfer Switches, Data Package 5; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

1.4.1 Proof of Listing

Submit proof of listing by UL 1008.

1.4.2 Automatic Transfer Switch Drawings

Drawings shall include outline, arrangement, and detail drawings. Detail drawings shall include manufacturer's name and catalog number, electrical ratings, total system transfer statement, reduced normal supply voltage at which transfer to the alternate supply is initiated, transfer delay times, short-circuit current rating, wiring diagram, description of interconnections, testing instructions, acceptable conductor type for terminals, tightening torque for each wire connector, and other required UL 1008 markings.

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES

Provide four-pole, automatic transfer switches for use in emergency systems in accordance with UL 1008. Each automatic transfer switch shall be rated for total system transfer and have the current and voltage ratings as indicated. The rating of the switch shall be adequate for withstanding the effects of the indicated RMS symmetrical fault current when protected by the indicated overcurrent device without contact welding. The switch operating mechanism shall be electrically operated from the source to which it is transferring, shall have quick-make, quick-break, load break contacts, and shall be mechanically held in both positions. Non-fire pump service transfer switches shall have manual operating means provided for maintenance and servicing accessible only by opening the enclosure. The manual operating means shall affect the opening and closing of the switch contacts at the same rate of speed as that caused by the automatic operation of the switch. The switch enclosure shall comply with UL 508, NEMA Type 4X, and shall be equipped with an equipment ground lug.

2.1.1 Automatic Transfer Switch Controls

2.1.1.1 Controls for Utility-Generator Automatic Transfer Switch

Provide all necessary controls to start the generator set upon loss of the normal (utility) source, transfer the load to the generator set upon reaching rated voltage and frequency, re-transfer the load when the normal (utility) source returns, and stop the generator set.

The switch shall include the following control features.

a. Three-phase normal source voltage sensing circuit with adjustable dropout, 75-93 percent of nominal, and pickup, 85-100 percent of nominal.

b. Engine starting control contacts with adjustable commit-to-start delay circuit, 0.5-6.0 seconds.

c. Voltage/frequency sensing circuit, set for 80 percent of nominal, for enabling load transfer to emergency source.

d. Transfer to emergency source time delay for transfer switches as indicated, adjustable 0-5 minutes.

e. Re-transfer to normal source time delay, adjustable 1-30 minutes.

f. Programmable exerciser to allow automatic starting of the generator set and subsequent load transfer. Exercise periods shall be selectable for 1 to 24 hours per day for 0 to 7 days a week.

g. Adjustable time delay transition or in-phase monitor feature for indicated transfer switches to allow safe transfer of highly inductive loads between two non-synchronized sources.

2.1.1.2 Controls for Preferred Utility Source Automatic Transfer Switch

Provide all the necessary controls to transfer the load to the alternate utility source upon loss of the preferred utility source and re-transfer the load to the preferred utility source when the preferred utility source returns. The switch shall include the following control features.

a. Three-phase preferred and alternate source voltage sensing circuit with adjustable dropout, 75-98 percent of nominal, and pick-up, 85-100 percent of nominal.

b. Re-transfer to normal source time delay, adjustable 1-30 minutes.

c. Adjustable time delay transition or in-phase monitor feature for indicated transfer switches to allow safe transfer of highly inductive loads between two non-synchronized sources.

2.1.2 Front Panel Devices

Provide devices mounted on cabinet front consisting of:

a. Mode selector switch with the following positions and associated functions;

1. TEST - Simulates loss of normal/preferred source system operation.

2. NORMAL - Transfers system to normal/preferred source bypassing re-transfer time delay.

b. Lamps for indicating connected source and normal/preferred source is available.

c. Auxiliary contacts for indicating connected source and normal/preferred source available.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall conform to the requirements of NFPA 70 and manufacturer's recommendation.

3.2 PREREQUISITES FOR FUNCTIONAL ACCEPTANCE TESTING

Completion of the following requirements is mandatory prior to scheduling functional acceptance tests for the automatic transfer switch.

3.2.1 Performance of Acceptance Checks and tests

Complete as specified in paragraph entitled "Acceptance Checks and Tests". The Acceptance Checks and Tests shall be accomplished by the Testing organization as described in Section 26 08 00 APPARATUS INSPECTION AND TESTING.

3.2.2 Manufacturers O&M Information

The manufacturers O&M information required by the paragraph entitled "SD-10 Operation and Maintenance Data", shall have been submitted to and approved by the Contracting Officer.

3.2.3 Test Equipment

All test equipment and instruments shall be on hand prior to scheduling field tests, or subject to Contracting Officer's approval, evidence shall be provided to show that arrangements have been made to have the necessary equipment and instruments on site prior to field testing.

3.3 FIELD QUALITY CONTROL

Give Contracting Officer 15 days notice of dates and times scheduled for tests which require the presence of the Contracting Officer. The Contracting Officer will coordinate with the using activity and schedule a time that will eliminate or minimize interruptions and interference with the activity operations. The contractor shall be responsible for costs associated with conducting tests outside of normal working hours and with incorporating special arrangements and procedures, including temporary power conditions. The contractor shall provide labor, equipment, apparatus, including test load, and consumables required for the specified tests. Calibration of all measuring devices and indicating devices shall be certified. The test load shall be a cataloged product in accordance with Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS. Perform the following field tests in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.3.1 Automatic Transfer Switch Acceptance Checks and Tests

a. Visual and Mechanical Inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.

3. Confirm correct application of manufacturer's recommended lubricants.

4. Verify that manual transfer warnings are attached and visible.

5. Verify tightness of all control connections.

6. Verify tightness of accessible bolted connections by calibrated torque-wrench method. Thermographic survey is not required.

7. Perform manual transfer operation.

8. Verify positive mechanical interlocking between normal and alternate sources.

b. Electrical Tests

1. Measure contact-resistance.

2. Perform insulation-resistance on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole for one minute. Perform tests in both source positions.

3. Verify settings and operations of control devices.

4. Calibrate and set all relays and timers.

3.3.2 Functional Acceptance Tests

Functional Acceptance Tests shall be coordinated with Section 26 32 13.00 20 SINGLE OPERATION GENERATOR SETS and shall include simulating power failure and demonstrating the following operations for each automatic transfer switch. Contractor shall show by demonstration in service that the automatic transfer switches are in good operating condition, and function not less than five times.

a. Perform automatic transfer tests:

1. Simulate loss of normal/preferred power.

2. Return to normal/preferred power.

3. Simulate loss of emergency power.

4. Simulate all forms of single-phase conditions.

b. Verify correct operation and timing of the following functions:

1. Normal source voltage-sensing relays.

2. Engine start sequence.

3. Time delay upon transfer.

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4. Alternate source voltage-sensing relays.

5. Automatic transfer operation.

6. Interlocks and limit switch function.

7. Time delay and retransfer upon normal power restoration.

-- End of Section --

SECTION 26 56 00.00 22

EXTERIOR LIGHTING
06/11

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 in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS-5	(2009; Errata 2009; Amendment 2010) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

ASTM INTERNATIONAL (ASTM)

ASTM B 117	(2009) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 1089	(2006) Standard Specification for Spun Cast Prestressed Concrete Poles
ASTM G 154	(2006) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

EUROPEAN COMMITTEE FOR STANDARDIZATION (CEN/CENELEC)

EN 60529	(1991; A1 2000) Degrees of Protection Provided By Enclosures (IP Code)

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9	(2000; Errata 2004; Errata 2005; Errata 2006) IES Lighting Handbook
IESNA LM-79	(2008) Electrical and Photometric Measurements of Solid-State Lighting Products
IESNA LM-80	(2008) Measuring Lumen Maintenance of LED Light Sources
IESNA TM-15	(2007; Addendum 2009) Luminaire Classification System for Outdoor Luminaires
IESNA RP-8	(2000; Errata 2004; R 2005; Errata 2007) Roadway Lighting

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2012; Errata 2012; INT 1 2012; INT 2 2012; INT 3 2012) National Electrical Safety Code
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60068-2-14	(2009) Environmental testing – Part 2-14: Tests – Test N: Change of temperature - Edition 6.0
IEC 60068-2-30	(2005) Environmental Testing - Part 2-30: Tests - Test Db: Damp Heat, Cyclic (12 H + 12 H Cycle); Ed 3.0

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.13	(2004; R 2009) American National Standard for Roadway Lighting Equipment, Metal Brackets for Wood Poles
ANSI C136.21	(2004; R 2009) American National Standard for Roadway and Area Lighting Equipment - Vertical Tenons Used with Post-Top-Mounted Luminaires
ANSI C136.3	(2005; R 2009) American National Standard for Roadway and Area Lighting Equipment Luminaire Attachments
NEMA C136.31	(2010) For Roadway and Area Lighting Equipment— Luminaire Vibration
NEMA ANSLG C78.377	(2008) American National Standard for electric lamps— Specifications for the Chromaticity of Solid State Lighting Products
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 1310	(2005) Standard for Safety Class 2 Power Units - Fifth Edition; Reprint with revisions through and including September 30, 2010
UL 1598	(2008; Reprint Jan 2010) Luminaires
UL 773	(1995; Reprint Mar 2002) Standard for Plug-In, Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2006; Reprint Mar 2011) Standard for Nonindustrial Photoelectric Switches for Lighting Control
UL 8750	(2009) Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products - First Edition

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

c. Groundline section is that portion between one foot above and 2 feet below the groundline.

d. Useful Life is the operating hours before reaching 70% of the initial rated lumen output point with no catastrophic failures under normal conditions.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Photometric Plan; G

Submit computer generated photometric analysis of the "designed to" values for the “end of useful life” of the lighting installation, using an LLD value of 0.7. Submittal shall include the following:

Horizontal illuminance measurements at finished grade. Spacing between computer calculation points must be 10' maximum.

Vertical illuminance measurements at 5 foot above finished grade

Minimum footcandle level

Maximum footcandle level

Average maintained footcandle level

Maximum and minimum ratio (Horizontal)

Warranty; G

LED Luminaire Warranty; G

SD-02 Shop Drawings

Luminaire drawings; G,

Poles; G,

SD-03 Product Data

Local/Regional Materials

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

Energy Efficiency

LED Luminaires; G,

LED Luminaire Photocell Switch; G

Concrete poles; G,

Brackets

SD-05 Design Data

Design Data for luminaires; G,

Wind Loading Calculations, G

SD-06 Test Reports

LED Luminaire IESNA LM-79 Report; G

Submit report on manufacturer's standard production model luminaire. Submittal shall include:

Testing agency, report number, date, manufacturer's name, catalog number, LED driver, drive current, ambient temperature

Luminaire Efficacy (Lumens/watt)

Color Qualities (CCT and CRI)

Electrical Measurements (input voltage, input current, input power (watts))

Spectral Distribution over visible wavelengths (mW/nm)

Absolute Intensity Candlepower (cd) Summary table

Isocandela Plot

Luminance Summary table

Illuminance - Point to Point

Illuminance - Isofootcandle Plot

Picture of sample

Absolute Intensity Candlepower (cd) Summary table

Photometric File including B.U.G. rating in IES Format

LED Luminaire IESNA LM-80 Report; G

Submit report on manufacturer's standard production LED package, array, or module. Submittal shall include:

Testing agency, report number, date, type of equipment, and LED light source being tested.

All data required by IESNA LM-80.

Test laboratories for the IESNA LM-79 and IESNA LM-80 reports shall be one of the following:

National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.

One of the qualified labs listed on the DOE SSL web site (http://www1.eere.energy.gov/buildings/ssl/test_labs.html).

A manufacturer's in-house lab that meets the following criteria:

a. Manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires and the manufacturer's lab has been successfully certifying these fixtures for a minimum of 15 years,

b. Annual equipment calibration including photometer calibration in accordance with National Institute of Standards and Technology.

Operating test

Submit operating test results as stated in paragraph entitled "Field Quality Control."

SD-07 Certificates

Fixture Useful Life Certificate; G

Submit certification from the manufacturer indicating the expected useful life of the luminaires provided. The useful life shall be directly correlated to the IESNA LM-80 test data, adjusted for the thermal properties of manufacturer's luminaire, and adjusted for local average ambient operating conditions.

SD-08 Manufacturer's Instructions

Concrete poles

Submit instructions prior to installation.

SD-10 Operation and Maintenance Data

Operational Service

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

1.4 QUALITY ASSURANCE

1.4.1 Drawing Requirements

1.4.1.1 Luminaire Drawings

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and computerized candlepower distribution data shall accompany shop drawings.

1.4.1.2 Poles

Include dimensions, wind load determined in accordance with AASHTO LTS-5, pole deflection, pole class, and other applicable information. For concrete poles, include: section and details to indicate quantities and position of prestressing steel, spiral steel, inserts, and through holes; initial prestressing steel tension; and concrete strengths at release and at 28 days.

1.4.2 Design Data for Luminaires

a. Distribution data according to IESNA classification type as defined in IESNA HB-9.

b. Computerized horizontal illumination levels in footcandles at ground level, taken every 10 feet. Include average maintained footcandle level and maximum and minimum ratio. Provide Photometric Plan for project.

c. Shielding as defined by IESNA RP-8 or B.U.G. rating for the installed position as defined by IESNA TM-15.

d. Provide safety certification and file number for the luminaire family.

Include listing, labeling and identification per NFPA 70 (NEC). Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratory).

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer. Component parts of the item shall be the products of the same manufacturer, unless stated otherwise in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if the manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires for a minimum of 15 years. Products shall have been in satisfactory commercial or industrial use for 15 years prior to bid opening. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 15-year period.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Concrete Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation.

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available

from a minimum of three sources.

1.6.2 Energy Efficiency

Comply with National Energy Policy Act. Comply with Energy Star requirements for the following lighting products: ___.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7.1 LED Luminaire Warranty

Life of exterior LED lighting (primarily the luminaire) is not yet well understood given the relative newness of the technology for this application. Projected life of LED luminaires is a key component to payback scenarios in project evaluations, therefore it is very important that products perform as anticipated. Since life claims provided by suppliers is typically 50,000 hours or greater and the first cost of exterior LED luminaires may be significant, site Warranty shall assure that the product will perform as claimed in terms of useful life. Provide Fixture Useful Life Certificate.

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

a. Provide a written five year on-site replacement warranty for material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.

    1. Finish warranty shall include warranty against failure and against substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

    2. Material warranty shall include:

        (a) All power supply units (PSUs), including drivers.

        (b) Replacement when more than 10% of LED sources in any lightbar or subassembly(s) are defective or non-starting.

b. Warranty period must begin on date of beneficial occupancy. Contractor shall provide the Contracting Officer signed warranty certificates prior to final payment.

1.8 OPERATIONAL SERVICE

Coordinate with manufacturer for maintenance agreement. Collect information from the manufacturer about maintenance agreement options, and submit to Contracting Officer. Services shall reclaim materials for recycling and/or reuse. Services shall not landfill or burn reclaimed materials. Indicate procedures for compliance with regulations governing disposal of mercury. When such a service is not available, local recyclers shall be sought after to reclaim the materials.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION,

2.2 LED LUMINAIRES

UL 1598 and UL 8750. Provide luminaires as indicated. Provide luminaires complete with LED light source and power supply unit. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

2.2.1 General Requirements

a. Luminaire shall be UL-listed for wet locations and wiring cavity must be field accessible for service or repair needs.

b. Luminaire shall be full cutoff or fully shielded as defined by IESNA RP-8. Alternatively, the full cutoff can be validated by meeting the following IESNA TM-15 B.U.G. Ratings (backlight, uplight, and glare):

   1. Maximum uplight (U) rating of U0 for residential areas and U1 for all other areas.

   2. Maximum glare (G) rating equal to G0 for residential areas and G2 for all other areas.

c. Optical system for roadway and area luminaires shall be sealed and rated for IP 66 as defined in EN 60529.

d. Luminaire shall be fully assembled and electrically tested prior to shipment from factory.

e. For all mast arm mounted luminaires, a wildlife shield shall be included in the fixture to prevent wildlife access to the fixture.

f. Color of the luminaire shall be bronze unless specified otherwise.

g. The coating must be capable of surviving ASTM B 117 Salt Fog environment for 1000 hrs minimum without blistering or peeling.

h. The coating shall demonstrate gloss retention of greater than or equal to 90% for 1000 hrs exposure QUV test per ASTM G 154 UVB-313 Lamps, 4 hr Condensation 50 °C.

i. Luminaire shall be tested according to IEC 60068-2-14 for thermal shock. Luminaire shall be fully functional after completion of testing.

j. Luminaire shall be tested according to IEC 60068-2-30, damp heat, steady state, for high humidity and high temperatures. Luminaire shall be fully functional after testing.

k. Luminaire arm bolts shall be 304 stainless steel or zinc plated steel.

l. If a lens not integral to the LED is used, construct the luminaire optical enclosure (lens/window) of clear and UV-resistant acrylic or tempered glass.

m. 80% of the luminaire material by weight should be recyclable at end of life.

n. Produce a minimum efficacy of 60 lumens per Watt driven at 350mA or a minimum of 50 lumens per Watt driven at 525mA tested per IESNA LM-79. Theoretical models of initial raw LED lumens per watt are not acceptable.

o. Incorporate modular electrical connections and construct luminaire to allow replacement of all or any part of the optics, heat sinks, power supply units, and electrical components using only a simple tool, such as a screwdriver.

p. Luminaire shall have a nameplate bearing the manufacturer's name, address, model number, date of manufacture, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

q. Fixture weight and effective projected area (EPA) shall not exceed the pole requirements for wind loading. Provide wind loading calculations.

r. Roadway and area luminaires shall have an integral tilt adjustment of +/- 5° to allow the unit to be leveled, in accordance with ANSI C136.3.

s. Luminaire must pass 3G vibration testing in accordance with NEMA C136.31.

t. Provide LED Luminaire IESNA LM-79 Report and LED Luminaire IESNA LM-80 Report.

2.2.2 Wiring

All factory electrical connections shall be made using crimp, locking, or latching style connectors. Twist style wire nuts are not acceptable.

2.2.3 Power Supply Units

UL 1310. Power Supply Unit (PSU) including drivers shall meet the following requirements:

a. Minimum efficiency of 85%.

b. Drive current per LED shall not exceed 525mA ±10%.

c. Rated to operate between ambient temperatures of -30°C and +40°C .

d. Designed to operate on voltage system to which they are connected ranging from 120 V to 277 V nominal.

e. Operating frequency: 50/60 Hz.

f. Power Factor (PF): Greater than or equal to 0.90.

g. Total Harmonic Distortion (THD) current: Less than or equal to 20%.

h. FCC Part 15 Class B.

i. Reduction of Hazardous Substances (RoHS) compliant.

j. Luminaires under a covered structure such as canopies shall be UL listed with a sound rating of "A."

2.2.4 LED Light Source

a. Luminaires must be rated for operation in ambient temperatures of -30°C to +40°C.

b. Correlated Color Temperature (CCT) shall be in accordance with NEMA ANSLG C78.377.

Nominal CCT: 4000 K: 3985 ± 275 K or Nominal CCT 4500 K: 4503 ± 243 K

c. Color Rendering Index (CRI) shall be:

Greater than or equal to 70 for 4000 K - 6500 K

2.2.5 Surge Protection

Provide surge protection integral to luminaire to meet "C Low" waveforms as defined in IEEE C62.41.2, Scenario 1 Location Category C.

2.2.6 LED Luminaire Photocell Switch

UL 773 or UL 773A, hermetically sealed silicon diode type cell, rated 277 volts ac, 60 Hz, with single-throw contacts designed to fail to the ON position. Switch shall turn on at or below 32 lux (3 footcandles) and off at 43 to 107 lux (4 to 10 footcandles). A time delay shall prevent accidental switching from transient light sources. Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition. Provide switch:

a. Compliant with Reduction of Hazardous Substances (RoHS).

b. Utilizing an ambient light sensing technology which inherently minimizes the contribution of typical high power LED light sources to the sensed light level.

c. With a rated life expectancy of 90,000 hours continuous operation.

d. Integral to the luminaire, rated 1000 VA, minimum.

2.3 POLES

Provide poles designed for wind loading of 130 miles per hour determined in accordance with AASHTO LTS-5 while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be embedded-base type designed for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by stainless steel captive screws. Scratched, stained, chipped, or dented poles shall not be installed.

2.3.1 Concrete Poles

Provide concrete poles conforming to ASTM C 1089. Cross-sectional shape shall be round.

2.3.1.1 Steel Reinforcing

Prestressed concrete pole shafts shall be reinforced with steel prestressing members. Design shall provide internal longitudinal loading by either pretensioning or post tensioning of longitudinal reinforcing members.

2.3.1.2 Tensioned Reinforcing

Primary reinforcement steel used for a prestressed concrete pole shaft shall be tensioned between 60 to 70 percent of its ultimate strength. The amount of reinforcement shall be such that when reinforcement is tensioned to 70 percent of its ultimate strength, the total resultant tensile force does not exceed the minimum section compressive strength of the concrete.

2.3.1.3 Coating and Sleeves for Reinforcing Members

Where minimum internal coverage cannot be maintained next to required core openings, such as handhole and wiring inlet, reinforcing shall be protected with a vaporproof noncorrosive sleeve over the length without the 1/2 inch concrete coverage. Each steel reinforcing member which is to be post-tensioned shall have a nonmigrating slipper coating applied prior to the addition of concrete to ensure uniformity of stress throughout the length of such member.

2.3.1.4 Strength Requirement

As an exception to the requirements of ASTM C 1089, poles shall be naturally cured to achieve a 28-day compressive strength of 7000 psi. Poles shall not be subjected to severe temperature changes during the curing period.

2.3.1.5 Shaft Preparation

Completed prestressed concrete pole shaft shall have a hard, smooth, nonporous surface that is resistant to soil acids, road salts, and attacks of water and frost, and shall be clean, smooth, and free of surface voids and internal honeycombing. Poles shall not be installed for at least 15 days after manufacture.

2.4 BRACKETS AND SUPPORTS

ANSI C136.3, ANSI C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

2.5 EQUIPMENT IDENTIFICATION

2.5.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.5.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. Luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only _____":

a. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

b. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

c. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.

d. ANSI ballast type (M98, M57, etc.) for HID luminaires.

e. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

Markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.6 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Concrete Poles

Install according to pole manufacturer's instructions.

3.1.2 GROUNDING

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper,

provide specially treated or lined connectors suitable for this purpose.

3.1.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

SECTION 31 05 19

GEOTEXTILE
08/08

PART 1 GENERAL

This section applies to geotextile placed above the geomembrane and atop the stone protective cover layer.

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.

ASTM INTERNATIONAL (ASTM)

ASTM D4354	(2012) Sampling of Geosynthetics for Testing
ASTM D4355	(2007) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2012) Determining Apparent Opening Size of a Geotextile
ASTM D4759	(2011) Determining the Specification Conformance of Geosynthetics
ASTM D4833	(2007) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Submit a description of techniques, procedures and equipment proposed for deploying the geotextile and aggregate cover for the geomembrane in

accordance with Section 02 56 13 WASTE CONTAINMENT GEOMEMBRANE.

SD-03 Product Data

Thread
Manufacturing Quality Control Sampling and Testing

SD-04 Samples

Quality Assurance Samples and Tests

SD-07 Certificates

Geotextile; G

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle geotextile in accordance with ASTM D4873.

1.3.1 Delivery

Notify the Contracting Officer a minimum of 24 hours prior to delivery and unloading of geotextile rolls packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, immediately rewrap rolls with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Label each roll with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

1.3.2 Storage

Protect rolls of geotextile from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, either elevate rolls off the ground or place them on a sacrificial sheet of plastic in an area where water will not accumulate.

1.3.3 Handling

Handle and unload geotextile rolls with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

PART 2 PRODUCTS

2.1 RAW MATERIALS

A minimum of 30 days prior to scheduled use, submit manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. This submittal shall include copies of manufacturer's quality control test results. For needle punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. The certificate of compliance shall be attested to by a person having legal authority to bind the geotextile manufacturer.

2.1.1 Geotextile

Provide geotextile that is a nonwoven pervious sheet of polymeric material consisting of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Add stabilizers and/or inhibitors to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material shall not be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 1
MINIMUM PHYSICAL REQUIREMENTS FOR GEOTEXTILE

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB TENSILE ELONGATION	PERCENT	50	ASTM D4632
GRAB STRENGTH	LBS	230	ASTM D4632
MASS/UNIT AREA	OZ/SY	10	ASTM D5261
PUNCTURE	LBS	120	ASTM D4833
TRAPEZOID TEAR	LBS	95	ASTM D4533
APPARENT OPENING SIZE	U.S. SIEVE	100	ASTM D4751
PERMITTIVITY	SEC -1	0.8	ASTM D4491
ULTRAVIOLET DEGRADATION	PERCENT	70 AT 500 HRS	ASTM D4355

2.1.2 Thread

A minimum of 30 days prior to scheduled use, submit proposed thread type for sewn seams along with data sheets showing the physical properties of the thread. Construct sewn seams with high-strength polyester, nylon, or other approved thread type. Thread shall have ultraviolet light stability equivalent to the geotextile and the color shall contrast with the geotextile.

2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. A minimum of 30 days prior to scheduled use, submit manufacturer's quality control manual. Documentation describing the quality control program shall be made available upon request. Perform manufacturing quality control sampling and testing in accordance with the manufacturer's approved quality control manual. As a minimum, geotextiles shall be randomly sampled for testing in accordance with ASTM D4354, Procedure A. Acceptance of geotextile shall be in accordance with ASTM D4759. Tests not meeting the specified requirements will result in the rejection of applicable rolls.

PART 3 EXECUTION

3.1 QUALITY ASSURANCE SAMPLES AND TESTS

3.1.1 Quality Assurance Samples

Provide assistance to the Contracting Officer in the collection of quality assurance samples for quality assurance testing; assign 30 days in the schedule to allow for testing. Collect samples upon delivery to the site for quality assurance testing at a frequency of one per 100,000 square feet. Identify samples with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted on the sample. Discard the outer layer of the geotextile roll prior to sampling a roll. Samples shall then be collected by cutting the full-width of the geotextile sheet a minimum of 3 feet long in the machine direction. Rolls which are sampled shall be immediately resealed in their protective covering.

3.1.2 Quality Assurance Tests

The Contractor shall provide quality assurance samples to the CQA Consultant. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method ASTM D4355 shall not be performed on the collected samples. Geotextile product acceptance shall be based on ASTM D4759. Tests not meeting the specified requirements will result in the rejection of applicable rolls.

In case of failing test results, the Manufacturer may request that another sample be retested by the CQA Laboratory with Manufacturer's technical representative present during the testing procedures. The costs for retesting include engineering, analyses, and all associated expenses shall be paid for the Manufacturer. The Manufacturer may also have the sample retested at two different laboratories approved by the Government. If both laboratories report passing results, the material shall be accepted. If both laboratories do not report passing results, all material from the lot representing the failing sample will be considered out of specification and rejected. The Manufacturer may obtain additional samples from rolls immediately before and after the failing roll or as directed by the CQA Consultant and have them tested by the CQ Laboratory at his/her own expense. If these rolls pass, only the failing roll will be rejected. If they fail, the entire lot will be rejected.

3.2 INSTALLATION

3.2.1 Subgrade Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile. Subgrade materials and compaction requirements shall be in accordance with Section 02 56 13 GEOMEMBRANE.

3.2.2 Placement

Notify the Contracting Officer a minimum of 24 hours prior to installation of geotextile. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles. On slopes steeper than 10 horizontal on 1 vertical, lay the geotextile with the machine direction of the fabric parallel to the slope direction.

3.3 SEAMS

3.3.1 Overlap Seams

Continuously overlap geotextile panels a minimum of 12 inches at all longitudinal and transverse joints. Where seams must be oriented across the slope, lap the upper panel over the lower panel. If approved, sewn seams may be used instead of overlapped seams.

3.3.2 Sewn Seams

Factory and field seams shall be continuously sewn on all slopes steeper than 1 vertical on 4 horizontal. The stitch type used shall be a 401 locking chain stitch or as recommended by the manufacturer. Provide Quality Assurance seam samples to the Government at the request of the Contracting Officer. Seam strength shall meet the minimum requirements specified in Table 1. The thread at the end of each seam run shall be tied off to prevent unraveling. Skipped stitches or discontinuities shall be sewn with an extra line of stitching with a minimum of 18 inches of overlap.

3.4 PROTECTION

Protect the geotextile during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Use adequate ballast (e.g. sand bags) to prevent uplift by wind. The geotextile shall not be left uncovered for more than 14 days after installation.

3.5 REPAIRS

Repair torn or damaged geotextile. Clogged areas of geotextile shall be removed. Perform repairs by placing a patch of the same type of geotextile over the damaged area. The patch shall extend a minimum of 24 inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Remove and replace geotextile rolls which cannot be repaired. On slope if a tear exceeds 10% of the width of roll, the roll shall be removed from the slope and replaced. Repairs shall be performed at no additional cost to the Government.

3.6 PENETRATIONS

Construct engineered penetrations of the geotextile by methods recommended by the geotextile manufacturer.

3.7 COVERING

Do not cover geotextile prior to inspection and approval by the Contracting Officer. The Contractor shall request the presence of the Contracting Officer during covering of the geotextile. The aggregate shall have a maximum particle size of 1 inch and shall be free of sticks, roots and other objects which could damage the geotextile. Place aggregate in a manner that prevents aggregate from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves. The aggregate shall be pushed out over the geotextile in an upward tumbling motion. On side slopes, backfill shall be placed from the bottom of the slope upward. Aggregate shall not be dropped onto the geotextile from a height greater than 3 feet. The initial aggregate lift shall be 12 inches. Equipment proposed to be operated directly on top of the geotextile shall meet requirements for equipment proposed for use directly on the geomembrane (including submittal requirements) specified in Section 02 56 13 WASTE CONTAINMENT GEOMEMBRANE. A minimum of 12 inches of aggregate shall be maintained between full-scale construction equipment and the geotextile. Aggregate material type, compaction, and testing requirements are described in Section 33 31 16 LEACHATE COLLECTION SYSTEM. Equipment placing aggregate shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding5 mph.

-- End of Section --

SECTION 31 05 20

GEOCOMPOSITE DRAINAGE LAYER
08/08

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.

ASTM INTERNATIONAL (ASTM)

ASTM D1505	(2010) Density of Plastics by the Density-Gradient Technique
ASTM D1603	(2012) Carbon Black Content in Olefin Plastics
ASTM D4218	(1996; R 2008) Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
ASTM D4355	(2007) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4716	(2008; R 2013) Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
ASTM D4751	(2012) Determining Apparent Opening Size of a Geotextile
ASTM D4833	(2007) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D5199	(2012) Measuring Nominal Thickness of Geosynthetics
ASTM D5261	(2010) Measuring Mass Per Unit Area of Geotextiles
ASTM D7005	(2003; R 2008) Standard Test Method for

	Determining the Bond Strength (Ply Adhesion) of Geocomposites
ASTM D7179	(2007; 2013) Standard Test Method for Determining Geonet Breaking Force

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sampling and Testing
Seams and Overlaps; G
End seam details.
Installer's QC manual, a minimum of 30 days prior to geocomposite shipment. The QC manual shall contain procedures and recommendations for geocomposite deployment, field replacement, geocomposite seams and overlaps, testing, and repair of defects.
Penetrations
Construction Quality Control (QC) Laboratory
Qualifications of Construction Quality Control laboratory.

SD-04 Samples

Geocomposite
Seams and Overlaps

SD-06 Test Reports

Sampling and Testing
Geocomposite
Manufacturer's quality control test results.
Geocomposite Membrane Repair Log; G

SD-07 Certificates

Completed test logs with a statement certifying compliance with specified requirements herein; G

1.3 QUALITY ASSURANCE

1.3.1 Installer

The installer shall have installed the geocomposite material at a minimum of 5 projects of comparable scope and complexity and shall have installed a minimum of 2,000,000 square feet of the proposed geocomposite material.

1.3.2 QC Specialist

The QC Specialist is responsible for monitoring and documenting (including interpreting test results) activities related to the QC of the geocomposite material from manufacturing through installation. The QC Specialist shall have provided QC and/or QA inspection during installation of geocomposite material for at least 5 projects and shall have performed QC and /or QA inspection on a minimum of 2 million square feet of geocomposite material.

1.3.3 QC Laboratory

Provide a construction quality control (QC) laboratory that has also performed quality assurance (QA) testing, if required, of geocomposite for at least five completed projects, having a total minimum area of 2 million square feet. Submit qualifications of laboratory which shall carry current accreditation via the Geosynthetic Accreditations Institute's Laboratory Accreditation Program (GAI-LAP) for the tests it will be required to perform.

1.4 DELIVERY, STORAGE, AND HANDLING

The QC Specialist shall be present during delivery and unloading of the geocomposite. Ensure the geocomposite material has not been damaged during shipping, storage, or handling. Any geocomposite material found to be damaged shall be repaired or replaced. Accept delivery of material only after the required submittals have been approved. Each roll shall be labeled with the manufacturer's name, product identification, lot number, roll number, and roll dimensions. Rolls that have attached geotextiles shall be individually wrapped in plastic. Store the rolls in a level and dry area.

PART 2 PRODUCTS

2.1 GEOCOMPOSITE

The polymer used to manufacture the geonet component of the geocomposite shall be polyethylene which is clean and free of any foreign contaminants. Submit one properly identified 24 by 24 inch minimum size geocomposite sample; fasteners proposed for use; and the method of seaming and overlapping. Submit manufacturer's quality control test results. Regrind material which consists of edge trimmings and other scraps may be used to manufacture the geonet; however, post-consumer recycled materials shall not be used. Conform the geocomposite to the property requirements listed in Table 1. Component criteria for the geonet alone and geotextile alone are also listed in Table 1. The geonet shall be covered on both sides with nonwoven geotextile. Create geocomposite by heat bonding geotextile to the geonet. The geotextile shall not be bonded to the drainage net within 6 inches of the edges of the rolls. Where applicable, Table 1 property values represent minimum average roll values (MARV). The value for AOS represents the maximum average roll value (MaxARV).

TABLE 1 - GEOCOMPOSITE PROPERTIES

PROPERTY	TEST METHOD	TEST VALUE	MINIMUM MQC TESTING FREQUENCY
GEONET COMPONENT			
Thickness, minimum avg, Note 1	ASTM D5199	250 mil	50,000 sq ft
Polymer Density, minimum avg	ASTM D1505	0.940 g/cc	50,000 sq ft
Carbon Black Content	ASTM D1603 ASTM D4218	1.5-3 percent	50,000 sq ft

TABLE 1 - GEOCOMPOSITE PROPERTIES			
PROPERTY	TEST METHOD	TEST VALUE	MINIMUM MQC TESTING FREQUENCY
Tensile Strength, minimum avg, Note 2	ASTM D7179	60 lbs/inch	100,000 sq ft
GEOTEXTILE COMPONENT			
Mass/Unit Area, MARV	ASTM D5261	6.0 oz/SY	50,000 sq ft
Grab Strength, MARV	ASTM D4632	160 lbs	50,000 sq ft
Grab Elongation, MARV	ASTM D4632	50 percent	100,000 sq ft
Tear Strength, MARV	ASTM D4533	65 lbs	100,000 sq ft
Puncture Strength, MARV	ASTM D4833	90 lbs	100,000 sq ft
Permittivity, MARV	ASTM D4491	1.3/sec	500,000 SF
AOS(O95), MaxARV	ASTM D4751	.21 mm	500,000 SF
UV Stability, percent retained (500 hours)	ASTM D4355	70 percent	Note 3
GEOCOMPOSITE			
Transmissivity, min, including attached geotextiles, Note 4	ASTM D4716	1.0 gal/min-foot	100,000 sq ft
Ply Adhesion, minimum avg, Note 5	ASTM D7005	1.0 lbs/inch	100,000 sq ft
Note 1: The diameter of the presser foot shall be 2.22 inches and the pressure shall be 2.9 psi. For other thickness options, see manufacturer's literature.			
Note 2: This is the average peak value for five equally spaced machine direction tests across the roll width.			
Note 3: Manufacturer's historical data.			

TABLE 1 - GEOCOMPOSITE PROPERTIES			
PROPERTY	TEST METHOD	TEST VALUE	MINIMUM MQC TESTING FREQUENCY
Note 4: Manufacturing quality control transmissivity tests shall be measured using a gradient of 0.1 under a normal pressure of 10,000 psf, water at 70 degrees F. Use a minimum seating period of 15 minutes. Perform the test between rigid end platens.			
Note 5: Average of five tests across the roll width. Discounting the outer 1 foot of each side of the roll, collect samples at the 10, 30, 50, 70, and 90 percent positions across the roll width. Test both sides for double sided geocomposites.			

2.2 SAMPLING AND TESTING

Maintain written logs of all sampling and testing performed. Make results available to the Contracting Officer within 24 hours of test completion. Submit completed test logs with a statement certifying compliance with specified requirements herein within 72 hours of completion of the geocomposite membrane layer within each cell.

2.2.1 Manufacturing Quality Control Testing

Manufacturing quality control test methods and frequencies shall be in accordance with Table 1 unless otherwise approved. Submit manufacturer's quality control manual a minimum of 30 days prior to geocomposite shipment and construction quality control test results.

2.2.2 Construction Quality Control Testing

Perform a minimum of one construction quality control transmissivity test in accordance with the requirements of this paragraph. Measure transmissivity using a gradient of 1.0 under a normal pressure of 8, 11.4, and 14 psi . Attach geotextile to the geonet in the same configuration as will be used in the field. The geonet shall be sandwiched between geotextile on the bottom and geotextile on the top. Use a minimum seating period of 100 hours. The construction quality control test results shall achieve a minimum transmissivity of 0.0406.

In case of failing test results, the Manufacturer may request that another sample be retested by the QC Laboratory with Manufacturer's technical representative present during the testing procedures. The costs for retesting including engineering, analyses, and all associated expenses shall be paid for the Manufacturer. The Manufacturer may also have the sample retested at two different laboratories approved by the Government. If both laboratories report passing results, the material shall be accepted. If both laboratories do not report passing results, all material from the lot representing the failing sample will be considered out of specification and rejected. The Manufacturer may obtain additional samples from rolls immediately before and after the failing roll as directed by the CQA Consultant and have them tested by the QC Laboratory at his/her own expense. If these rolls pass, only the failing roll will be rejected. If they fail, the entire lot will be rejected.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Surface Preparation

Prior to placement of the geocomposite, the geomembrane shall be smooth and free of all materials which could damage the geocomposite.

3.1.2 Placement

The geocomposite shall not be damaged during placement. Unroll the geocomposite in the direction of maximum slope, keeping the net flat against the subgrade to minimize wrinkles and folds. The geocomposite shall not be dragged across textured geomembrane if a geotextile is attached to the surface facing the geomembrane. Place adequate ballast (e.g. sandbags) to prevent uplift by wind prior to covering.

3.1.3 Seams and Overlaps

3.1.3.1 Geonet Side Seams

Overlap geonet side seams a minimum of 4 inches. Side seam fastener spacing shall be a maximum of 5 feet. In anchor trenches, fastener spacing shall be a maximum of 6 inches.

3.1.3.2 Geonet End Seams

Overlap geonet end seams a minimum of 1 foot. End seam fastener spacing shall be a maximum of 6 inches. The overlaps shall be in the direction of flow. Geonet to geonet contact shall be required at geocomposite end seam connections. End seams shall not be allowed on side slopes steeper than 4 horizontal on 1 vertical.

3.1.3.3 Geonet Fasteners

Tie geonet rolls together with plastic fasteners. The fasteners shall be a contrasting color from the geonet and attached geotextiles. Metallic fasteners will not be allowed.

3.1.3.4 Geotextile Seams

The geotextile component of the geocomposite shall be thermally bonded using approved methods. Holes placed in geotextile to allow seaming of geonet rolls shall be covered by placing geotextile cap strips.

3.1.3.5 Geotextile Cap Strips

Place geotextile cap strips over any exposed edges of geocomposite. Cap strips shall be a minimum of 2 feet in width and shall be thermally bonded to the geotextile component of the geocomposite.

3.1.4 Stacked Geocomposites

When geocomposites are to be stacked, stagger roll ends and edges so that joints do not lie above one another. Stacked layers shall be laid in the same direction and in a manner that prevents interlocking.

3.1.5 Corners

In the corners of landfill liner side slopes, install an extra layer of geocomposite material from the top to the bottom of the slope.

3.1.6 Penetrations

Submit penetration details. Mechanically attach a geotextile apron to pipes and other appurtenances penetrating through the geocomposite so that soil is prevented from getting into the geocomposite. The apron of the attached geotextile shall extend out from the pipe or appurtenance a minimum of 2 feet. The apron geotextile shall be thermally bonded to the geotextile component of the geocomposite.

3.2 REPAIRS

3.2.1 Geonet Damage

The QC Specialist shall inspect the installed geocomposite for conformance to installation requirements and integrity of completed installation. Maintain a Geocomposite Membrane Repair Log, with the location and size of repairs, and corrective action taken noted.

Make repairs by placing a patch of the geocomposite over the damaged area. Extend the patch a minimum of 2 feet beyond the edge of the damage. Use approved fasteners, spaced every 6 inches around the patch, to hold the patch in place. If more than 25 percent of the roll width is damaged, approval must be obtained to repair or replace the damaged roll.

3.2.2 Geotextile Damage

Repair damaged geotextile by placing a patch of geotextile over the damaged area with a minimum of 12 inches of overlap in all directions. The geotextile patch shall be thermally bonded in place.

3.3 PROTECTION AND BACKFILLING

Cover the geocomposite with the specified materials within 14 days of acceptance. Place aggregate from the bottom of the slope upward and shall not be dropped directly onto the geocomposite from a height greater than 3 feet. The aggregate shall be pushed out over the geocomposite in an upward tumbling motion so that wrinkles in the geocomposite do not fold over. Equipment proposed to be operated directly on top of the geocomposite shall meet requirements for equipment proposed for use directly on the geomembrane (including submittal requirements) specified in Section 02 56 13 WASTE CONTAINMENT GEOMEMBRANE. The initial lift thickness shall be 12 inches. A minimum of 24 inches of aggregate shall be maintained between construction equipment with a ground pressure greater than 7 psi and the geocomposite. Aggregate compaction and testing requirements are described in Section 33 31 16 LEACHATE COLLECTION SYSTEM.

-- End of Section --

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SECTION 31 23 00.00 20

EXCAVATION AND FILL
02/11

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 in the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1140	(2000; R 2006) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2321	(2011) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3787	(2007; R 2011) Bursting Strength of Textiles - Constant-Rate-of-Traverse (CRT), Ball Burst Test
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4355	(2007) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles

ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2012) Determining Apparent Opening Size of a Geotextile
ASTM D4759	(2011) Determining the Specification Conformance of Geosynthetics
ASTM D6241	04(2009) Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile Related Products Using a 50 mm Probe
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D698	(2012) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT RS	(2012) Standard Specifications for Roads and Structures

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011; Change 7 2012) Safety and Health Requirements Manual

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D698 or ASTM D1557, as applicable, for general soil types, abbreviated as percent laboratory maximum density.

1.2.2 Hard Materials

Weathered rock, dense consolidated deposits, conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment for removal.

1.2.3 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in

volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Dewatering work plan

Submit 15 days prior to starting work.

SD-06 Test Reports

Borrow Site Testing

Common Fill, Fill and Backfill Materials Testing

Select material test

Density tests

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Ground water elevations indicated by the boring logs were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

d. For borings performed for the Landfill Site, no topsoil was encountered, except pine straw accumulation of 2 to 4 inches were observed and around trees and brush organic accumulation of 6 to 8 inch thickness were observed.

e. At the Recycling Facility the groundwater elevation is 7 feet below existing grades.

f. Material character is indicated by the boring logs located in the Geotechnical Data accompanying this specification The geotechnical data presented herein is included for the Contractor's information only and while it is considered to represent subsurface conditions existing on the project site at the boring locations existing at this time, it

is not guaranteed to fully represent all subsurface conditions.

If a geotechnical report is included herein, any portion of the report pertaining to an expressed recommendation made by the geotechnical report writer shall not be considered part of the contract design documents, and design parameters or assumptions that may have changed during the course of the design may not be totally reflected in the report..

g. Hard materials will be encountered in some excavations. Difficulty in excavation of hard material shall not be grounds for a Contractor claim for additional compensation.

h. Unsuitable soils are expected to be encountered during subgrade preparation, and at the direction of the Contracting Officer, shall be removed and replaced with backfill and fill, as directed by the Contracting Officer. Payment for removal and replacement of unsuitable material with backfill/fill material shall be at the contract unit price per cubic yard, multiplied by the total quantity of cubic yards, as specified in the document titled "Instruction to Bidders". Include in the bid a unit price per unit cubic yard based on the quantity stated in the document titled "Instruction to Bidders". If the Contracting Officer requires an increase or decrease in the quantity of unsuitable soil removed and replaced with backfill/fill material the contract price will be adjusted in accordance with the Contract Clause of the contract. The unit price bid will be used for upward or downward adjustment of the quantity subject to provisions of "FAR 52.211-18, Variations in Estimated Quantities".

i. Blasting will not be permitted. Remove material in an approved manner.

1.6 REQUIREMENTS FOR SOIL FROM OFF GOVERNMENT PROPERTY

Soils brought in from off Government property for use as backfill shall be tested as indicated below and not brought on site until Borrow Site Testing reports have been approved by the Contracting Officer.

Do not furnish or transport soils onto the MCB Camp Lejeune when such act would violate the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or the General Statutes of North Carolina. Provide certification that all soil furnished under the contract contains no petroleum or hazardous or toxic materials as defined in DoD Instruction 4715.6, which implements 10 U.S.C. 2692. The following methods shall be used to determine if soil meets this standard:

If the total amount of soil to be brought onto the MCB Camp Lejeune for a single contract is less than 1000 cubic yards, certify the soil meets the standard by inspecting for "Apparent Contamination" (visual or other indications of contamination including abnormal or unnatural color, chemical or petroleum odors, or saturation with a chemical or petroleum). Soil which is contaminated, as determined by inspecting for "Apparent Contamination", shall not be utilized on the MCB Camp Lejeune or outlying fields.

If the total amount of soil to be brought onto the MCB Camp Lejeune for a single contract is greater than 200 cubic yards, provide certification that the soil meets the standard by analytical testing performed by a laboratory holding current certification from the North Carolina Department of Environment and Natural Resources, Division of Water Quality. Collect one

representative sample of the soil to be used for each 200 cubic yards or fraction thereof, and analyze for Gasoline Range Organics, Diesel Range Organics, Oil and Grease, and 8 RCRA Metals (Totals). If any of the test results are greater than the Method Detection Limits for petroleum, the soil from which the sample was taken shall not be certified as meeting the standard. If any test results are greater than the following North Carolina soil-to-groundwater target concentrations for the 8 RCRA metals, the soil from which the sample was taken shall not be certified as meeting the standard. All units are mg/kg (ppm); Arsenic 26.2; Barium 848; Cadmium 2.72; Chromium 27.2; Lead 270.06; Mercury 0.0154; Selenium 12.2; and Silver 0.223.

1.7 QUALITY ASSURANCE

1.7.1 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.7.2 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

1.8 Regulatory Requirements

Provide work and materials in accordance with applicable requirements of NCDOT RS. Divisions and Sections mentioned herein refer to those specifications. Paragraphs in NCDOT RS entitled "Method of Measurement" shall not apply.

1.9 Modification of References

Where term "Engineer" is used in NCDOT RS it shall be construed to mean Contracting Officer. Where term "state" is used, it shall mean "Federal Government".

PART 2 PRODUCTS

2.1 SOIL MATERIALS

2.1.1 Satisfactory Materials

Any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and frozen, deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 4 inches. The Contracting Officer shall be notified of any contaminated materials.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic (plasticity index equals zero). Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

2.1.4 Common Fill

Approved, satisfactory soil material with the characteristics required to compact to the soil density specified for the intended location.

2.1.5 Backfill and Fill Material (Except Landfill Embankment Material)

Provide ASTM D2487, classification GW, GW-GM, GP, GP-GM, GC, SW, SW-SM, SP, SP-SM, SM, SC with a ASTM D4318 liquid limit less than 20; ASTM D4318 plasticlimit less than 6; and a maximum of 25 percent by weight passing ASTM D1140, No. 200 sieve; and free of rubble, organics, clay, debris, and other unsuitable material.

2.1.6 Backfill and Fill Material at Landfill Embankments

Approved, satisfactory soil material with a maximum of 35 percent by weight passing ASTM D1140, No. 200 sieve; with the characteristics required to compact to the soil density specified; except material placed within 12 inches of the clay liner or finished grade shall have an ASTM D4318 plasticity index greater than 8 and shall not have stone greater than 2 inches in diameter.

2.1.7 Select Material

Provide materials classified as GW, GP, SW, SP by ASTM D2487 where indicated or specified, with a maximum of 15 percent by weight passing ASTM D1140, No. 200 sieve.

2.1.8 Topsoil

Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

2.1.9 Material Handling

On-site excavated materials which after drying are suitable for use as common fill or backfill/fill material but which, when excavated, are too

wet for immediate compaction in fill areas shall be placed either temporarily in stockpiles until the moisture content is reduced sufficiently to permit them to be placed in their final location, or placed in embankments and then conditioned using ploughing, disking, or harrowing to obtain the required moisture content for attaining the required compaction. Material placed within 10 feet of structures or completed work shall be placed at a moisture content suitable for attaining the required compaction; further conditioning of the material after placement is not allowed.

2.2 UTILITY BEDDING MATERIAL

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D1557 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide ASTM D2321 materials as follows:

a. Class I: Angular, 0.25 to 1.5 inches, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

b. Class II: Coarse sands and gravels with maximum particle size of 1.5 inches, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

2.3 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property, except that borrow materials conforming to common fill, fill and backfill material and select fill may be obtained from the Government borrow pit. The Government borrow pit is located as indicated. If the Government borrow pit is used, the Contractor shall perform clearing, grubbing, and stripping required for providing access to suitable borrow material. The Contractor is responsible for loading, hauling, handling and all incidental costs associated with obtaining borrow material. Dispose of materials from clearing and grubbing operations off Government property. Strip top 12 inches of soil material from borrow area and stockpile. After removal of borrow material, regrade borrow pit using stockpiled soil material to contours which will blend in with adjacent topography. Maximum side slopes shall be two horizontal to one vertical. Excavation and backfilling of borrow pit shall ensure proper drainage.

2.4 FILTER FABRIC FOR GRAVEL ROAD/PAVEMENTS

Provide a pervious sheet of polyester, or polypropylene, ultraviolet resistant filaments woven, spun bonded, fused, or otherwise manufactured into a nonraveling fabric with uniform thickness and strength. Fabric shall have the following manufacturer certified minimum average roll properties as determined by ASTM D4759:

a. Grab tensile strength (ASTM D4632) min. 200 lbs.
machine and transversed direction

b. Grab elongation (ASTM D4632) min. 12 percent
machine and transverse direction

c.	Puncture resistance (ASTM D6241)	min. 700 lbs.
d.	Trapezoidal Tear (ASTM D4533)	min. 755 lbs.
e.	Apparent Opening Size (ASTM D4751)	max. US No 40 Sieve
f.	Permittivity (ASTM D4491)	min. 0.05 sec (-1)
g.	Water Flow Rate (ASTM D4491)	min. 4 gpm/ft 2
h.	Ultraviolet Degradation (ASTM D4355)	70 percent Strength retained at 500 hours

2.5 MATERIAL FOR RIP-RAP

Filter fabric and rock conforming to these requirements for construction indicated. Provide Class A rip-rap, unless noted otherwise.

2.5.1 Filter Fabric

A woven or nonwoven polypropylene, nylon, or polyester containing stabilizers and/or inhibitors to make the fabric resistant to deterioration from ultraviolet, and with the following properties:

a. Minimum grab tensile strength (TF 25 #1/ASTM D4632) 180 pounds

b. Minimum Puncture (TF 25 #4/ASTM D3787) 75 psi in the weakest direction

c. Apparent Opening Size 40-80 (U.S. Sieve Size)

d. Minimum Trapezoidal tear strength (TF 25 #2/ASTM D4533) 50 pounds

2.6 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Yellow:	Electric
Blue:	Water Systems
Green:	Sewer Systems

2.6.1 Warning Tape

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.7 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheeting

Provide shoring and sheeting where necessary. In addition to Section 25 A and B of EM 385-1-1, include provisions in the shoring and sheeting plan that will accomplish the following:

a. Prevent undermining of pavements, foundations and slabs.

b. Prevent slippage or movement in banks or slopes adjacent to the excavation.

3.1.2 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.1.2.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils, prevent erosion and undermining of foundations. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation and fill operations shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.1.2.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.

Operate dewatering system continuously until construction work below existing water levels is complete.

3.1.3 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

3.1.4 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.2 SURFACE PREPARATION

3.2.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations within the limits of disturbance indicated by the temporary sediment fencing. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

3.2.2 Stripping

3.2.2.1 Non-Wooded Areas

Strip all organic material up to a depth of 10 inches without contamination by subsoil material from the site where excavation or grading is indicated. Stockpile material meeting requirements specified for topsoil to be used in the new work separately from other excavated material. Extend clearing and stripping laterally at least 5 feet beyond the perimeter of the new work. Satisfactory material unsuitable for use as topsoil shall be stockpiled and used for backfilling. Unsatisfactory material shall be disposed of as surplus material. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.2.2 Wooded Areas

After clearing and grubbing operations, remove material containing organics to a depth of 12 inches below existing grade and dispose of as surplus material.

3.2.3 Unsuitable Material

After stripping, undercut may be required in isolated areas to remove unsuitable soil. Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath structures paved areas or concrete slabs that are to receive fill of less than 5 feet height. Perform undercutting

of unsuitable material as specified in Paragraph titled "SUBGRADE PREPARATION".

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory or unsuitable material. Unsatisfactory or unsuitable material encountered below the grades shown shall be removed as directed by the Contracting Officer. Refill with backfill and fill material or select material and compact to 95 percent of ASTM D698 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with backfill and fill material and compact to 95 percent of ASTM D698 maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced with satisfactory materials to the indicated excavation grade. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.3.1 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length.

3.3.2 Excavated Materials

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

3.4 HAULING EQUIPMENT

Equipment used for hauling shall be sized appropriately for the site conditions (soil character and moisture content). The Contractor shall be responsible for not deteriorating subgrade soils due to excessive wheel loads or traffic passes by utilizing methods such as routing equipment uniformly over the full width of embankments, constructing bridges of soil material over subgrades for traffic, etc. See specification sections pertaining to the clay liner, geotextile, geocomposite and aggregate cover material for additional requirements for hauling/material deployment equipment.

3.5 SUBGRADE PREPARATION

3.5.1 Landfill Embankment Area

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be identified by proof rolling, removed and replaced with

satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 6 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus 2 percent of optimum moisture. Minimum subgrade density shall be as specified herein.

3.5.2 Proof Rolling

Proof rolling shall be provided at the Landfill site and for the concrete pavement subgrade at the Recycling Facility Site. Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Prior to placement of fill material, level and proof roll the existing subgrade of the area with four passes (two passes perpendicular to the others) of a 10 ton, smooth drum roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2 1/2 to 3 1/2 miles per hour. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer. Bids shall be based on removal and replacement of unsuitable material with backfill/fill material in accordance with the paragraph "CRITERIA FOR BIDDING".

3.6 SUBGRADE FILTER FABRIC

Place filter fabric as indicated directly on prepared subgrade free of vegetation, stumps, rocks larger than 2 inches diameter and other debris which may puncture or otherwise damage the fabric. Repair damaged fabric by placing an additional layer of fabric to cover the damaged area a minimum of 3 feet overlap in all directions. Overlap fabric at joints a minimum of 3 feet. Obtain approval of filter fabric installation before placing fill or backfill. Place fill or backfill on fabric in the direction of overlaps and compact as specified herein. Follow manufacturer's recommended installation procedures.

3.7 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

3.7.1 Common Fill Placement

For the Recycling Facility Site, provide for general site, except where backfill/fill material is specified. At the Landfill site, provide only as specified under paragraph "Backfill and Fill Material Placement at Landfill Embankments". Place in 10 inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

3.7.2 Backfill and Fill Material (Except Landfill Embankment Material) Placement

Provide for paved areas, utility trenches, and under concrete slabs. Place in 8 inch lifts. Do not place over wet or frozen areas. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

3.7.3 Backfill and Fill Material Placement at Landfill Embankments

Provide for the Landfill general site, except common fill may be used in lieu of backfill/fill material north of the Interior Road's northern "Limits of Disturbance" or west of the Perimeter Road's western "Limits of Disturbance" indicated.

After proof rolling inspection/approval by the Contracting Officer, embankment fill material shall be deposited in compacted lifts to the grades indicated. Proper bonding between lifts shall be attained by leveling, moistening, and rolling. Place material in continuous and approximately horizontal layers, not more than 8 inches in thickness after compaction. Prior to and during compaction the material in each lift shall be wetted or dried as required to provide the optimum moisture content for compaction. Compaction shall be accomplished by equipment well-suited for the terrain and the soil being compacted. Maintain the embankment in an approved manner, including maintaining surfaces free of vegetation, until completion of fill operations. Shape embankments to properly drain throughout construction. Construct and maintain adequate drainage of surface runoff to prevent soil erosion. Replace damaged or displaced embankment areas. Finished or subgrade surfaces shall be smooth and within +/- 0.10 feet of plan grades indicated.

3.7.4 Backfill and Fill Material Placement Over Pipes and at Walls

Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.

3.7.5 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 10 inch lifts to top of trench and in 10 inch lifts to one foot over pipe outside structures and paved areas. Place backfill in 4 to 6 inch lifts when hand compaction is used.

3.8 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

3.9 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.10 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

3.11 COMPACTION

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required.

3.11.1 General Site and Common Fill Placed Atop Landfill Liners

Compact underneath areas designated for vegetation and areas outside the 5 foot line of the paved area to 85 percent of ASTM D698.

3.11.2 Embankments to Receive Landfill Liners

Compact the top 12 inches of subgrade and fill material to 95 percent of ASTM D698.

3.11.3 Structures, Paved Areas, and Concrete Slabs

For the Landfill Site compact top 12 inches of subgrades and fill material to 95 percent of ASTM D698, except compact the uppermost 12 inches of fill placed below the pavement section to 98 percent of ASTM D1557. Compact within 5 feet of structures, paved areas and concrete slabs to 90 percent of ASTM D698.

For the Recycling Site compact the top 6 inches of subgrades and compact fill material to 98 percent of ASTM D1557 maximum density. Compact within 5 feet of structures, paved areas and concrete slabs to 90 percent of ASTM D1557.

3.12 FINISH OPERATIONS

3.12.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by

Contractor's operations, grade as directed.

3.12.2 Topsoil and Seed and Sod

Provide as specified in Section 01 57 13.00 22 EROSION AND SEDIMENT CONTROL and Section 32 92 23SODDING.

3.12.3 Protection of Surfaces

Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.13 DISPOSITION OF SURPLUS MATERIAL

Surplus soil material conforming to satisfactory material shall be disposed of within 2 miles of the Landfill site at an exact location determined by the Contracting Officer.

Remove from Government property soil material not meeting requirements specified for satisfactory material and brush, refuse, stumps, roots, and timber.

3.14 FIELD QUALITY CONTROL

3.14.1 Sampling

Take the number and size of samples required to perform the following tests.

3.14.2 Testing

Perform one of each of the following tests for every 5000 cubic yards of each material used. Provide additional tests for each source change.

3.14.2.1 Common Fill, Fill and Backfill Materials Testing

Test fill and backfill material in accordance with ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D1557 for moisture density relations.

3.14.2.2 Select Material Testing

Test select material in accordance with ASTM C136 for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.14.2.3 Density Tests

Test density in accordance with ASTM D1556, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556 density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556 density test at the start of the job, and for every 10 ASTM D6938 density tests thereafter. Except for the Landfill material placement, test each lift at randomly selected locations every 2500 square feet for fill areas and every 2500 square feet of subgrade in cut. For the Landfill material placement, test each lift at randomly selected locations every 15,000 square feet of material. In

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addition, test the final lifts beneath structures, paved areas, and concrete slabs every 2500 square feet of material. Include density test results in daily report.

Bedding and backfill in trenches: One test per 150 linear feet in each lift.

-- End of Section --

SECTION 32 01 19

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS
08/08

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.

ASTM INTERNATIONAL (ASTM)

ASTM C509	(2006; R 2011) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM D6690	(2012) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM D789	(2007; E 2010) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 525	(1989) Corps of Engineers Test Method for Evaluation of Hot-Applied Joint Sealants for Bubbling Due to Heating

1.2 SYSTEM DESCRIPTION

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started maintained in satisfactory condition at all times. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 30 days prior to use on the project.

1.2.1 Joint Preparation Equipment

1.2.1.1 Concrete Saw

Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified or for refacing joints or cleaning sawed joints where sandblasting does not provide a clean joint.

1.2.1.2 Sandblasting Equipment

Include with the sandblasting equipment an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening should not exceed 1/4 inch. The air compressor shall be portable and capable of furnishing not less than 150 cfm and maintaining a line pressure of not less than 90 psi at the nozzle while in use. Demonstrate compressor capability, under job conditions, before approval. The compressor shall be equipped with traps that will maintain

the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 1 inch above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle as necessary to secure satisfactory results.

1.2.1.3 Waterblasting Equipment

Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. Provide water tank and auxiliary resupply equipment of sufficient capacity to permit continuous operations. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 1 inch above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle as necessary to obtain satisfactory results. A pressure gauge mounted at the pump shall show at all times the pressure in psi at which the equipment is operating.

1.2.1.4 Hand Tools

Hand tools may be used, when approved, for removing defective sealant.

1.2.2 Sealing Equipment

1.2.2.1 Hot-Poured Sealing Equipment

The unit applicators used for heating and installing ASTM D6690 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's Recommendations; G
Equipment.

SD-04 Samples

Materials

SD-06 Test Reports

Certified copies of the test reports; G

SD-07 Certificates

Compatibility of Sealant and Backup Material

1.4 QUALITY ASSURANCE

Submit manufacturer's recommendations for sealant storage, handling and installation; including preparation of joints, and a statement certifying compatilibity with backup material, for approval

1.4.1 Safety

Prior to work commencing, verify the existence of any LOX storage or piping on the project site. Do not place joint sealant within 25 feet of any liquid oxygen (LOX) equipment, LOX storage, or LOX piping. Thoroughly clean joints in this area and leave them unsealed.

1.4.2 Test Requirements

Provide certified test reports for the joint sealant and backup or separating material for conformance with the referenced applicable material specification. Provide certificate of Compatibility of Sealant and Backup Material. Testing of the materials shall have been performed in an approved independent laboratory. Submit certified copies of the test reports for approval 30 days prior to the use of the materials at the job site. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials. No material will be allowed to be used until it has been approved.

1.4.3 Trial Joint Sealant Installation

Prior to the cleaning and sealing of the joints for the entire project, prepare a test section at least 150 feet long using the specified materials and approved equipment, so as to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the test section and before any other joint is sealed, inspect the test section to determine that the materials and installation meet the requirements specified. If it is determined that the materials or installation do not meet the requirements, remove the materials, and reclean and reseal the joints at no cost to the Government. When the test section meets the requirements, it may be incorporated into the permanent work and paid for at the contract unit price per linear foot for sealing items scheduled. Prepare and seal all other joints in the manner approved for sealing the test section.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the job site for defects, unload, and store them with a minimum of handling to avoid damage. Provide storage facilities at the job site for maintaining materials at the temperatures and conditions recommended by the manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 50 degrees F and rising at the time of application of the materials. Do not apply sealant if moisture is observed in the joint.

PART 2 PRODUCTS

2.1 SEALANTS

Materials for sealing joints shall be as follows:

Area	Sealing Material
	ASTM D6690, Type III and COE CRD-C 525

2.2 PRIMERS

When primers are recommended by the manufacturer of the sealant, use them in accordance with the recommendation of the manufacturer.

2.3 BACKUP MATERIALS

Provide backup material that is a compressible, nonshrinking, nonstaining, nonabsorbing material, nonreactive with the joint sealant. The material shall have a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C509. The backup material shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the joint.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before the installation of the sealant, thoroughly clean the joints to remove all laitance, curing compound, filler, protrusions of hardened concrete, or old sealant from the sides and upper edges of the joint space to be sealed.

3.1.1 Sawing

3.1.1.1 Facing of Joints

Accomplish facing of joints using a concrete saw as specified in paragraph EQUIPMENT to enlarge the joint opening to the width and depth shown on the drawings. Stiffen the blade with a sufficient number of suitable dummy (used) blades or washers. Thoroughly clean, immediately following the sawing operation, the joint opening using a water jet to remove all saw cuttings and debris.

3.1.2 Sandblasting

The newly exposed concrete joint faces and the pavement surfaces extending a minimum of 1/2 inch from the joint edges shall be sandblasted or waterblasted clean. Use a multiple-pass technique until the surfaces are free of dust, dirt, curing compound, filler, old sealant residue, or any foreign debris that might prevent the bonding of the sealant to the concrete. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave them completely free of debris and water.

3.1.3 Back-Up Material

Provide as indicated to prevent the entrance of the sealant below the specified depth. Take care to ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.4 Rate of Progress of Joint Preparation

Limit the stages of joint preparation, which include sandblasting, air pressure cleaning and placing of the back-up material to only that lineal footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

3.2.1 Hot-Poured Sealants

Sealants conforming to ASTM D6690 shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Withdraw and waste sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

Seal joints immediately following final cleaning of the joint walls and following the placement of the separating or backup material. Open joints, that cannot be sealed under the conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing Joints

Immediately preceding, but not more than 50 feet ahead of the joint sealing operations, perform a final cleaning with compressed air. Fill the joints from the bottom up to the depth indicated. Remove and discard excess or spilled sealant from the pavement by approved methods. Install the sealant in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's instructions. Check the joints frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

3.4 INSPECTION

3.4.1 Joint Cleaning

Inspect joints during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Cleaned joints will be approved prior to installation of the separating or back-up material and joint sealant.

3.4.2 Joint Sealant Application Equipment

Inspect the application equipment to ensure conformance to temperature

requirements and proper installation. Evidences of bubbling, improper installation, failure to cure or set will be cause to suspend operations until causes of the deficiencies are determined and corrected.

3.4.3 Joint Sealant Test Section

Inspect joint sealant test section. Provide written notice of deficiencies and required corrections or adjustments in joint seal installation procedures. Correct deficiencies and obtain approval of test section by the Contracting Officer prior to installing sealant in the remainder of the work.

3.4.4 Joint Sealant

Inspect the joint sealant for conformance to contract requirements, joint seal manufacturer's instructions, and the test section. Inspect for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

3.5 ACCEPTANCE

Reject joint sealant that fails to cure properly, or fails to bond to joint walls, or reverts to the uncured state, or fails in cohesion, or shows excessive air voids, blisters, surface defects, swelling, or other deficiencies, or is not properly recessed within indicated tolerances. Remove rejected sealant and reclean and reseal joints in accordance with the specification. Perform removal and reseal work promptly by and at the expense of the Contractor.

3.6 CLEAN-UP

Upon completion of the project, remove all unused materials from the site and leave the pavement in a clean condition.

-- End of Section --

SECTION 32 05 33

LANDSCAPE ESTABLISHMENT
02/10

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.

ASTM INTERNATIONAL (ASTM)

ASTM D2103	(2010) Standard Specification for Polyethylene Film and Sheeting

1.2 DEFINITIONS

1.2.1 Pesticide

Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.2.2 Stand of Turf

100 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 32 92 19 SEEDINGand Section 32 92 23 SODDING applies to this section for installation of seedand sod requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Integrated Pest Management PlanG

SD-03 Product Data

Fertilizer; G

SD-07 Certificates

Maintenance inspection report

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Delivery

Deliver fertilizer, gypsum, iron to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, may be furnished in bulk with a certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Fertilizer and Lime, Storage

Material shall be stored in designated areas. Lime andfertilizer shall be stored in cool, dry locations away from contaminants.

1.5.3 Handling

Do not drop or dump materials from vehicles.

PART 2 PRODUCTS

2.1 POST-PLANT FERTILIZER

Fertilizer for groundcover, wildflowers, and grasses is not permitted.

2.2 PESTICIDES

Pesticides and herbicides are not permitted. Use black sheet polyethylene conforming to ASTM D2103, minimum thickness 5/32 inch where indicated on plans. Submit an Integrated Pest Management Plan, including weed and pest management strategies and proposed alternatives to herbicides and pesticides. Use biological pest controls as approved in the Plan.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide landscape construction maintenance to include mowing, edging, overseeding, aeration, and weeding for all newly installed landscape areas , unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

3.1.1 Policing

The Contractor shall police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Policing shall extend to both sides of fencing or walls. Collected debris shall be promptly removed and disposed of at an approved disposal site.

3.1.2 Drainage System Maintenance

The Contractor shall remove all obstructions from surface and subsurface drain lines to allow water to flow unrestricted in swales, gutters, catch basins, storm drain curb inlets, and yard drains. Remove grates and clear debris in catch basins. Open drainage channels are to be maintained free of all debris at all times. Edges of these channels shall be clear of any encroachment by vegetation.

3.2 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the Contracting Officer shows that the new turf furnished under this contract has been satisfactorily installed to a 95 percent stand of coverage. The establishment period shall continue for a period of 365 days.

3.2.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed . Inspect areas once a week during the installation and establishment period and perform needed maintenance promptly.

3.2.2 Promotion of Growth

Groundcover shall be maintained in a manner that promotes proper health, growth, natural color.Turf shall have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, aerate, topdress and perform other operations necessary to promote growth, as approved by Contracting Officer and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

3.2.3 Mowing

3.2.3.1 Turf

Turf shall be mowed at a uniform finished height. Mow turfed area to a

minimum average height of 1" inches when average height of grass becomes 1 1/2" inches for spring/summer maintenance and to a minimum average height of 1 1/2" inches when the average height of grass reaches 2 inches for fall maintenance. The height of turf is measured from the soil. Turf shall not be mowed during periods of drought. Mowing of turf shall be performed in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area shall be picked up and disposed. Adjacent paved areas shall be swept/vacuumed clean.

3.2.4 Turf Edging and Trimming

Perimeter of planter bed edges, sidewalks, driveways, curbs, and other paved surfaces shall be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and to provide a clear cut division line between planter beds, turf, and ground cover. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Edging shall be performed on the same day that turf is mowed. Use of string line trimmers is permitted in "soft" areas such as an edge between turfgrass and a planter bed. Care shall be exercised to avoid damage to any plant materials, structures, and other landscape features.

Trimming around trees, fences, poles, walls, and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming shall be performed on the same day the turf's mowed. Care shall be exercised to avoid "Girdling" trees located in turf areas. The use of protective tree collars on trees in turf areas may be utilized as a temporary means to avoid injury to tree trunks. At the end of the plant establishment period Contractor will be responsible for removing all protective tree collars.

3.2.5 Post-Fertilizer Application

Do not fertilize wildflowers, groundcover, and grasses. Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies shall be determined by the laboratory soil analysis results the requirements of the particular turf species. Organic fertilizer shall be used. In the event that organic fertilizer is not producing the desired effect, the Contractor shall contract the Contracting Officer for approval prior to the use of a synthetic type of fertilizer.Fertilizer shall be applied by approved methods in accordance with the manufacturer's recommendations.

3.2.6 Turf Clearance Area

Trees located in turf areas shall be maintained with a growth free clearance of 18 inches from the tree trunk base. The use of mechanical weed whips to accomplish the turf growth free bed area is prohibited.

3.2.7 Replanting

Replant in accordance with Section 32 92 23 SODDING and within specified planting dates areas which do not have a satisfactory stand of turf. Replant areas which do not have a satisfactory stand of other groundcover and grasses.

3.2.8 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf.

3.2.9 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer.

3.3 SLOPE AND EROSION CONTROL MAINTENANCE3.3.1 Slope Erosion Control Maintenance

The Contractor shall provide slope erosion control maintenance to prevent undermining of all slopes in newly sodded areas. Maintenance tasks include immediate repairs to weak spots in sloped areas, and maintaining clean, clear culverts, and graded berms, and terraces to intercept and direct water flow to prevent development of large gullies and slope erosion Eroded areas shall be filled with amended topsoil and replanted with the same plant species. Erosion control blankets damaged due to slope erosion shall be reinstalled.

3.3.2 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period.

3.3.2.1 Remedial Work

Remedial measures directed by the Contracting Officer to ensure slope stability have been completed.

3.3.3 Unsatisfactory Work

When work is found to not meet design intent and specifications, maintenance period will be extended at no additional cost to the Government until work has been completed, inspected and accepted by Contracting Officer.

3.4 FIELD QUALITY CONTROL

3.4.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations shall be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Results of site observation visits shall be submitted to the Contracting Officer within 7 calendar days of each site observation visit.

-- End of Section --

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SECTION 32 10 00

BITUMINOUS CONCRETE PAVEMENT
08/08

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.

ASTM INTERNATIONAL (ASTM)

ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2950/D2950M	(2011) Density of Bituminous Concrete in Place by Nuclear Methods

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT RS	(2012) Standard Specifications for Roads and Structures

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Mix design

Density

Thickness

Straightedge test

Submit reports for testing specified under paragraph entitled "Field Quality Control."

SD-07 Certificates

Aggregate base course

Asphalt or Bituminous concrete and material sources

Obtain approval of the Contracting Officer for materials and material sources 14 days prior to the use of such material in the work.

Asphalt mix design

Provide a copy of the NCDOT approved mix design for use when performing field testing. The approved mix design must match material sources that will be used in this contract.

Submit certificates, signed by the producer, that paving materials and incidental construction items conform to specification requirements.

1.3 QUALITY ASSURANCE

1.3.1 Regulatory Requirements

Provide work and materials in accordance with applicable requirements of NCDOT RS. Divisions and Sections mentioned herein refer to those specifications. Paragraphs in NCDOT RS entitled "Measurement and Payment" shall not apply.

1.3.2 Modification of References

Where term "Engineer" is used in NCDOT RS it shall be construed to mean Contracting Officer.

1.3.3 Mix Design

Submit results of laboratory tests performed on each mix design. Testing shall have been accomplished not more than one year prior to date of material placement. Provide certification that sources of materials identified in the mix design have not changed since the mix design.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not produce or place bituminous concrete when the weather is rainy or foggy, when the base course is frozen or has excess moisture, or when the ambient temperature is less than 40 degrees F in the shade away from artificial heat.

PART 2 PRODUCTS

2.1 ASPHALT OR BITUMINOUS CONCRETE

Provide asphalt concrete in accordance with the applicable requirements of the NCDOT RS, Section 610, Type S-9.5B and Type I-19.0B, except where specified otherwise. Recycled asphalt pavement material may be used as permitted by SHS, but shall be limited to 30% of the total mixture.

2.2 AGGREGATE BASE COURSE

NCDOT RS, materials for construction of the base course shall be in accordance with Sections 1005 and 1010, Size No. ABC.

2.3 BITUMINOUS TACK COAT

NCDOT RS, Section 605. Emulsified asphalts shall be diluted at the rate of one part water to one part asphalt.

2.4 MARKINGS

Provide in accordance with specification Section 32 17 23.00 20, PAVEMENT MARKINGS.

2.5 COMPOSITION OF MIXTURE REQUIREMENTS

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Excavation and Filling

Excavation and filling to establish elevation of subgrade is specified in Section 31 23 00.00 20 EXCAVATION AND FILL.

3.2 CONSTRUCTION

Provide construction in accordance with the applicable requirements of the NCDOT RS, except where indicated or specified otherwise.

3.2.1 Subgrade

NCDOT RS, preparation of subgrade shall be in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

3.2.2 Aggregate Base Course

Begin spreading base material at the point nearest the source of supply. Permit traffic and hauling over the base, taking measures to avoid damage (rutting) to the subgrade and base materials due to repeated loadings from hauling equipment. Fill ruts formed by traffic and reroll. After base course placement, continue machining and rolling until surface is smooth, compacted, well bonded, and true to the designed cross section. Compact to 100 percent ASTM D1557 maximum dry density. Maintain the base smooth and true to grade and cross section until bituminous concrete placement.

3.2.3 Bituminous Tack Coat Placement

Provide tack coat on existing pavement vertical edges and between successive horizontal lifts after prolonged periods of time between lifts or when surfaces become excessively dirty prior to receiving successive lifts. Apply at the rate of 0.10 gallon residual asphalt per square yard. Thoroughly clean surfaces to receive the tack coat immediately prior to application of tack coat. Tack coat shall be tacky at the time of bituminous concrete placement.

3.2.4 Bituminous Surface and Base Courses

NCDOT RS, methods of construction of the surface and base courses shall be in accordance with Division III, Section 610. Placement will not be permitted unless the Contractor has a working asphalt thermometer on site.

3.3 FIELD QUALITY CONTROL

Sample shall be taken by Contractor as specified herein. Contractor shall replace pavement where sample cores have been removed. Submit 2 pavement cores when using the in-place nuclear density method.

3.3.1 Sample and Core Identification

Place each sample and core in a container and securely seal to prevent loss

of material. Tag each sample for identification. Tag shall contain the following information:

a. Contract No.

b. Sample No.

c. Quantity

d. Date of Sample

e. Sample Description

f. Source/Location/Stations Placed/depth below the finish grade

g. Intended Use

h. Thicknesses of various lifts placed

3.3.2 Testing

3.3.2.1 Testing of Pavement Course

a. Density: Determine density of pavement on each lift placed by in-place testing using Nuclear Method in accordance with ASTM D2950/D2950M. Compare to 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

b. Thickness: Determine thickness of finished pavement by recording the differential elevations obtained from adjacent fixed elevations and corresponding top of finished aggregate base course. Take measurements around the perimeter of the pavement excavation at 10 foot intervals.

c. Straightedge Test: Test compacted surface of bituminous surface and base courses with a straightedge as work progresses. Apply straightedge parallel with and at right angles to center line after final rolling. Variations in the bituminous base course surface shall not be more than 1/4 inches from the lower edge of the 10 foot straightedge; variations in bituminous surface course surface shall not be more than 1/4 from the lower edge of the 10 foot straightedge. Pavement showing irregularities greater than that specified shall be corrected as directed by Contracting Officer.

-- End of Section --

SECTION 32 13 13.06

PORTLAND CEMENT CONCRETE FOR PAVEMENT AND SITE FACILITIES
11/11

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.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 301	(2010; Errata 2011) Specifications for Structural Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting

ASTM INTERNATIONAL (ASTM)

ASTM A184/A184M	(2006; E2011) Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A497/A497M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A615/A615M	(2012) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A996/A996M	(2009b) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM C1077	(2012) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C131	(2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C143/C143M	(2012) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2012) Standard Specification for Portland Cement
ASTM C1602/C1602M	(2012) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C171	(2007) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2012) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2013) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C494/C494M	(2012) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881/C881M	(2010) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C94/C94M	(2012a) Standard Specification for Ready-Mixed Concrete
ASTM D1751	(2004; R 2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural

Construction (Nonextruding and Resilient Bituminous Types)

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT RS (2012) Standard Specifications for Roads and Structures

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 521 (1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data; G

Curing materials

Admixtures

Dowel

Reinforcement

Submit a complete list of materials including type, brand and applicable reference specifications.

Sodium Silicate Surface Sealer

SD-04 Samples

Field-Constructed Mockup

SD-05 Design Data; G

Concrete mix design

Thirty days minimum prior to concrete placement, submit a mix design, with applicable tests, for each strength and type of concrete for approval. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, and admixtures; and applicable reference specifications. Provide mix proportion data using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required. Submittal shall clearly indicate where each mix design will be used when more than one mix design is submitted. Obtain acknowledgement of approvals prior to concrete placement. Submit a new mix design for each material source change.

SD-06 Test Reports; G

Aggregate tests

Concrete slump tests

Air content tests

Compressive strength tests

SD-07 Certificates; G

Ready-mixed concrete plant

Batch tickets

Cementitious materials

1.3 DELIVERY, STORAGE, AND HANDLING

ASTM C94/C94M.

1.3.1 Batching and Mixing Plant

a. Location: The batching and mixing plant shall be located off Government property. The concrete shall be mixed and delivered in accordance with ASTM C94/C94M, except as specified otherwise herein. If the 90 minute maximum batch to discharge time period is exceeded, the load shall be rejected at the Contractor's expense. The 90 minute time period shall include anticipated delays at the Station due to routine security procedures and traffic during normal work hours. There shall be operable telephonic or radio communication between the plant and the placing site at all times concreting is taking place.

1.3.2 Equipment

All plant, equipment, tools, and machines used in the work shall be maintained in satisfactory working conditions at all times.

1.4 QUALITY ASSURANCE

1.4.1 Ready-mixed Concrete Plant Certification

Unless otherwise approved by the Contracting Officer, ready mixed concrete shall be produced and provided by a National Ready-Mix Concrete Association (NRMCA) certified plant. If a volumetric mobile mixer is used to produce the concrete, rather than ready-mixed concrete, the mixer(s) must conform to the standards of the Volumetric Mixer Manufacturers Bureau (VMMB). Verification shall be made by a current VMMB conformance plate affixed to the volumetric mixer equipment.

1.4.2 QC Specialist

The QC Specialist is responsible for monitoring and documenting activities related to the QC of Portland cement concrete from mix design through installation. The QC Specialist shall have provided QC or QA inspection on at least 2 projects of similar size and complexity as this project within the last 3 years.

1.4.3 Contractor Qualifications

Unless waived by the Contracting Officer, the Contractor shall meet one of

the following criteria:

a. Contractor shall have at least one National Ready Mixed Concrete Association (NMRCA) certified concrete craftsman on site, overseeing each placement crew during all concrete placement.

b. Contractor shall have no less than three NRMCA certified concrete installers, who shall be on site working as members of each placement crew during all concrete placement.

1.4.4 Required Information

Submit copies of laboratory test reports showing that the mix has been successfully tested to produce concrete with the properties specified and that mix will be suitable for the job conditions. The laboratory test reports shall include mill test and all other test for cementitious materials, aggregates, and admixtures. Provide maximum nominal aggregate size, combined aggregate gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Test reports shall be submitted along with the concrete mix design. Sampling and testing of materials, concrete mix design, sampling and testing in the field shall be performed by a commercial testing laboratory which conforms to ASTM C1077. The laboratory shall be approved in writing by the Government.

1.4.5 Modification to References

Except as specified herein or as indicated, work and materials shall be in accordance with the NCDOT RS. The provisions therein for method of measurement and payment do not apply, and references to "Engineer" and "State" shall be interpreted to mean the "Contracting Officer" and the "Federal Government" respectively.

1.4.6 Batch Tickets

ASTM C94/C94M. Submit mandatory batch ticket information for each load of ready-mixed concrete.

1.4.7 Field-Constructed Mockup

Install a minimum of one paving lane 90 feet long to demonstrate typical joints, surface finish, texture, color, thickness, and standard of workmanship. Test panels shall be placed using the mixture proportions, materials, and equipment as proposed for the project. Test mock up panels in accordance with requirements in FIELD QUALITY CONTROL. The location of the mockup shall be approved by the Contracting Officer, and shall be at a location of relatively little post - construction traffic.

When a test panel is does not meet one or more of the requirements, the test panel shall be rejected, removed, and replaced at the Contractor's expense. If the test panels are acceptable, they may be incorporated into the project with the approval of the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cementitious Materials

The applicable material sections of NCDOT RS for Class AA SLIPFORM for concrete pavement and Class A for all other concrete shall govern, except as specified otherwise herein. The concrete shall be air-entrained, and shall conform to the range of tolerances specified in the NCDOT RS, except as specified otherwise herein.

2.1.1.1 Cement

ASTM C150/C150M Type I or II.

2.1.1.2 Fly Ash

ASTM C618, Type F. Fly ash certificates shall include test results in accordance with ASTM C618. A minimum of 25 percent and a maximum of 30 percent by weight of required cement content shall be fly ash.

2.1.1.2 Slag and Silica Fume

Slag or silica fume shall not be used.

2.1.2 Water

Water shall conform to ASTM C1602/C1602M. Hot water shall not be used unless approved by the Contracting Officer.

2.1.3 Aggregate

Coarse aggregate shall consist of crushed or uncrushed gravel, crushed stone, or a combination thereof. Aggregates, as delivered to the mixers, shall consist of clean, hard, uncoated particles. Coarse aggregate shall be washed. Washing shall be sufficient to remove dust and other coatings. Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. Both coarse and fine aggregates shall meet the requirements of ASTM C33/C33M. For pavement, the percentage of wear of coarse aggregate shall not exceed 40 percent when subjected to the Los Angeles abrasion test in accordance with ASTM C131.

2.1.4 Admixtures

ASTM C494/C494M: Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures. Where not shown or specified, the use of admixtures is subject to written approval of the Contracting Officer.

ASTM C260/C260M: Air-entraining.

2.1.5 Reinforcement

All reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. however,

reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties shall not be used.

2.1.5.1 Reinforcing Bars and Bar Mats

Reinforcing bars shall conform to ASTM A615/A615M, billet-steel or ASTM A996/A996M, rail and axle steel, Grade 60. Bar mats shall conform to ASTM A184/A184M. The bar members may be billet rail or axle steel.

2.1.5.2 Welded Wire Reinforcement

Welded Wire Reinforcement shall be smooth, conforming to ASTM A497/A497M or ASTM A185/A185M, and shall be furnished in flat sheets.

2.1.6 Dowel Bars

Bars shall conform to ASTM A615/A615M, Grade 60 for plain billet-steel bars of the size and length indicated. Remove all burrs and projections from the bars. Coat the bars with a rust-inhibiting paint.

2.1.7 Dowel Bar Assemblies

Dowel bar assemblies shall consist of a framework of metal bars or wires arranged to provide rigid support for the dowels throughout the paving operation, secured to the base material, with a minimum of four continuous bars or wires extending along the joint line. The dowels shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from rising, sliding out, or becoming distorted during paving operations.

2.1.8 Curing Materials

2.1.8.1 White-Burlap-Polyethylene Sheet

ASTM C171, 0.004 inch thick white opaque polyethylene bonded to 10 oz/linear yard (40 inch) wide burlap.

2.1.8.2 Liquid Membrane-Forming Compound

ASTM C309, white pigmented, Type 2, Class A.

2.1.9 Joint Fillers and Sealants

For pavement, provide as specified in Section 32 01 19 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

2.1.9.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D1751. Expansion joint filler shall be 3/4 inch thick for pavements and 1/2 inch thick for walks, unless indicated otherwise.

2.1.10 Sodium Silicate Surface Sealer

Surface sealer shall be a low viscosity, colorless, aqueous solution of at least 9% sodium silicate developed as a penetrating concrete sealer that will not produce a vapor barrier nor change the concrete surface appearance or "skid resistance" characteristics of pedestrian or vehicular traffic. Provide MSDS literature and worker protection in accordance with supplier

literature and recommendations.

2.2 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C881/C881M, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.

b. Material for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.

c. Material for use for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

2.3 CONTRACTOR-FURNISHED MIX DESIGN

Contractor-furnished mix design concrete shall be designed in accordance with ACI 211.1 except as modified herein, and the mix design shall be as specified herein under paragraph entitled "Submittals." The Class AA concrete shall have a minimum compressive strength of 4500 pounds per square inch and flexural strength of 650 pounds per square inch at 28 days. The concrete shall be air entrained. The air content shall be 6.0 plus or minus 1.5 percent. Maximum size aggregate shall be 1.0 inch. The maximum slump shall be 1.5 inches when slip form is used and 3 inches when fixed forms are used. The maximum water-cement ratio shall be 0.45.

The mix design shall utilize compressive and flexural samples from trail batches tested at 7, 14, 28 and 56 days. The 56 day samples shall be used for monitoring strength gain, and not used for acceptance. Provide a minimum of 2 flexural strength beam samples for each set of sample test dates. Flexural strength samples shall be 6" x 6" x 20".

If the cementitious material is not sufficient to produce concrete of the strength required it shall be increased as necessary, without additional compensation under the contract. The cementitious factor shall be calculated using cement and Class F fly ash. The mix shall use a cement replacement (by weight) of 25 percent - 30 percent Class F fly ash.

PART 3 EXECUTION

3.1 FORMS

3.1.1 Construction

Construct forms to be removable without damaging the concrete.

3.1.2 Coating

Before placing the concrete, coat the contact surfaces of forms except existing pavement sections where bonding is required, with a non-staining mineral oil, non-staining form coating compound, or two coats of

nitro-cellulose lacquer. When using existing pavement as a form, clean existing concrete and then coat with asphalt emulsion bondbreaker before concrete is placed.

3.1.3 Thickness, Grade and Alignment

Check and correct grade elevations and alignment of the forms immediately before placing the concrete. Verify concrete between forms shall be of thickness required by making 'stick' measurements using stringline and a ruler taken every 50 feet of set forms.

3.2 REINFORCEMENT

3.2.1 Dowel Bars

Install bars accurately aligned, vertically and horizontally, at indicated locations and to the dimensions and tolerances indicated. Before concrete placement thoroughly oil the sliding portion of each dowel. Dowels must remain in position during concrete placement and curing.

3.2.2 Setting Slab Reinforcement

Reinforcement shall be positioned on suitable chairs prior to concrete placement. At expansion, contraction and construction joints, place the reinforcement as indicated. Reinforcement, when placed in concrete, shall be free of mud, oil, scale or other foreign materials. Place reinforcement accurately and wire securely. The laps at splices shall be 12 inches minimum and the distances from ends and sides of slabs and joints shall be as indicated.

3.3 MEASURING, MIXING, CONVEYING, AND PLACING PAVEMENT CONCRETE

3.3.1 Measuring

ASTM C94/C94M.

3.3.2 Mixing

ASTM C94/C94M, except as modified herein. Begin mixing within 30 minutes after cement has been added to aggregates. When the air temperature is greater than 85 degrees F, place concrete within 60 minutes. With the approval of the Contracting Officer, a hydration stabilizer admixture meeting the requirements of ASTM C494/C494M Type D, may be used to extend the placement time to 90 minutes. Additional water may be added to bring slump within required limits as specified in Section 11.7 of ASTM C94/C94M, provided that the specified water-cement ratio is not exceeded.

3.3.3 Conveying

ASTM C94/C94M.

3.3.4 Placing

Follow guidance of ACI 301, except as modified herein. Do not exceed a free vertical drop of 5 feet from the point of discharge. Deposit concrete either directly from the transporting equipment or by conveyor on to the pre-wetted subgrade or subbase, unless otherwise specified. Do not place concrete on frozen subgrade or subbase. Deposit the concrete ahead of the paver-finisher or vibrating truss screed to an approximately uniform

height. Place concrete continuously at a uniform rate, with minimum amount of segregation, without damage to the grade and without unscheduled stops except for equipment failure or other emergencies. If this occurs within 10 feet of a previously placed or intended location of a construction or contraction joint, remove concrete back to joint, repair any damage to grade, install a construction joint and continue placing concrete only after cause of the stop has been corrected.

3.3.4.1 Transfer and Spreading Equipment

Equipment for transferring concrete from the transporting equipment to the paving lane in front of the paver or vibrating truss screed shall be a telescoping conveyor or chute for conveying concrete, which will accept the concrete and spread it evenly across the paving lane in front of the paver-finisher or the vibrating truss screed and strike off the surface evenly to a depth which permits the screed to operate efficiently.

3.3.4.2 Paver-Finisher/Vibrating Truss Screed

a. General: Paving shall be accomplished using a slipform paver-finisher. For placement areas that are small or odd-shaped and are inaccessible by slipform equipment, finishing shall be with a welded steel vibrating truss screed of triangular cross section. The truss screed shall extend at least 1 foot beyond width of paving lane and have a vibrator consisting of a rotating eccentric weight type of substantial weight to produce desired results. The screed shall be capable of riding the forms, kept aligned with the forms, and spread the load so as to prevent deformation of the forms. Clary screeds, rotating or non-rotating pipe or tube floats or mechanical floats shall not be allowed. Machines that cause displacement of properly installed forms or causes ruts or indentations in the prepared underlying materials and machines that cause frequent delays due to mechanical failures shall be replaced as directed. The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall weigh at least 2200 lb/foot of lane width, and shall be powered by an engine having at least 6.0 horsepower/foot of lane width. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The mechanisms for forming the pavement shall be easily adjustable in width and thickness and for required crown. In addition to other spreaders required by paragraph Transfer and Spreading Equipment, the paver-finisher shall be equipped with a full width knock-down auger or paddle mechanism, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate.

b. Paver Vibrators: Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete, as required. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The paver-finisher shall be equipped with an electronic vibrator monitoring device displaying the operating frequency of each individual internal vibrator. The monitoring device shall have a readout display visible to the paver operator. It shall operate continuously while paving, and shall display all vibrator frequencies with manual or automatic sequencing among all individual vibrators. The spacing of the immersion vibrators across the paving lane shall be as necessary to

properly consolidate the concrete, but the clear distance between vibrators shall not exceed 30 inches. The outside vibrators shall not be more than 12 inches from the lane edge. Spud vibrators shall operate at a frequency of not less than 8000 impulses/minute and an amplitude of not less than 0.03 inch and tube vibrators at a frequency of not less than 5000 impulses/minute and an amplitude of not less than 0.03 inch, as determined by COE CRD-C 521.

If a vibrating truss screed is used, handheld vibrators shall be used ahead of the screed, spaced across the paving lane as necessary to properly consolidate the concrete, with insertion points no greater than 30 inches apart. Operate the vibrators at a speed of at least 3600 vibrations/minute (60 HZ). Do not allow the vibrator head to contact the joints, dowel assemblies, reinforcement, side forms, or come within two inches of the bottom of the concrete being placed. Vibrators shall be operated from a bridge that spans the paving lane that can support personnel and equipment without deflecting and is sufficiently wide to enable proper use of equipment.

c. Screed or Extrusion Plate: The paver-finisher shall be quipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface and shall so finish the surface that no significant amount of hand finishing, except use of cutting straightedges, is required. The screed or extrusion plate shall be constructed to provide adjustment for crown in the pavement. The entire machine shall provide adjustment for variation in lane width or thickness and to prevent more than 8 inches of the screed or extrusion plate extending over previously placed concrete on either end when paving fill-in lanes. Machines that cause displacement of properly installed forms or cause ruts or indentations in the prepared underlying materials and machines that cause frequent delays due to mechanical failures shall be replaced as directed.

d. Fixed Forms: If fixed forms are used the paver-finisher shall be equipped with wheels designed to ride the forms, keep it aligned with the forms, and spread the load so as to prevent deformation of the forms.

e. Slipform: The slipform paver-finisher shall be automatically controlled and crawler mounted with padded tracks so as to be completely stable under all operating conditions. The paver-finisher shall finish the surface and edges so that no edge slump beyond allowable tolerance occurs. Suitable moving side forms shall be provided that are adjustable and will produce smooth, even edges, perpendicular to the top surface and meeting specification requirements for alignment and freedom from edge slump.

f. Longitudinal Mechanical Float: A longitudinal mechanical float shall be specially designed and manufactured to smooth and finish the pavement surface without working excess paste to the surface. It shall be rigidly attached to the rear of the paver-finisher or to a separate self-propelled frame spanning the paving lane. The float plate shall be at least 5 feet long by 8 inches wide and shall automatically be oscillated in the longitudinal direction while slowly moving from edge to edge of the paving lane, with the float plate in contact with the surface at all times.

3.3.5 Cold Weather

Except with authorization, do not place concrete when ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. When authorized, when concrete is likely to be subjected to freezing within 24 hours after placing, heat concrete materials so that temperature of concrete when deposited is between 65 and 80 degrees F. Methods of heating materials are subject to approval of the Contracting Officer. Do not heat mixing water above 165 degrees F. Remove lumps of frozen material and ice from aggregates before placing aggregates in mixer. Follow practices found in ACI 306.1.

3.3.6 Hot Weather

Maintain required concrete temperature in accordance with Figure 2.1.5 in ACI 305R to prevent evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. After placement, use fog spray, apply monomolecular film, or use other suitable means to reduce the evaporation rate. Start curing when surface of fresh concrete is sufficiently hard to permit curing without damage. Cool underlying material by sprinkling lightly with water before placing concrete. Follow practices found in ACI 305R.

3.4 PAVING

3.4.1 Consolidation

The paver vibrators shall be inserted into the concrete not closer to the underlying material than 2 inches. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. Concrete in small, odd-shaped slabs or in locations inaccessible to the paver mounted vibration equipment shall be vibrated with a hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete.

3.4.2 Operation

When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement, including keeping the existing pavement surface free of any debris, and placing rubber mats beneath the paver tracks. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 8 inches.

3.4.3 Required Results

The paver-finisher shall be operated to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface. Multiple passes of the paver-finisher shall not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing, other than the use of cutting straightedges, except in very infrequent instances. No water, other than true fog sprays (mist), shall be applied

to the concrete surface during paving and finishing.

3.4.4 Fixed Form Paving

Forms shall be steel, except that wood forms may be used for curves having a radius of 150 feet or less, and for fillets. Forms may be built up with metal or wood, added only to the base, to provide an increase in depth of not more than 25 percent. The base width of the form shall be not less than eight-tenths of the vertical height of the form, except that forms 8 inches or less in vertical height shall have a base width not less than the vertical height of the form. Wood forms for curves and fillets shall be adequate in strength and rigidly braced. Forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire base. Forms shall not be set on blocks or on built-up spots of underlying material. Forms shall remain in place at least 12 hours after the concrete has been placed. Forms shall be removed without injuring the concrete.

3.4.5 Slipform Paving

The slipform paver shall shape the concrete to the specified and indicated cross section in one pass, and shall finish the surface and edges so that only a very minimum amount of hand finishing is required. Dowels shall not be installed by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete.

3.4.6 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement.

3.4.7 Placing Dowels

Dowels shall be installed with alignment not greater than 1/8 inch per ft. Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 5/8 inch and a vertical tolerance of plus or minus 3/16 inch. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of rust inhibiting primer paint, and then oiled just prior to placement. Dowels in longitudinal joints shall be omitted when the center of the dowel is located within a horizontal distance from an intersecting joint equal to or less than 18 inches.

3.4.7.1 Contraction Joints

Dowels in contraction joints within the paving lane shall be held securely in place by means of rigid metal basket assemblies. The dowels shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable anchors. Immediately prior to placing concrete, cut spacer wires.

3.4.7.2 Dowels Installed in Hardened Concrete

Installation shall be by bonding the dowels into holes drilled into the hardened concrete. Holes approximately 1/8 inch greater in diameter than the dowels shall be drilled into the hardened concrete. Dowels shall be bonded in the drilled holes using epoxy resin injected at the back of the

hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing the straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel.

3.5 PAVEMENT JOINTS

All joints shall be straight, perpendicular to the finished grade of the pavement, and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch.

3.5.1 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using preformed joint filler of the type, thickness, and width indicated, and shall extend the full slab depth. Edges of the concrete at the joint face shall be edged. The joint filler strips shall be installed flush with pavement surface.

3.5.2 Contraction and Construction Joints

Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints and conform to the details indicated.

Sawed contraction joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the indicated depth. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. Sawing at a given joint location shall be discontinued when a crack develops ahead of the saw cut. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears.

After the end of the curing period, joints shall be sawed to provide a sealant reservoir conforming to the details indicated.

3.6 FINISHING CONCRETE PAVEMENT

Start finishing operations immediately after placement of concrete. Use finishing machine, except hand finishing may be used in emergencies and for concrete slabs in inaccessible locations or of such shapes or sizes that machine finishing is impracticable.

3.6.1 Side Form Finishing

Strike off and screed concrete to the required slope and cross-section. Transverse rotating tube or pipe shall not be permitted.. Elevation of concrete shall be such that, when consolidated and finished, pavement surface will be adequately consolidated and at the required grade. Make as many passes over each area of pavement and at such intervals as necessary to give proper compaction, retention of coarse aggregate near the finished surface, and a surface of uniform texture, true to grade and slope. Do not permit excessive operation over an area, which will result in an excess of mortar and water being brought to the surface.

3.6.1.1 Equipment Operation

Maintain the travel of machine on the forms without lifting, wobbling, or other variation of the machine which tend to affect the precision of concrete finish. Keep the tops of the forms clean by a device attached to the machine. During the first pass of the finishing machine, maintain a uniform ridge of concrete ahead of the front screed for its entire length.

3.6.1.2 Joint Finish

Before concrete is hardened, correct edge slump of pavement, exclusive of edge rounding, in excess of 0.02 foot. Finish concrete surface on each side of construction joints to the same plane, and correct deviations before newly placed concrete has hardened.

3.6.1.3 Hand Finishing

Strike-off and screed surface of concrete to elevations slightly above finish grade so that when concrete is consolidated and finished pavement surface is at the indicated elevation. Vibrate entire surface until required compaction and reduction of surface voids is secured with a strike-off template.

3.6.1.4 Longitudinal Floating

After initial finishing, further smooth and consolidate concrete by means of hand-operated longitudinal floats. Use floats that are not less than 12 feet long and 6 inches wide and stiffened to prevent flexing and warping.

3.6.2 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. Following initial texturing on the first day of placement, the Placing Foreman, and the Contracting Officer representative, shall inspect the texturing for compliance with design requirements. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris. The concrete in areas of recesses for tie-down anchors, lighting fixtures, and other outlets in the pavement shall be finished to provide a surface of the same texture as the surrounding area.

3.6.2.1 Brooming

Finish the surface of the slab by brooming the surface with a stiff bristle broom at least 18 inches wide. Gently pull the broom over the surface of the pavement from edge to edge just before the concrete becomes non-plastic. Slightly overlap adjacent strokes of the broom. Broom

perpendicular to centerline of pavement so that corrugations produced will be uniform in character and width, and not more than 1/16 inch in depth. Broomed surface shall be free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near the surface.

3.6.3 Edging

At the time the concrete has attained a degree of hardness suitable for edging, carefully finish slab edges, including edges at formed joints, with an edge having a maximum radius of one-eighth inch. When brooming is specified for the final surface finish, edge transverse joints before starting brooming, then operate broom to obliterate as much as possible the mark left by the edging tool without disturbing the rounded corner left by the edger. Clean by removing loose fragments and soupy mortar from corners or edges of slabs which have crumbled and areas which lack sufficient mortar for proper finishing. Refill voids solidly with a mixture of suitable proportions and consistency and refinish. Remove unnecessary tool marks and edges. Remaining edges shall be smooth and true to line.

3.6.4 Repair of Surface Defects

Follow guidance of ACI 301, except as specified in paragraph 'REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS'.

3.7 CURING AND PROTECTION

Protect concrete adequately from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks and oil stains, and do not allow it to dry out from the time it is placed until the expiration of the minimum curing periods specified herein. Use White-Burlap-Polyethylene Sheet or liquid membrane-forming compound, except as specified otherwise herein. Do not use membrane-forming compound on surfaces where its appearance would be objectionable, on surfaces to be painted, where coverings are to be bonded to concrete, or on concrete to which other concrete is to be bonded. Maintain temperature of air next to concrete above 40 degrees F for the full curing periods.

3.7.1 White-Burlap-Polyethylene Sheet

Wet entire exposed surface thoroughly with a fine spray of water, saturate burlap but do not have excessive water dripping off the burlap and then cover concrete with White-Burlap-Polyethylene Sheet, burlap side down. Lay sheets directly on concrete surface and overlap 12 inches. Make sheeting not less than 18 inches wider than concrete surface to be cured, and weight down on the edges and over the transverse laps to form closed joints. Repair or replace sheets when damaged during curing. Check daily to assure burlap has not lost all moisture. If moisture evaporates, resaturate burlap and re-place on pavement (re-saturation and re-placing shall take no longer than 10 minutes per sheet). Leave sheeting on concrete surface to be cured for at least 14 days.

3.7.2 Liquid Membrane-Forming Compound Curing

Apply compound immediately after surface loses its water sheen and has a dull appearance and before joints are sawed. Agitate curing compound thoroughly by mechanical means during use and apply uniformly in a continuous operation by suitable power-spraying equipment. Compound shall

form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Apply an additional coat of compound immediately to areas where film is defective. Respray concrete surfaces that are subject to heavy rainfall within 3 hours after curing compound has been applied in the same manner.

3.7.2.1 Protection of Treated Surfaces

Keep concrete surfaces to which liquid membrane-forming compounds have been applied free from vehicular traffic and other sources of abrasion for not less than 72 hours. Foot traffic is allowed after 24 hours for inspection purposes. Maintain continuity of coating for entire curing period and repair damage to coating immediately.

3.7.3 Final Surface Sealing

The concrete surface shall be sealed with a sodium silicate solution applied at least 28 days after curing begins, after joint sealing, and prior to application of paint markings. Apply when the ambient temperature is expected to be above 40 degrees F and the relative humidity is expected to be below 75% both during and for 24 hours after application. Surface preparation and cleaning shall be in accordance with manufacturer's recommendations. However, as a minimum, the surface shall receive a 2000 psi minimum high pressure waterblasting to insure complete removal of any curing compound, followed by cleaning using dry brooming, vacuuming, then wet brooming and thoroughly vacuuming and allowed to dry 24 hours prior to the initial application. Test the surface (every 5000 sf) to verify complete curing compound removal by placing a few drops of water on the surface and observe if the water is readily absorbed into the concrete. If it is readily absorbed, additional pressure washing is not required. Apply two coats using low pressure airless spray equipment that can insure uniform coverage. Each coat shall be applied to not cover more than 200 square feet per gallon. Excessive application can result in efflorescence and excess material shall be rinsed off with water and the area treated again once the area has dried. The second coat shall not be applied until the first has dried. Prior to and after each application evaluate the surface, with the Contracting Officer present, for proper coverage. If the second application rate needs adjusting, modify as approved by the Contracting Officer. After the second application evaluate the surface for any excess silicate, indicated by residue or a 'dusting' appearance. Remove any excess silicate by pressure wash, as it may affect adherence of subsequent paint markings. Protect treated areas from pedestrian traffic until dry and vehicular traffic for a minimum of 8 hours.

3.8 CONCRETE WALKS

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 1/2 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures space expansion joints every 50 feet maximum. Give walks a broomed finish. unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

3.9 FIELD QUALITY CONTROL

3.9.1 Sampling

The Contractor's approved laboratory shall collect samples of fresh concrete in accordance with ASTM C172/C172M during each working day as required to perform tests specified herein. Make test specimens in accordance with ASTM C31/C31M.

The Contractor shall provide and maintain adequate facilities on the project site for safe storage and initial curing of concrete test specimens as required by ASTM C31/C31M for the sole use of the Testing Agency. The Contractor shall provide a source of electrical power for the curing facilities.

The Testing Agency shall record and report the maximum and minimum temperature within the onsite curing facility during initial curing for each set of cylinder specimens.

3.9.2 Consistency Tests

The Contractor's approved laboratory shall perform concrete slump tests in accordance with ASTM C143/C143M. Take samples for slump determination from concrete during placement. Perform tests at the beginning of a concrete placement operation and and for each batch (minimum) or every 30 cubic yards (maximum) of concrete to ensure that specification requirements are met. In addition, perform tests each time test cylinders are made.

3.9.3 Compressive Strength Tests

ASTM C39/C39M. Make six test cylinders (6" x 12") for each set of tests in accordance with ASTM C31/C31M. Precautions shall be taken to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and two cylinders at 56 days. Samples for strength tests of each mix design of concrete placed each day shall be taken not less than once a day. Each strength test result shall be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than f'c or if any strength test result falls below f'c by more than 500 psi, take a minimum of three ASTM C42/C42M core samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core test shall be considered structurally adequate if average of three cores is equal to at least 85 percent of f'c and if no single core is less than 75 percent of f'c. Locations represented by erratic core strengths shall be retested. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.9.4 Air Content Tests

Test air-entrained concrete for air content at the same frequency as specified for slump tests. Determine percentage of air in accordance with ASTM C231/C231M on samples taken during placement of concrete in forms.

3.9.5 Surface Testing

Surface testing for surface smoothness and plan grade shall be performed as indicated below by the Contractor. The measurements shall be properly referenced in accordance with paving lane identification and stationing,

and a report given to the Government within 24 hours after measurement is made. A final report of surface testing, containing all surface measurements and a description of all actions proposed to be taken to correct deficiencies, shall be provided to the Government upon conclusion of surface testing.

3.9.5.1 Surface Smoothness Requirements

The finished surfaces shall have no abrupt change of 1/8 inch or more, and shall be within the tolerances specified when checked with a 12 foot straightedge: 1/4 inch for both directions.

3.9.5.2 Surface Smoothness Testing Method

The surface of the pavement shall be tested with the straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 15 feet apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.

3.9.6 Plan Grade Testing and Conformance

The surfaces shall vary not more than 0.06 foot above or below the plan grade line or elevation indicated. Each pavement category shall be checked by the Contractor for conformance with plan grade requirements by running lines of levels at intervals to determine the elevation at each joint intersection.

3.9.7 Test for Pavement Thickness

Measure during concrete placement to determine in-place thickness of concrete pavement.

3.10 REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS

3.10.1 General Criteria

New pavement slabs that are broken, have spalled edges, or contain cracks shall be removed and replaced or repaired, as specified hereinafter at no cost to the Government. Replacement or repairs shall be made at the Contracting Officer's discretion. Removal of partial slabs is not permitted. Slabs with spalls, regardless of spall size, shall be sawn full depth to remove the spalled face (on pilot-lanes only), or removed, as directed. The Contracting Officer will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be at least 6 inch diameter, and shall be drilled and backfilled with a well consolidated concrete mixture bonded to the walls of the hole with Type V, Grade 3 epoxy resin. perform drilling of cores and refilling holes at no expense to the Government.

3.10.2 Slabs with Cracks

Cracks that do not exceed 25 percent of the design thickness in depth shall be cleaned and then pressure injected full depth with epoxy resin, Type IV, Grade 1. Slabs containing cracks deeper than 25 percent of the design thickness shall be removed.

3.10.3 Removal and Replacement of Full Slabs

Where it is necessary to remove full slabs, removal shall be in accordance with paragraph: Removal of Existing Pavement Slab. Removal and replacement shall be full depth, by full width of the slab, and the limit of removal shall be normal to the paving lane and extend to each original joint. Dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified in paragraph: Placing Dowels. Original damaged dowels or tie bars shall be cut off flush with the joint face. Protruding portions of dowels shall be painted and lightly oiled. All four edges of the new slab shall thus contain dowels. Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material shall be recompacted and shaped as specified in the appropriate section of these specifications, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care shall be taken to prevent any curing compound from contacting dowels. The resulting joints around the new slab shall be prepared and sealed as specified for original construction.

3.10.4 Repairing Spalls Along Joints

Where directed, spalls along joints of new slabs, along edges of adjacent existing concrete, and along parallel cracks shall be repaired by first making a vertical saw cut at least 1 inch outside the spalled area and to a depth of at least 2 inches. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete and into at least 1/2 inch of visually sound concrete. Spalls along joints to be sealed with compression seals shall be sawn, chipped out, and repaired to a depth to restore the full joint-face support. The cavity thus formed shall be thoroughly cleaned with high pressure water jets supplemented with oil-free compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The prepared cavity shall be filled with: Portland cement concrete or latex modified mortar for larger cavities, those more than 1/3 cu. ft. in size after removal operations; Portland cement mortar for cavities between 0.03 cu. ft. and 1/3 cu. ft.; and epoxy resin mortar or epoxy resin or latex modified mortar for those cavities less than 0.03 cu. ft. in size. Portland cement concretes and mortars shall be very low slump mixtures, 1/2 inch slump or less, proportioned, mixed, placed, consolidated by tamping, and cured, all as directed. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, suing proportions and mixing and placing procedures as recommended by the manufacturer and approved by the Contracting Officer. Proprietary patching materials may be used, subject to approval by the Contracting Officer. The epoxy resin

materials shall be placed in the cavity in layers not over 2 inches thick. The time interval between placement of additional layers shall be such that the temperature of the epoxy resin material does not exceed 140 degrees F at any time during hardening. mechanical vibrators and hand tampers shall be used to consolidate the concrete or mortar. any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert of other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints. The reservoir shall be thoroughly cleaned and then sealed with the sealer specified for the joints. In lieu of sawing, spalls not adjacent to joints and popouts, both less than 6 inches in maximum dimension, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.

3.10.5 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. slabs containing weak surfaces less than 1/4 inch thick shall be diamond ground to remove the weak surface. Slabs containing weak surfaces greater than 1/4 inch thick shall be removed and replaced.

3.11 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Prior to commencing pavement removal operations, inventory the pavement distresses (cracks, spalls, and corner breaks) along the pavement edge to remain. After pavement removal, the remaining edge shall again be surveyed to quantify any damage caused by Contractor's removal operations. Perform both surveys in the presence of the Contracting Officer. Repairs shall be made as specified herein. All operations shall be carefully controlled to prevent damage to the concrete pavement and to the underlying material to remain in place. All saw cuts shall be made perpendicular to the slab surface, forming rectangular areas.

3.11.1 Removal of Existing Pavement Slab

When existing concrete pavement is to be removed and adjacent concrete is to be left in place, the joint between the removal area and adjoining pavement to stay in place shall first be cut full depth with a standard diamond-type concrete saw. Next, a full depth saw cut shall be made parallel to the joint at least 24 inches from the joint and at least 6 inches from the end of any dowels. This saw cut shall be made with a diamond saw as specified in paragraph: Sawing Equipment. All pavement to be removed beyond this last saw cut shall be removed in accordance with the approved demolition work plan. All pavement between this last saw cut and the joint line shall be removed by carefully pulling pieces and blocks away from the joint face with suitable equipment and then picking them up for removal. In lieu of this method, this strip of concrete may be carefully broken up and removed using hand-held jackhammers, 30 lb or less, or other approved light-duty equipment which will not cause stress to propagate across the joint saw cut and cause distress in the pavement which is to remain in place. In lieu of the above specified removal method, the slab may be sawcut cull depth to divide it into several pieces and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and safe lifting devices used for attachment to the slab.

3.11.2 Edge Repair

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. slabs which are damaged during construction shall be removed and replaced as directed by the Contracting Officer at no cost to the Government. Repair of previously existing damage areas will be considered a subsidiary part of concrete pavement construction.

3.11.2.1 Underbreak and Underlying Material

All underbreak shall be repaired by removal and replacement of the damaged slabs in accordance with paragraph: Removal and Replacement of Full Slabs. The underlying material adjacent to the edge of and under the existing pavement which is remain in place shall be protected from damage or disturbance during removal operations and until placement of new concrete, and shall be shaped as shown on the drawings or as directed. Sufficient underlying material shall be kept in place outside the joint line to completely prevent disturbance of material under the pavement which is to remain in place. Any material under the portion of the concrete pavement to remain in place which is disturbed or loses its compaction shall be carefully removed and replaced with concrete.

3.12 PAVEMENT PROTECTION

Protect the pavement against all damage prior to final acceptance of the work by the Government. Aggregates, rubble, or other similar construction materials shall not be placed on airfield pavements. Except for concrete paving and finishing equipment, traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least 28 days old, or for a longer period if so directed. The concrete paving and finishing machines, and similar equipment may be permitted to ride upon the edges of previously constructed slabs when the concrete has attained a minimum field cured compressive strength of 2500 psi and approved means are furnished to prevent damage to the slab edge. all new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean, and spillage of concrete or other materials shall be cleaned up immediately upon occurrence. Other existing pavements used by the contractor shall be power broomed at least daily when traffic operates. For fill-in lanes, equipment shall be used that will not damage or spall the edges or joints of the previously constructed pavement.

-- End of Section --

SECTION 32 17 23.00 20

PAVEMENT MARKINGS & SIGNAGE
04/06

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 in the text by the basic designation only.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT RS	(2012) Standard Specifications for Roads and Structures

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-1952	(Rev E) Paint, Traffic and Airfield Markings, Waterborne

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Paints for roads and streets

Equipment

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section.

SD-07 Certificates

Submit certificates, signed by the producer, that materials conform to the specification requirements.

Paints for roads and streets

Signs

Qualifications

SD-08 Manufacturer's Instructions

Paints for roads and streets

Submit manufacturer's Material Safety Data Sheets.

1.3 DELIVERY AND STORAGE

Deliver paint materials in original sealed containers that plainly show the

designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site for maintaining materials at temperatures recommended by the manufacturer.

1.4 WEATHER LIMITATIONS

Apply paint to clean, dry surfaces, and unless otherwise approved, only when the air and pavement surface temperature is at least 5 degrees above the dew point and the air and pavement temperatures are above 50 degrees F and less than 110 degrees F for water-based materials. Maintain paint temperature within these same limits.

1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work shall be approved by the Contracting Officer and maintained in satisfactory operating condition. Submit construction equipment list for approval by the Contracting Officer.

1.5.1 Mobile and Maneuverable

Application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

1.5.2 Paint Application Equipment

1.5.2.1 Hand-Operated, Push-Type Machines

Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be acceptable for marking small street and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Applicator for water-based markings shall be equipped with non-stick coated hoses; metal parts in contact with the paint material shall be constructed of grade 302, 304, 316, or equal stainless steel.

1.5.3 Surface Preparation Equipment

1.5.3.1 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order to adequately clean the surfaces to be marked. Water will be furnished at no cost to the Contractor from a fire hydrant designated by the Contracting Officer or authorized representative and located within a reasonable proximity to the work area. The Contractor shall install a gate valve and a back-flow prevention device on the fire hydrant tap. The Contractor shall furnish all equipment, material, and labor required to obtain and deliver water from the designated fire hydrant to the work area(s).

1.5.4 Traffic Controls

Suitable warning signs and traffic cones shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement

markers. Painting equipment shall be marked with warning signs clearly visible to motorists or pedestrian traffic indicating painting equipment in operation.

1.6 MAINTENANCE OF TRAFFIC

1.6.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.7 QUALIFICATIONS

The Contractor shall submit documentation certifying that pertinent personnel are qualified for equipment operation and handling of materials.

PART 2 PRODUCTS

2.1 MATERIALS

Provide materials conforming to the requirements specified herein.

2.1.1 Paints for Roads and Streets

FS TT-P-1952, color as indicated and matching colors corresponding to Federal Standard No. 595b for the following colors:

Crystal: Color No. 17886 (White)

Yellow: Color No. 13538

Handicap Blue: Color No. 15080

2.1.2 Signs

NCDOT RS, provide materials in accordance with Section 901, unless indicated otherwise.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Allow new pavement surfaces to cure for a period of not less than 30 days before final pavement marking application. Thoroughly clean surfaces within, and to 1 inch beyond each area to be marked, before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove impregnated dirt or coatings adhering to the pavement by water blasting. Do not commence painting in any area until pavement surfaces are dry and clean.

3.2 APPLICATION

3.2.1 Testing for Moisture

Apply pavement markings to dry pavement only. The Contractor shall test the pavement surface for moisture before beginning work after each period of rainfall, fog, high humidity, or cleaning, or when the ambient

temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the Contracting Offices or authorized representative. Employ the "plastic wrap method" to test the pavement for moisture as follows: Cover the pavement with a 300 mm by 300 mm (12 inch by 12 inch) section of clear plastic wrap and seal the edges with tape. After 15 minutes, examine the plastic wrap for any visible moisture accumulation inside the plastic. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap.

3.2.2 Painting

Apply paint pneumatically with approved equipment at rate of coverage (recommended by the manufacturer. Provide guidelines and templates as necessary to control paint application and to provide characters and symbols indicated. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.

3.2.3 Signs

NCDOT RS, methods of construction of signs shall be in accordance with Sections 902 and 903.

3.3 FIELD TESTING and INSPECTION

3.3.1 Sampling and Testing

Submit documentation certifying that pavement marking materials conform to specified requirements and material proposed for use have been manufactured within 6 months of being used on this project.

3.3.2 Inspection

Examine material at the job site to determine that it is the material referenced in the certificate of compliance.

3.3.3 Surface Preparations and Application Procedures

Surface preparations, application procedures, and Quality Control verification results will be examined by the Contracting Officer to determine conformance with the requirements specified.

3.4 QUALITY ASSURANCE

Inspect newly applied markings for adequate coverage of paint, alignment of markings, and proper line width.

-- End of Section --

SECTION 32 31 13

CHAIN LINK FENCES AND GATES
08/10

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.

ASTM INTERNATIONAL (ASTM)

ASTM A116	(2011) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A702	(1989; R 2006) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A90/A90M	(2011) Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM C94/C94M	(2012a) Standard Specification for Ready-Mixed Concrete
ASTM F 1043	(2011a) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(2010) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures
ASTM F 567	(2011) Standard Practice for Installation of Chain Link Fence
ASTM F 626	(2008) Standard Specification for Fence Fittings
ASTM F 883	(2009) Padlocks

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-191	(Rev K) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and

	Accessories)
FS RR-F-191/1	(Rev F) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric)
FS RR-F-191/2	(Rev E) Fencing, Wire and Post, Metal (Chain-Link Fence Gates)
FS RR-F-191/3	(Rev E; Am 1) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FS RR-F-191/4	(Rev F) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fence Assembly; G

Location of Gate, Corner, End, and Pull Posts; G

Gate Assembly; G

Gate Hardware and Accessories; G

Erection/Installation Drawings; G

SD-03 Product Data

Fence Assembly; G

Gate Assembly; G

Gate Hardware and Accessories; G

; GZinc Coating; G

; GFabric; G

Stretcher Bars; G

Concrete; G

SD-07 Certificates

Certificates of Compliance; GSD-08 Manufacturer's Instructions

Fence Assembly; G

Gate Assembly; G

Hardware Assembly; G

Accessories; G

1.3 ASSEMBLY AND INSTALLATION INSTRUCTIONS

Submit manufacturer's erection/installation drawings and instructions that detail proper assembly and materials in the design for fence, gate, hardware and accessories.

Submit erection/installation drawings along with manufacturer's catalog data for complete fence assembly, gate assembly, gate hardware assembly and accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

1.5 QUALITY ASSURANCE

1.5.1 Required Report Data

Submit reports of listing of chain-link fencing and accessories regarding weight in ounces for zinc coating.

1.5.2 Certificates of Compliance

Submit certificates of compliance in accordance with the applicable reference standards and descriptions of this section for the following:

a. Zinc coating

b. Fabric

c. Stretcher bars

d. Gate hardware and accessories

e. Concrete

PART 2 PRODUCTS

2.1 GENERAL

Provide fencing materials conforming to the requirements of ASTM A116, ASTM A702, ASTM F 626, and as specified.

Submit manufacturer's data indicating percentage of recycled material content in protective fence materials, including chain link fence, fabric, and gates to verify affirmative procurement compliance.

2.2 ZINC COATING

Provide hot-dip galvanized (after fabrication) ferrous-metal components and accessories, except as otherwise specified.

Provide zinc coating of weight not less than 1.94 ounces per square foot, as determined from the average result of two specimens, when tested in accordance with ASTM A90/A90M.

Provide zinc coating conforming to the requirements of the following:

a. Pipe: FS RR-F-191/3 Class 1 Grade A in accordance with ASTM F 1083.

b. Hardware and accessories: ASTM A153/A153M, Table 1

c. Surface: ASTM F 1043

d. External: Type B-B surface zinc with organic coating, 0.97 ounce per square foot minimum thickness of acrylated polymer.

e. Internal: Surface zinc coating of 0.97 ounce per square foot minimum.

Provide galvanizing repair material that is cold-applied zinc-rich coating conforming to ASTM A780/A780M.

2.3 FABRIC

FS RR-F-191 and detailed specifications as referenced and other requirements as specified.

FS RR-F-191/1; Type I, zinc-coated steel, 9 gage. Mesh size, 2 inches. Height of fabric, as indicated.

Provide fabric consisting of No. 9-gage wires woven into a 2-inch diamond mesh, with dimensions of fabric and wire conforming to ASTM A116, ASTM A702 and ASTM F 626, with 1.20 ounces per square foot zinc galvanizing.

Provide one-piece fabric widths for fence heights up to 12 feet.

2.4 TOP AND BOTTOM SELVAGES

Provide twisted and barbed top selvage and knuckled bottom selvage.

2.5 POSTS AND BRACES

FS RR-F-191/3 line posts; Class 1, steel pipe, Grade A. End, corner, and pull posts; Class 1, steel pipe, Grade A. Braces; Class 1, steel pipe, Grade A, in minimum sizes listed in FS RR-F-191/3 for each class and grade.

2.6 LINE POSTS

Minimum acceptable line posts are as follows:

Over 6-feet high:

2.0 inch O.D. pipe weighing 3.65 pounds per linear foot.

2.7 END, CORNER, AND PULL POSTS

Provide minimally acceptable end, corner, and pull posts as follows:

Over 6 feet high:

Grade A: 2.875 inch O.D. pipe weighing 5.79 pounds per linear foot.

2.8 POST-BRACE ASSEMBLY

Provide bracing consisting of 1.660 inches O.D. pipe Grade A weighing 2.27 pounds per linear foot and 3/8 inch adjustable truss rods and turnbuckles.

2.9 STRETCHER BARS

Provide bars that have one-piece lengths equal to the full height of the fabric with a minimum cross section of 3/16 by 3/4 inch, in accordance with ASTM A116, ASTM A702 and ASTM F 626.

2.10 POST TOPS

Provide tops that are steel, wrought iron, or malleable iron designed as a weathertight closure cap. Provide one cap for each post, unless equal protection is provided by a combination post-cap and barbed-wire supporting arm.

2.11 STRETCHER BAR BANDS

Provide bar bands for securing stretcher bars to posts that are steel, wrought iron, or malleable iron spaced not over 15 inches on center. Bands may also be used in conjunction with special fittings for securing rails to posts. Provide bands with projecting edges chamfered or eased.

2.12 GATE POSTS

Provide a gate post for supporting each gate leaf as follows:

Over 6 feet wide and up to 13 feet wide:

2.875 inch O.D. pipe Grade A weighing 5.79 pounds per linear foot.

Over 18-feet wide:

Provide 8.625 inch O.D. pipe weighing 24.70 pounds per linear foot.

2.13 GATES

Unless indicated otherwise, FS RR-F-191/2; Type II, double swing. Shape and size of gate frame, as indicated. Framing and bracing members, round of steel alloy. Steel member finish, zinc-coated. Provide gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade, except that steel pipe frames are a minimum of 1.90 inches o.d., 0.120 inches minimum wall thickness and aluminum pipe frames and intermediate braces are 1.869 inches o.d. minimum, 0.940 lb/ft of length. Gate fabric, is as specified for fencing fabric. Coating for steel latches, stops, hinges, keepers, and accessories, galvanized. Provide plunger bar type gate latches. Provide truss rods or intermediate braces for gate leaves less than 8 feet wide. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding is not permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

For gate leaves over 6 feet high or 6 feet wide, provide perimeter gate frames of 1.90 inch O.D. pipe Grade A weighing 2.72 pounds per linear foot.

Provide gate frame assembly that is welded or assembled with special malleable or pressed-steel fittings and rivets to provide rigid

connections. Install fabric with stretcher bars at vertical edges; stretcher bars may also be used at top and bottom edges. Attach stretcher bars and fabric to gate frames on all sides at intervals not exceeding 15 inches. Attach hardware with rivets or by other means which provides equal security against breakage or removal.

Provide diagonal cross-bracing, consisting of 3/8-inch diameter adjustable-length truss rods on welded gate frames, where necessary to obtain frame rigidity without sag or twist. Provide nonwelded gate frames with diagonal bracing.

2.14 GATE HARDWARE AND ACCESSORIES

Provide gate hardware and accessories that conforms to ASTM A116, ASTM A702, ASTM F 626, and be as specified:

Provide malleable iron hinges to suit gate size, non-lift-off type, offset to permit 180-degree opening.

Provide latch that permits operation from either side of the gate, with a padlock eye provided as an integral part of the latch.

Provide stops and holders of malleable iron for vehicular gates. Provide stops that automatically engage the gate and hold it in the open position until manually released.

Provide double gates with a cane bolt and ground-set keeper, with latch or locking device and padlock eye designed as an integral part.

2.15 MISCELLANEOUS HARDWARE

Provide miscellaneous hot-dip galvanized hardware as required.

2.16 WIRE TIES

Provide 16-gage galvanized steel wire for tying fabric to line posts,spaced 12 inches on center. For tying fabric to braces, space wire ties 24 inches on center. For tying fabric to tension wire, space 0.105-inch hog rings 24 inches on center.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

FS RR-F-191/4. Provide wire ties constructed of the same material as the fencing fabric.

2.17 CONCRETE

Provide concrete conforming to ASTM C94/C94M, and obtaining a minimum 28-day compressive strength of 3,000 psi.

2.18 GROUT

Provide grout of proportions one part portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

2.19 PADLOCKS

Provide padlocks conforming to ASTM F 883, with chain.

PART 3 EXECUTION

Provide complete installation conforming to ASTM F 567.

3.1 GENERAL

Ensure final grading and established elevations are complete prior to commencing fence installation.

3.2 EXCAVATION

Provide excavations for post footings which are drilled holes in virgin or compacted soil, of minimum sizes as indicated.

Space footings for line posts 10 feet on center maximum and at closer intervals when indicated, with bottoms of the holes approximately 3-inches below the bottoms of the posts. Set bottom of each post not less than 36-inches below finished grade when in firm, undisturbed soil. Set posts deeper, as required, in soft and problem soils and for heavy, lateral loads.

3.3 SETTING POSTS

Remove loose and foreign materials from holes and the soil moistened prior to placing concrete.

Provide tops of footings that are trowel finished and sloped or domed to shed water away from posts. Set hold-open devices and other accessories in concrete.

Keep exposed concrete moist for at least 7 calendar days after placement or cured with a membrane curing material, as approved.

Maintain vertical alignment of posts set in concrete construction until concrete has set.

3.3.1 Earth

Provide concrete bases of dimensions indicated. Compact concrete to eliminate voids, and finish to a dome shape.

3.3.2 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and a diagonal tension rod.

3.4 CONCRETE STRENGTH

Provide concrete that has attained at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 calendar days after placement, before rails or fabric are installed. Do not stretch fabric and wires or hang gates until the concrete has attained its full design strength.

Take samples and test concrete to determine strength as specified.

3.5 BRACE ASSEMBLY

Provide bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at midheight of the fabric.

Install brace assemblies so posts are plumb when the diagonal rod is under proper tension.

Provide two complete brace assemblies at corner and pull posts where required for stiffness and as indicated.

3.6 TENSION WIRE INSTALLATION

Install tension wire by weaving them through the fabric and tying them to each post with not less than 7-gage galvanized wire or by securing the wire to the fabric with 10-gage ties or clips spaced 24 inches on center.

3.7 FABRIC INSTALLATION

Provide fabric in single lengths between stretch bars with bottom barbs placed approximately 1-1/2-inches above the ground line. Pull fabric taut and tied to posts and tension wire with wire ties and bands.

Install fabric on the security side of fence, unless otherwise directed.

Ensure fabric remains under tension after the pulling force is released.

3.8 STRETCHER BAR INSTALLATION

Thread stretcher bars through or clamped to fabric 4 inches on center and secured to posts with metal bands spaced 15 inches on center.

3.9 GATE INSTALLATION

Install gates plumb, level, and secure, with full opening without interference. Install ground set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricated where necessary.

3.10 TIE WIRES

Provide tie wires that are U-shaped to the pipe diameters to which attached. Twist ends of tie wires not less than two full turns and bent so as not to present a hazard.

3.11 FASTENERS

Install nuts for tension bands and hardware on the side of the fence opposite the fabric side. Peen ends of bolts to prevent removal of nuts.

3.12 ZINC-COATING REPAIR

Clean and repair galvanized surfaces damaged by welding or abrasion, and cut ends of fabric, or other cut sections with specified galvanizing repair material applied in strict conformance with the manufacturer's printed instructions.

3.13 TOLERANCES

Provide posts that are straight and plumb within a vertical tolerance of 1/4 inch after the fabric has been stretched. Provide fencing and gates that are true to line with no more than 1/2 inch deviation from the established centerline between line posts. Repair defects as directed.

3.14 SITE PREPARATION

3.14.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation.

3.15 FENCE INSTALLATION

Install fence on prepared surfaces to line and grade indicated. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.15.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10 feeton center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade. Provide drawings showing location of gate, corner, end, and pull posts.

3.15.2 Top and Bottom Tension Wire

Install top and bottom tension wires before installing chain-link fabric, and pull wires taut. Place top and bottom tension wires within 8 inches of respective fabric line.

3.16 ACCESSORIES INSTALLATION

3.16.1 Post Caps

Install post caps as recommended by the manufacturer.

3.16.2 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

3.17 CLEANUP

Remove waste fencing materials and other debris from the work site.

-- End of Section --

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SECTION 32 92 19

SEEDING
10/06

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.

ASTM INTERNATIONAL (ASTM)

ASTM C602	(2012) Agricultural Liming Materials
ASTM D4427	(2007) Peat Samples by Laboratory Testing
ASTM D4972	(2001; R 2007) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Native Grasses and Forbs.

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 23 00.00 20 EXCAVATION AND FILL, , , Section 32 92 23 SODDING, , , and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Wood cellulose fiber mulch

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

State certification and approval for seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer Gypsum Sulfur Iron and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, gypsum sulphur iron and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Gypsum Sulfur Iron and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer .

2.1.2 Planting Dates

Planting Season	Planting Dates
Permanent Seeding	January 1 - March 31
	Refer to Civil E&S Plan

2.1.3 Permanent Seed Mixture, and WeightPurity

Proportion seed mixtures by weight. Temporary seeding must later be replaced by permanent seeding for a permanent stand of native grasses and forbs. The same requirements of native seeding apply for temporary seeding. Refer also to Civil Erosion and Sediment Control Plans for temporary seeding requirements and dates. Temporary and seeding may be applied concurrently if done within the permanent seeding seasons specified herein and within temporary seeding constraints. Disturbed areas shall not be left unstabilized if distrubance occurs outside of the permanent seeding seasons.

Botanical Name	Common Name	Minimum Percent Pure Seed	Minimum Percent Germination and Hard Seed	Percentage of Mixture
Schizachyr scoparium	Little Bluestem, Ecotype	96	80	50
Sorghatrum nutans	Indiangra NC Ecotype	96	80	15
Elymus virginicus 'Suther'	Virginia Wildrye, NC Ecotype	96	80	15
Parthenium integrifol	Wild Quinine, NC Ecotype	96	80	5

Botanical Name	Common Name	Minimum Percent Pure Seed	Minimum Percent Germination and Hard Seed	Percentage of Mixture
Coreposis lanceolata	Lanceleaf Coreopsis Coastal Plain NC Ecotype	96	80	5
Tridens flavus 'Suther'	Purpletop NC Ecotype	96	80	5
Eragrostis spectabili	Purple Lovegrass VA Ecotype	96	80	5

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor .

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0

Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade burnt limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C602 of not less than 140 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D4427 . Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.9 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 61 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3.10 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.4.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

2.4.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

2.4.3 Wood Cellulose Fiber Mulch

Use recovered materials of either paper-based (100 percent) or wood-based (100 percent) hydraulic mulch. Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 5.5 to 8.2 . Use with hydraulic application of grass seed and fertilizer.

2.5 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.6 EROSION CONTROL MATERIALS

Erosion control material shall conform to the following:

2.6.1 Erosion Control Blanket

100 percent agricultural straw stitched with a degradable nettings, designed to degrade within 12 months.

2.6.2 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids shall resist mold growth.

2.6.3 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of off-site topsoilon-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate pH adjusters soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy frozen snow covered or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method shall be drill seeding.

3.2.2.1 Drill Seeding

Seedbed shall be compacted prior to seeding. Seed shall be drilled at the rate of 25 pounds per acre. Use Truax or equivalent seed drills. Drill seed uniformly to average depth of 1/2 inch.

3.2.2.2 Hydroseeding

First, mix water and fiber. Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. Fiber shall be added at 1,000 pounds, dry weight, per acre. Then add and mix seed and fertilizer to produce a homogeneous slurry. Seed shall be mixed to ensure broadcasting at the rate of 25 pounds per acre. When hydraulically sprayed on the ground, material shall form a blotter like cover impregnated uniformly with grass seed. Spread with one application with no second application of mulch.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.2.3.2 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier shall be sprayed at a rate between 10 to 13 gallons per 1000 square feet. Sunlight shall not be completely excluded from penetrating to the ground surface.

3.2.3.3 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

3.2.3.4 Asphalt Adhesive Coated Mulch

Hay or straw mulch may be spread simultaneously with asphalt adhesive applied at a rate between 10 to 13 gallons per 1000 square feet, using power mulch equipment which shall be equipped with suitable asphalt pump and nozzle. The adhesive-coated mulch shall be applied evenly over the surface. Sunlight shall not be completely excluded from penetrating to the ground surface.

3.2.4 Rolling

Immediately after seeding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width. If seeding is performed with cultipacker-type seeder or by hydroseeding, rolling may be eliminated.

3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Clean other paving when work in adjacent areas is complete.

-- End of Section --

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SECTION 32 92 23

SODDING
04/06

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.

ASTM INTERNATIONAL (ASTM)

ASTM C602	(2012) Agricultural Liming Materials
ASTM D4427	(2007) Peat Samples by Laboratory Testing
ASTM D4972	(2001; R 2007) pH of Soils

TURFGRASS PRODUCERS INTERNATIONAL (TPI)

TPI GSS	(1995) Guideline Specifications to Turfgrass Sodding

U.S. DEPARTMENT OF AGRICULTURE (USDA)

DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

100 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 23 00.00 20 EXCAVATION AND FILL, , , Section 32 92 19 SEEDING, , , and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

Sod farm certification for sods. Indicate type of sod in accordance with TPI GSS.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Sod Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer Gypsum Sulfur Iron and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer gypsum sulphur iron and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Sod Storage

Lightly sprinkle with water, cover with moist burlap, straw, or other approved covering; and protect from exposure to wind and direct sunlight until planted. Provide covering that will allow air to circulate so that internal heat will not develop. Do not store sod longer than 24 hours. Do not store directly on concrete or bituminous surfaces.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Sod

Place sod a maximum of thirty six hours after initial harvesting, in accordance with TPI GSS as modified herein.

PART 2 PRODUCTS

2.1 SODS

2.1.1 Classification

Nursery grown, certified as classified in the TPI GSS. Machine cut sod at a uniform thickness of 3/4 inch within a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece shall be strong enough to support its own weight when lifted by the ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will be rejected.Wood pegs and wire staples for anchorage shall be as recommended by sod supplier.

2.1.2 Purity

Sod species shall be genetically pure, free of weeds, pests, and disease.

2.1.3 Planting Dates

Lay sod from April 1 to September 15 for warm season spring planting.

2.1.4 Composition

2.1.4.1 Proportion

Proportion grass species as follows.

Botanical Name	Common Name	Percent
Eremochloa ophuroides	Centipede Grass	100

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor .

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components shall conform to the

following limits:

Silt	25-50 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade burnt limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C602 of not less than 140 percent.

2.3.2 Aluminum Sulfate

Commercial grade.

2.3.3 Sulfur

100 percent elemental

2.3.4 Iron

100 percent elemental

2.3.5 Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D4427 . Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation.

2.3.6 Sand

Clean and free of materials harmful to plants.

2.3.7 Perlite

Horticultural grade.

2.3.8 Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, and soil stabilized with nitrogen and having the following properties:

2.3.8.1 Particle Size

Minimum percent by weight passing:

No. 4 mesh screen	95
No. 8 mesh screen	80

2.3.8.2 Nitrogen Content

Minimum percent based on dry weight:

Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.9 Gypsum

Coarsely ground gypsum comprised of calcium sulfate dihydrate 91 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

2.3.10 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 1200 degrees F. Gradation: A minimum 90 percent shall pass a No. 8 sieve; a minimum 99 percent shall be retained on a No. 60 sieve; and a maximum 2 percent shall pass a No. 100 sieve. Bulk density: A maximum 40 pounds per cubic foot.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

20 percent available nitrogen
27 percent available phosphorus
5 percent available potassium

2.5 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation containing no element toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Extent Of Work

Provide soil preparation (including soil conditioners), fertilizing, and sodding of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.2 Soil Preparation

Provide 4 inches of topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer pH adjusters soil conditioners into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting

Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.2.1 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3.1.2.2 Fertilizer Application RatesApply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site. 3.2 SODDING

3.2.1 Finished Grade and Topsoil

Prior to the commencement of the sodding operation, the Contractor shall verify that finished grades are as indicated on drawings; the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove from the surface debris and stones over a minimum 5/8 inch in any dimension.

3.2.2 Placing

Place sod a maximum of 36 hours after initial harvesting, in accordance with TPI GSS as modified herein.

3.2.3 Sodding Slopes and Ditches

For slopes 2:1 and greater, lay sod with long edge perpendicular to the contour. For V-ditches and flat bottomed ditches, lay sod with long edge perpendicular to flow of water. Anchor each piece of sod with wood pegs or wire staples maximum 2 feet on center. On slope areas, start sodding at bottom of the slope.

3.2.4 Finishing

After completing sodding, blend edges of sodded area smoothly into surrounding area. Air pockets shall be eliminated and a true and even surface shall be provided. Frayed edges shall be trimmed and holes and missing corners shall be patched with sod.

3.2.5 Rolling

Immediately after sodding, firm entire area except for slopes in excess of 3 to 1 with a roller not exceeding 90 pounds for each foot of roller width.

3.2.6 Watering

Start watering areas sodded as required by daily temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to minimum depth of 6 inches. Run-off, puddling, and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or plant material shall be prevented.

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3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations. Clean other paving when work in adjacent areas is complete.

-- End of Section --

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SECTION 33 31 16

LEACHATE COLLECTION SYSTEM
07/06

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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 198	(2010) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104	(2004) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(2003) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2001) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1999) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C153	(2000) Ductile-Iron Compact Fittings for Water Service
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose (Inch)
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM INTERNATIONAL (ASTM)

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A746	(2009) Standard Specification for Ductile Iron Gravity Sewer Pipe
ASTM C150/C150M	(2012) Standard Specification for Portland Cement
ASTM C270	(2012a) Standard Specification for Mortar for Unit Masonry
ASTM C443	(2011) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C478	(2012a) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C923	(2008) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C94/C94M	(2012a) Standard Specification for Ready-Mixed Concrete
ASTM C990	(2009) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1238	(2010) Melt Flow Rates of Thermoplastics by Extrusion Plastometer
ASTM D1248	(2012) Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D1505	(2010) Density of Plastics by the Density-Gradient Technique
ASTM D1525	(2009) Vicat Softening Temperature of Plastics
ASTM D1603	(2012) Carbon Black Content in Olefin Plastics
ASTM D1693	(2012) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D1785	(2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2240	(2005; R 2012) Standard Test Method for Rubber property - Durometer Hardness
ASTM D2241	(2009) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2837	(2011) Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
ASTM D3035	(2012; E 2012) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3261	(2012) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D3350	(2012) Polyethylene Plastics Pipe and Fittings Materials
ASTM D4101	(2011) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D638	(2010) Standard Test Method for Tensile Properties of Plastics
ASTM D695	(2010) Standard Test Method for Compressive Properties of Rigid Plastics
ASTM D696	(2008) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM D698	(2012) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

ASTM D746	(2007) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D790	(2010) Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM F1473	(2013) Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins
ASTM F477	(2010) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F714	(2012a) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005	(Basic) Frames.Covers, Gratings, Steps, Sump and Catch Basin, Manhole

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.27	Fixed Ladders

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT RS	(2012) Standard Specifications for Roads and Structures

1.2 SYSTEM DESCRIPTION

1.2.1 Leachate Gravity Pipeline

Provide new leachate piping and appurtenances. Provide each system complete and ready for operation. The leachate gravity sewer system includes equipment, materials, installation, and workmanship as indicated.

1.2.2 Leachate Pressure Lines

Provide pressure lines and dual containment where indicated..

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drawings

Installation and As-Built drawings, as specified.

Precast concrete manhole
Metal items
Frames and covers
Leachate Extraction Pumping System, G

Submit detailed dimension drawings showing all components of the system including leachate extraction pumps, motors, controls, wiring, carriage system, and auxiliary items. Drawings shall contain the details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances. Provide manufacturer's data on pump performance and level control system. Provide warranty statement.

SD-03 Product Data

Pipeline materials

Submit manufacturer's standard drawings or catalog cuts.

SD-06 Test Reports

Reports

Test and inspection reports, as specified.

SD-07 Certificates

Aggregates; GSD-09 Manufacturer's Field Reports

Leachate Extraction Pumping System, G

SD-10 Operation and Maintenance Data

Leachate Extraction Pumping System, G: Submit Data Package 3 in accordance with Section 01 78 23, "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualifications

Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Installing Contractor's License shall be current and be state certified or state registered.

1.4.2 Drawings

a. Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.

b. Submit As-Built Drawings for the complete leachate collection system showing complete detail with all dimensions, both above and below grade, including invert elevation.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 32 13 13.06 PORTLAND CEMENT CONCRETE PAVEMENT FOR SITE FACILITIES.

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

If sections of HDPE pipe are discovered with cuts or gouges in excess of 10% of the pipe wall thickness, the section shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the heat joint fusing method. Avoid chains or cable chokers when lifting fused sections of pipe. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Ductile Iron Gravity Sewer Pipe and Associated Fittings

2.1.1.1 Ductile Iron Gravity Pipe and Fittings

Ductile iron pipe shall conform to ASTM A746, Pressure Class 250. Fittings shall conform to AWWA C110 or AWWA C153. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved by the Contracting Officer, for push-on joint. Fittings shall have strength at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the joints specified hereinafter. Pipe and fittings shall have cement-mortar lining conforming to AWWA C104, standard thickness. Provide Protecto 401 Sewpercoat or approved equal interior pipe and fitting lining.

2.1.1.2 Ductile Iron Gravity Joints and Jointing Materials

Pipe and fittings shall have push-on joints or mechanical joints, except as otherwise specified in this paragraph. Push-on joint pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to AWWA C111. Mechanical joint requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.

Joints shall be flanged joints where indicated. Bolts, nuts, and gaskets for flanged connections shall be as recommended in the Appendix to AWWA C115. Flange for setscrewed flanges shall be of ductile iron, ASTM A536, Grade 70-50-05 or 60-42-10, and shall conform to the applicable requirements of ASME B16.1, Class 125. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated, and zinc-coated steel. Gasket for setscrewed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA C111. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.

2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

2.1.2.1 PVC Plastic Pressure Pipe and Fittings

a. Pipe and Fittings Less Than 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D1784, Class 12454B.

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D1785, Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Fittings for threaded pipe shall conform to requirements of ASTM D2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Pipe couplings when used, shall be tested as required by ASTM D2464.

(2) Push-On Joint: ASTM D3139, with ASTM F477 gaskets. Fittings for push-on joints shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D1785 or ASTM D2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D2466 or ASTM D2464.

2.1.3 High Density Polyethylene (HDPE) Pipe and Associated Fittings

2.1.3.1 HDPE Pipe and Fittings

HDPE pipe shall be manufactured from extra high molecular weight, high density PE 3408 polyethylene resin with the nominal physical properties outlined in Table 1. Pipe shall have a nominal iron pipe size outer diameter unless otherwise specified. Pipes having a diameter 3-inch and larger will be made to the dimensions and tolerances set forth in ASTM F714; tubing to ASTM D3035. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw

material. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, or other defects that may affect the wall integrity. Provide piping with DR11. Provide perforations as indicated.

HDPE fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabrication from HDPE pipe conforming to this specification. The fittings shall be fully pressure rated and provide a working pressure equal to that of the pipe with an included 2:1 safety factor.

The fittings shall be manufactured from the same resin type and cell classification as the pipe itself. The fittings shall be homogeneous throughout and free from cracks, holes, voids, or other defects.

2.1.3.2 HDPE Joints and Joining Materials

Sections of polyethylene pipe shall be joined by the butt fusion process into continuous lengths at the job site. The joining method shall be the heat fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The heat fusion equipment used in the joining procedure should be capable of meeting all conditions recommended by the pipe manufacturer.

Properly executed electrofusion fittings may be used. Extrusion welding or hot gas welding of HDPE shall not be used. Mechanical joint adapters, flanges, unions, transition fittings, and mechanical couplings may be used to mechanically connect HDPE pipe.

Table 1, HDPE Pipe

PROPERTY		TEST METHOD	UNITS	NOMINAL VALUES
Material Designation		PPI/ASTM	-	PE3608
Material Classification		ASTM D1248	-	III C 5 P34
Cell Classification		ASTM D3350	-	345464C
Density	(3)	ASTM D1505	gm/cu. cm	0.941 to 0.943
Melt Flow	(4)	ASTM D1238	gm/10 min	0.05 to 0.11
Flex Modulus	(5)	ASTM D790	psi	110,000 to 140,000
Tensile Str.	(4)	ASTM D638	psi	3200
ESCR		ASTM D1693	Hrs	>5000
PENT	(6)	ASTM F1473	Hrs	>100
HDB @ 73 deg F	(4)	ASTM D2837	psi	1600
HDB @ 140 deg F		ASTM D2837	psi	800
UV Stabilizer	(C)	ASTM D1603	%C	2 to 2.5

Table 1, HDPE Pipe

Hardness	ASTM D2240	Shore "D"	65
Compressive Strength (Yield)	ASTM D695	psi	1600
Elongation @ Yield	ASTM D638	%, minimum	8
Tensile Strength @ Ultimate (Type IV Spec.)	ASTM D638	psi	5,000
Elongation @ Break	ASTM D638	%, minimum	750
Modulus of Elasticity	ASTM D638	psi	130,000
Linear Thermal Expansion Coef	ASTM D696	in/in/Deg. F	1.2 x 10-4
Brittleness Temperature	ASTM D746	Deg F	<-180 Deg F
Vicat Soft Temperature	ASTM D1525	Deg F	+257

2.2 LEACHATE EXTRACTION PUMPING SYSTEM

All equipment within the leachate extraction pumping system shall be provided by a single manufacturer who shall have complete responsibility for the system. The manufacturer shall be a duly incorporated, licensed and insured entity with a minimum of ten (10) years experience in providing complete leachate extraction pumping systems for landfills and other wastewater applications.

2.2.1 Pumps

Leachate pump shall be of centrifugal, multi-stage, turbine, submersible design suitable for primary landfill leachate. The pump shall be coupled to a submersible motor that is non-overloading throughout the operating curve of the pump.

Pump and motor characteristics shall be as indicated. Pump design shall include the following features: an integral check valve of 300 series stainless steel; impellers, bowls, guide vanes, and inlet screen of 300 series stainless steel; each impeller shall have a Teflon seal ring to reduce hydraulic losses; all shaft bearings shall be Teflon; and a stainless steel flow inducer shall be provided at the pump inlet.

2.2.2 Motors

The motor shall be squirrel-cage induction type motor for submersible application and conform to NEMA standards. All materials coming in contact with leachate shall be 300 series stainless steel, Viton, Teflon or Tefzel. The motor shall not require the use of oil or grease for lubrication. The motor shall have a thrust bearing capable of handling the maximum thrust load of the pump. Motor pressure equalizing diaphragm assembly shall be Viton. A properly sized jacketed power cable of appropriate length, suitable for leachate service, shall be provided.

Electrical equipment and wiring shall be in accordance with Section 26 00 00.00 20, "Basic Electrical Materials and Methods," Section 26 20 00, "Internal Distribution System," and Section 33 71 02.00 20, "Underground

Electrical Distribution."

2.2.3 Carriage

The pump shall be mounted in a 300 series stainless steel carriage/sled shroud for use in a 18-inch HDPE riser pipe with a constant inside diameter set at the slope indicated.

The carriage/sled shall provide a low center of gravity and all wheels shall remain in contact with the inner contour of the riser pipe. The wheels shall be constructed of non-corrosive material with self-lubricating qualities and must be able to travel over welding beads typically found in riser pipe fabrications. A stainless steel inlet suction screen shall be provided to prevent debris from entering the inlet of the pump.

The level sensor shall be carriage/sled mounted and be removable or replaceable without disassembly of the pump assembly or removal of the pump from the carriage/sled. Sensor cable shall be field trimmed to proper length at time of installation by the Contractor.

A 1/4-inch safety/retrieval cable assembly with properly sized cable clips, snap hooks, and anchor eye bolt constructed of 300 series stainless steel shall be provided.

2.2.4 Discharge Hose

Discharge hose shall be 2-inch PVC flexible hose rated for 200 to 300 psi and -10 to +150 degrees F. Hose shall be trimmed to proper length at time of installation by the Contractor.

2.2.5 Discharge Hose Fittings

All hose fittings shall be 300 series stainless steel. All hose bands shall be hi-torque 300 series stainless construction. All hose fittings and bands shall be suitable for the application.

2.2.6 Discharge Exit Fittings

A riser side exit disconnect fitting shall be provided, that will allow quick connection/disconnection of the pump discharge hose from the pump discharge and riser exit, and allow the pump to be removed without interference of the stationary fittings. The exit arrangement shall thread through the riser pipe as to provide gas tight connection.

All fittings shall be 300 series stainless steel construction.

The exit connections will penetrate the riser wall approximately 6-inches from the top of the riser pipe by means of 300 series stainless steel, male threaded exit nipple.

2.2.7 Control Panel

The control panel, labeled UL508A and UL698A, shall provide level indication, pump operation, and motor protection. The control panel shall consist of a NEMA 4X, stainless steel enclosure with lockable outer cover. The door shall open a minimum of 180 degrees and be provided with a view window. The inner door shall be polished aluminum dead front and contain cutouts for the mounted equipment and operator accessible equipment. The dead front door shall provide protection of personnel from live internal

wiring.

Operator accessible components mounted on the dead front door shall include the following:

H-O-A Switch; Pump Run Indicating Light; Motor Overload Indicating Light; Digital Level Indicator; Elapsed Time Meter; Main Disconnect Breaker Switch; Pump Breaker Switch; Control Circuit Breaker Switch; and Electronic Overload Relay.

The back plate shall consist of 12-gauge sheet steel and finished with a primer coat and two coats of baked enamel. All hardware mounted to the sub-panel shall be accomplished with machine thread tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified with phenolic engraved nameplates.

The panel power distribution shall include all necessary components and shall be completely wired with standard copper conductors. Control wiring shall be properly sized and installed in Panduit type wiring trays.

A fully programmable electronic overload relay with alphanumeric LED display providing programming and diagnostic information shall be supplied for each pump. The electronic overload relay shall provide sixteen programmable parameters. Unit shall also provide eight viewable parameters while the motor is running.

An individual circuit breaker shall be provided from the main power, each pump and control circuit. All circuit breakers shall be heavy-duty thermal magnetic or motor circuit protectors similar and equal to Square D type FAL. Circuit breakers shall be indicating type, ON-OFF-TRIP positions.

Thermal magnetic breakers shall be quick-make and quick-break on manual or automatic operation. Breakers shall have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip.

Breakers shall be designed so that an overload on one pole automatically trips and opens all legs. Field installed handle ties shall not be acceptable.

Motor starters shall be open frame, across the line, NEMA rated with individual protection in each leg. Motor starter contacts and coil shall be replaceable from the front of the starter without removing it from the panel. Overload heaters shall be block type, utilizing melting alloy spindles and shall provide visual trip indication and an alarm contact for visual alarm. The overload shall be sized for the full load amp draw of the pump. Adjustable type overloads, definite purpose contactors, fractional size starters, and horsepower rated contactors or relays shall not be acceptable.

A fused type control transformer shall be used to provide the 120 VAC control circuit.

Individual surge arrestors shall be provided in the control panel for incoming supply power, control circuit and the 4 to 20 mA instrument circuit.

A thermostat-controlled heater shall be provided to control the inside temperature and alleviate the buildup of condensation in the control panel.

A corrosion inhibitor shall be provided within the enclosure.

A top mounted, 40 watt, weatherproof/shatterproof red visual high-level alarm beacon shall be provided.

2.2.8 Level Control

A panel mounted digital readout display controller shall be provided to indicate level in the sump. The pump "ON", "OFF" and "HIGH LEVEL" selections shall be capable of being set/adjusted on the front of the unit. The controller shall be capable of accepting a 4 to 20 mA signal from a submersible transducer, and provide a level indication range of 0 to 135 inches of liquid. When a high level condition occurs, the display will flash until the condition is corrected.

A submersible transducer with adequate sized cable shall be provided. The transducer shall be constructed of 300 series stainless steel and shall be mounted to the pump carriage. Transducer shall provide a 4 to 20 mA output signal and come equipped with built-in surge protection. Static accuracy shall be no less than 1.0%.

A permanent aneroid bellows type breather device shall be mounted in the control panel to prevent moisture in the vent tube.

A panel mounted intrinsically safe barrier shall be provided for the transducer signal.

2.2.9 Cable Fittings

Non-metallic, compression type threaded cable exit fittings, properly sized for the pump power cable and level sensor cable shall be provided for installation in the riser.

2.2.10 Spare Parts

Provide one complete carriage/sled mounted spare pump assembly with one level sensor with power and level sensor cable lengths to be installed in the deepest application in service.

2.2.11 Warranty

The manufacturer shall provide warranty without regard for or dependence on pass through warranties, which may or may not be provided by the original equipment manufacturer of various components of the system for a period of 60 months from date of start-up by the manufacturer's representative.

2.3 STONE DRAINAGE LAYER AND STONE PROTECTIVE COVER LAYER

2.3.1 Aggregates

NCDOT 78M, in accordance with NCDOT RS.

2.4 CONCRETE MATERIALS

2.4.1 Cement Mortar

Cement mortar shall conform to ASTM C270, Type M with Type II cement.

2.4.2 Portland Cement

Portland cement shall conform to ASTM C150/C150M, Type II low alkali (less than 0.60 percent alkalies) for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.4.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C94/C94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.5 MISCELLANEOUS MATERIALS

2.5.1 Precast Concrete Manholes

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C478; base and first riser shall be monolithic.

2.5.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C990butyl or AASHTO M 198, Type B gaskets. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C923.

2.5.3 Metal Items

2.5.3.1 Frames and Covers for Manholes

FS A-A-60005, cast iron; figure numbers shall be as indicated.

Frames and covers shall be cast iron or ductile iron. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.5.3.2 Safety Wording for Manhole Covers

Manhole covers for confined space manholes shall be labeled as required in Section 01 35 26, GOVERNMENTAL SAFETY REQUIREMENTS, paragraph titled "Confined Space Signage."

2.5.3.3 Manhole Steps

Zinc-coated steel conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D4101, copolymer polypropylene. Rubber shall conform to ASTM C443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes les 4 feet deep.

2.6 REPORTS

Submit Test Reports. Compaction and density test shall be in accordance with Section 31 23 00.00 20 "EXCAVATION AND FILL". Submit Inspection

Reports for daily activities during the installation of the sanitary system. Information in the report shall be detailed enough to describe location of work and amount of pipe laid in place, measured in linear feet.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.1.1 Location

The work covered by this section shall terminate at the points indicated.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20, "Excavation And Fill".

3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved.

3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.1.2 Special Requirements

3.1.2.1 Installation of Ductile Iron Gravity Sewer Pipe

Unless otherwise specified, install pipe and associated fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of AWWA C600 for pipe installation and joint assembly.

a. Make push-on joints with the gaskets and lubricant specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the

recommendations of Appendix A to AWWA C111. Make flanged joints with gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight, taking care to avoid undue strain on flanges, fittings, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fittings have dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions.

3.1.2.2 Installation of PVC Plastic Pressure Pipe and Fittings

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section; with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Pipe Less Than 4 Inch Diameter:

(1) Threaded joints shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. The joints shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.

(2) Push-On Joints: The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. Care shall be exercised to ensure that the gasket remains in proper position in the bell or coupling while making the joint.

(3) Solvent-weld joints shall comply with the manufacturer's instructions.

c. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C94/C94M having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

3.1.2.3 Installation of HDPE Piping

Installation of pipe and fittings in accordance with manufacturer's recommendations.

3.1.3 Leachate Extraction Pumping System

3.1.3.1 General

The installation of the leachate extraction pumping system shall be in accordance with the manufacturer's written instructions and as indicated. All appurtenances required for a complete and operating leachate pumping system shall be provided.

3.1.3.2 Start-up

The Contractor shall notify the pump equipment supplier and the Contracting Officer when the installation is complete and ready to be put into operation. The Contractor shall arrange a date for the accomplishment of the initial start-up and field test. The manufacturer shall provide a competent, experienced representative to adjust the equipment after installation and to supervise the initial operation.

The field test shall verify that the pump is built in accordance with the construction documents as to HP, voltage, phase and hertz. Verify pump capacity and pump speed as indicated. Equipment shall be free of cavitation, excess vibration, and over-heating and safety devices shall be demonstrated to perform as scheduled on drawings and within control sections of these specifications.

The leachate extraction pumping system will not be accepted until the Contracting Officer receives certification in a Start-up Report indicating that the system has been properly installed. The report shall also provide all component settings and motor operating characteristics.

3.1.4 Drainage Layer and Protective Cover Placement

Provide as indicated. Place in accordance with requirements specified for the underlying geotextile and geocomposite specification sections. Unless noted otherwise, place in 12 inch thick compacted lifts and compact to 90 percent ASTM D698 maximum density.

3.1.5 Concrete Work

Cast-in-place concrete is included in Section 32 13 13.06 PORTLAND CEMENT CONCRETE PAVEMENT FOR SITE FACILITIES. The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.6 Manhole Construction

Use precast concrete base sections. Make inverts in precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of

manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.1.7 Miscellaneous Construction and Installation

3.1.7.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.7.2 Metal Work

a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

3.1.8 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Section 01 50 00.00 20, "Temporary Facilities and Controls". Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Tests for Nonpressure Lines

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

3.2.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Test PVC plastic pressure lines in accordance with the requirements of AWWA C605 for pressure and leakage tests, using the allowable leakage given therein.

3.2.4 Field Tests for Concrete

Field testing requirements are covered in Section 32 13 13.06 PORTLAND CEMENT CONCRETE PAVEMENT FOR SITE FACILITIES

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES
02/10

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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 198	(2010) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	(2000) Concrete Pipe Handbook
ACPA 01-103	(2000) Concrete Pipe Installation Manual

ASTM INTERNATIONAL (ASTM)

ASTM A929/A929M	(2001; R 2007) Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C478	(2012a) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C76	(2011) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C923	(2008) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C990	(2009) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1751	(2004; R 2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient

Bituminous Types)

ASTM D1752 (2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005 (Basic) Frames.Covers, Gratings, Steps, Sump and Catch Basin, Manhole

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Placing Pipe

Printed copies of the manufacturer's recommendations for installation procedures of the materials being placed, prior to installation.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

Manufactured in accordance with and conforming to ASTM C76, Class III, unless indicated otherwise.

2.1.1.1 Joint Sealants

Provide primers and lubricants as recommended by the manufacturer. Concrete pipe joints shall be suitable for use with the joint sealants specified.

a. Butyl gaskets.

b. AASHTO M 198, Type B preformed plastic gaskets.

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A929/A929M.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for concrete under Section 32 13 13.06 PORTLAND CEMENT CONCRETE PAVEMENT FOR SITE FACILITIES. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C231/C231M. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D1751, or ASTM D1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.

2.3.2 Precast Reinforced Concrete Drainage Structures

Conform to ASTM C478. Joints between precast concrete risers and tops shall be rubber-type gaskets meeting the requirements of ASTM C990 or AASHTO M 198, Type B gaskets.

2.3.3 Frame and Cover for Gratings

FS A-A-60005 Cast iron, figure numbers as indicated.

2.4 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923.

2.5 EROSION CONTROL RIPRAP

Provide nonerodible rock not exceeding 15 inches in its greatest dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness ofas indicated.

PART 3 EXECUTION

3.1 EXCAVATION FOR STORM DRAINS AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 23 00.00 20, EXCAVATION AND FILL and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than indicated to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified, without any overexcavation. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in granular material minimum 4 inch in depth in trenches with soil foundation. Depth of granular bedding in trenches with rock foundation shall be 1/2 inch in depth per foot of depth of fill, minimum depth of bedding shall be 8 inch up to maximum depth of 24 inches. The middle third of the granular bedding shall be loosely placed. Bell holes and depressions for joints shall be removed and formed so entire barrel of pipe is uniformly supported. The bell hole and depressions for the joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PLACING PIPE

Submit printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering

sections of pipe into trenches. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

Note post installation requirements of paragraph 'Deflection Testing' in PART 3 of this specification for all pipe products including deflection testing requirements for flexible pipe.

3.3.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Concrete Pipe

3.4.1.1 Flexible Joints

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the provisions for rugger gasket jointing and jointing procedures of ACPA 01-103 or of ACPA 01-102, Chapter 9. Make joints with the gaskets previously specified for joints with this piping. Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, or precast reinforced concrete; complete with frames and covers or gratings. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

3.6 BACKFILLING

Perform earthwork operations in accordance with Section 31 23 00.00 20, EXCAVATION AND FILL.

3.6.1 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.7 PIPELINE TESTING

3.7.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed properly in accordance with the drawings and specifications.

3.7.2 Pipeline Testing

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

-- End of Section --

SECTION 33 71 01

OVERHEAD TRANSMISSION AND DISTRIBUTION
03/13

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.

ALLIANCE FOR TELECOMMUNICATIONS INDUSTRY SOLUTIONS (ATIS)

ATIS ANSI O5.1	(2008) Wood Poles -- Specifications & Dimensions

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C1	(2003) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C25	(2003) Sawn Crossarms - Preservative Treatment by Pressure Processes
AWPA C4	(2003) Poles - Preservative Treatment by Pressure Processes

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2012) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B2	(2008) Standard Specification for Medium-Hard-Drawn Copper Wire
ASTM B3	(2001; R 2007) Standard Specification for Soft or Annealed Copper Wire
ASTM B8	(2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D1654	(2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 404	(2012) Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500,000 V
IEEE C135.22	(1988) Standard for Zinc-Coated Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction
IEEE C2	(2012; Errata 2012; INT 1 2012; INT 2 2012; INT 3 2012) National Electrical Safety Code
IEEE C37.42	(2009) Standard Specifications for High-Voltage (> 1000 V) Expulsion-Type Distribution-Class Fuses, Fuse and Disconnecting Cutouts, Fuse Disconnecting Switches, and Fuse Links, and Accessories Used with These Devices
IEEE C62.11	(2005; Amd 1 2008) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C29.5	(1984; R 2002) Wet-Process Porcelain Insulators (Low and Medium Voltage Pin Type)
ANSI C29.7	(1996; 2002) American National Standard for Wet Process Porcelain Insulators - High-Voltage Line Post Type
NEMA WC 74/ICEA S-93-639	(2006) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 202-1	(2004) List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers
RUS Bull 1728H-701	(1993) Wood Crossarms (Solid and Laminated), Transmission Timbers and Pole Keys
RUS Bull 345-67	(1998) REA Specification for Filled Telephone Cables, PE-39

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2003; Reprint Feb 2010) Wire Connectors
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Conductors; G

Insulators; G

Wood Poles

Cutouts; G

Surge arresters; G

Nameplates; G

SD-06 Test Reports

Wood Crossarm Inspection Report

Field Test Plan; G

Field Quality Control; G

Ground resistance test reports; G

Submit report of the acceptance test results as specified by paragraph entitled "Field Quality Control"

SD-07 Certificates

Public Utility - Electrical Contractor's License; G

Wood poles; G

Wood crossarms; G

1.5 QUALITY ASSURANCE

1.5.1 Utility Contractor Qualifications

The Contractor must possess a valid North Carolina Public Utility - Electrical Contractor's License or equivalent from another state and be insured to do such work.

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 and IEEE C2 unless more stringent requirements are specified or indicated.

1.5.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5.4 Ground Resistance Test Reports

Submit the measured ground resistance of grounding system. When testing grounding electrodes and grounding systems, identify each grounding electrode and each grounding system for testing. Include the test method and test setup (i.e. pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

1.5.5 Wood Crossarm Inspection Report

Furnish an inspection report from an independent inspection agency, approved by the Contracting Officer, stating that offered products comply with applicable AWPA and RUS standards. The RUS approved Quality Mark "WQC" on each crossarm will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

1.5.5.1 Field Test Plan

Provide a proposed field test plan 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

1.6 MAINTENANCE

1.7 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ATIS ANSI O5.1. Handling of wood poles shall be in accordance with ATIS ANSI O5.1, except that pointed tools capable of producing indentations more than inch in depth shall not be used. Nails and holes are not permitted in top of poles.

1.8 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Consider materials specified herein or shown on contract drawings which are identical to materials listed in RUS 202-1 as conforming to requirements. Equipment and component items, not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall

withstand 120 hours of exposure to the salt spray test specified in ASTM B117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The described test mark and test evaluation shall be in accordance with ASTM D1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.2 POLES

Poles shall be of lengths and classes indicated.

2.2.1 Wood Poles

Wood poles machine trimmed by turning, Douglas Fir conforming to ATIS ANSI O5.1 and RUS Bull 345-67. Gain, bore and roof poles before treatment. Should additional gains be required subsequent to treatment, metal gain plates shall be provided. Pressure treat poles with pentachlorophenol,, except that Douglas Fir and Western Larch poles shall not be treated with CCA in accordance with AWPA C1 and AWPA C4 as referenced in RUS Bull 345-67. The quality of each pole shall be ensured with "WQC" (wood quality control) brand on each piece, or by an approved inspection agency report.

2.3 CROSSARMS AND BRACKETS

2.3.1 Wood Crossarms

Conform to RUS Bull 1728H-701. Pressure treat crossarms with pentachlorophenol, chromated copper arsenate (CCA), or ammoniacal copper arsenate (ACA). Treatment shall conform to AWPA C25. Crossarms shall be solid wood, distribution type, and a 1/4 inch 45 degree chamfer on all top edges. Cross-sectional area minimum dimensions shall be 4-1/4 inches in height by 3-1/4 inches in depth in accordance with IEEE C2 for Grade B construction. Crossarms shall be 8 feet in length, except that 10 foot crossarms shall be used for crossarm-mounted banked single-phase transformers or elsewhere as indicated. Crossarms shall be machined, chamfered, trimmed, and bored for stud and bolt holes before pressure treatment. Factory drilling shall be provided for pole and brace mounting, for four pin or four vertical line-post insulators, and for four suspension insulators, except where otherwise indicated or required. Drilling shall provide required climbing space and wire clearances. Crossarms shall be straight and free of twists to within 1/10 inch per foot of length. Bend or twist shall be in one direction only.

2.3.2 Crossarm Braces

Provide flat steel or steel angle as indicated. Provide braces with 38 inch span for 8 foot crossarms.

2.3.3 Armless Construction

Pole mounting brackets for line-post or pin insulators and eye bolts for suspension insulators shall be as shown. Brackets shall be attached to poles with a minimum of two bolts. Brackets may be either provided integrally as part of an insulator or attached to an insulator with a suitable stud. Bracket mounting surface shall be suitable for the shape of the pole. Brackets for wood poles shall have wood gripping members.

Horizontal offset brackets shall have a 5-degree uplift angle. Pole top brackets shall conform to IEEE C135.22, except for modifications necessary to provide support for a line-post insulator. Brackets shall provide a strength exceeding that of the required insulator strength, but in no case less than a 2800 pound cantilever strength.

2.4 HARDWARE

Hardware shall be hot-dip galvanized in accordance with ASTM A153/A153M and ASTM A123/A123M.

2.5 INSULATORS

Provide wet-process porcelain insulators which are radio interference free.

a. Line post type insulators: ANSI C29.7, Class 57-1S.

b. Pin insulators: ANSI C29.5, Class 55-5.

2.6 OVERHEAD CONDUCTORS, CONNECTORS AND SPLICES

Conductors of bare copper of sizes and types indicated.

2.6.1 Solid Copper

ASTM B1, ASTM B2, and ASTM B3, hard-drawn, medium-hard-drawn, and soft-drawn, respectively. ASTM B8, stranded.

2.6.2 Connectors and Splices

Connectors and splices shall be of copper alloys for copper conductors, aluminum alloys for aluminum-composition conductors, and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. Aluminum-composition, aluminum-composition to copper, and copper-to-copper shall comply with UL 486A-486B.

2.7 GROUNDING AND BONDING

2.7.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.7.2 Grounding Conductors

ASTM B3. Provide soft drawn copper wire ground conductors a minimum No. 4 AWG. Ground wire protectors shall be PVC.

2.7.3 Grounding Connections

UL 467. Exothermic weld or compression connector.

2.8 SURGE ARRESTERS

IEEE C62.11, metal oxide, polymeric-housed, surge arresters arranged for crossarm mounting. RMS voltage rating shall be 9 kV. Arresters shall be Distribution class.

2.9 FUSED CUTOUTS

Open type fused cutouts rated 200 amperes and 18 amperes symmetrical interrupting current at 15 kV ungrounded, conforming to IEEE C37.42. Type K fuses conforming to IEEE C37.42 with ampere ratings equal to 150 percent of the transformer full load rating.

2.10 CONDUIT RISERS AND CONDUCTORS

The riser shield shall be PVC containing a PVC back plate and PVC extension shield or a rigid galvanized steel conduit, as indicated, and conforming to UL 6. Provide conductors and terminations as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.11 ELECTRICAL TAPES

Tapes shall be UL listed for electrical insulation and other purposes in wire and cable splices. Terminations, repairs and miscellaneous purposes, electrical tapes shall comply with UL 510.

2.12 CALKING COMPOUND

Compound for sealing of conduit risers shall be of a puttylike consistency workable with hands at temperatures as low as 35 degrees F, shall not slump at a temperature of 300 degrees F, and shall not harden materially when exposed to air. Compound shall readily calk or adhere to clean surfaces of the materials with which it is designed to be used. Compound shall have no injurious effects upon the workmen or upon the materials.

2.13 NAMEPLATES

2.13.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable. Equipment containing liquid-dielectrics shall have the type of dielectric on the nameplate.

2.13.2 Field Fabricated Nameplates

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

PART 3 EXECUTION

3.1 INSTALLATION

Provide overhead pole line installation conforming to requirements of IEEE C2 for Grade B construction of overhead lines in light loading districts and NFPA 70 for overhead services. Provide material required to make connections into existing system and perform excavating, backfilling, and other incidental labor. Consider street, alleys, roads and drives

"public." Pole configuration shall be as indicated.

3.1.1 Wood Pole Installation

Provide pole holes at least as large at the top as at the bottom and large enough to provide 4 inch clearance between the pole and side of the hole.

3.1.1.1 Setting Depth of Pole

Pole setting depths shall be as follows:

Length of Pole (feet)	Setting in Soil (feet)	Setting in Solid Rock (feet)
20	5.0	3.0
25	5.5	3.5
30	5.5	3.5
35	6.0	4.0
40	6.0	4.0
45	6.5	4.5
50	7.0	4.5
55	7.5	5.0
60	8.0	5.0
65	8.5	5.5
70	9.0	5.5
75	9.5	6.0
80	10.0	6.0
85	10.5	6.5
90	11.0	6.5
95	11.5	7.0
100	12.5	7.5

3.1.1.2 Setting in Soil, Sand, and Gravel

"Setting in Soil" depths, as specified in paragraph entitled "Setting Depth of Pole," apply where the following occurs:

a. Where pole holes are in soil, sand, or gravel or any combination of these;

b. Where soil layer over solid rock is more than 2 feet deep;

c. Where hole in solid rock is not substantially vertical; or

d. Where diameter of hole at surface of rock exceeds twice the diameter of pole at same level.

3.1.1.3 Setting on Sloping Ground

On sloping ground, always measure hole depth from low side of hole.

3.1.1.4 Backfill

Thoroughly tamp pole backfill for full depth of the hole and mound excess fill around the pole.

3.1.1.5 Setting Poles

Set poles so that alternate crossarm gains face in opposite directions, except at terminals and dead ends where gains of last two poles shall be on side facing terminal or dead end. On unusually long spans, set poles so that crossarm comes on side of pole away from long span. Where pole top pins are used, they shall be on opposite side of pole from gain, with flat side against pole.

3.1.1.6 Alignment of Poles

Set poles in alignment and plumb except at corners, terminals, angles, junctions, or other points of strain, where they shall be set and raked against the strain. Set not less than 2 inches for each 10 feet of pole length above grade, nor more than 4 inches for each 10 feet of pole length after conductors are installed at required tension. When average ground run is level, consecutive poles shall not vary more than 5 feet in height. When ground is uneven, poles differing in length shall be kept to a minimum by locating poles to avoid the highest and lowest ground points. If it becomes necessary to shorten a pole, a piece shall be sawed off the top. Holes shall be dug large enough to permit the proper use of tampers to full depth of hole.

3.1.1.7 Pole Caps

Provide plastic pole caps with 1/4 inch sealing rings and four nailing tabs. Fill sealing area with either a bituminous, elastigum roof cement or an acceptable preservative paste to level of sealing ring to eliminate possibility of condensation. Place on pole top and nail each tab down with a 1 1/4 inch nail.

3.1.2 Hardware

Provide hardware with washer against wood and with nuts and lock nuts applied wrench tight. Provide locknuts on threaded hardware connections. Locknuts shall be M-F style and not palnut style.

3.1.3 Grounding

Unless otherwise indicated, grounding shall conform to IEEE C2 and NFPA 70. Pole grounding electrodes shall have a resistance to ground not exceeding 25 ohms. When work in addition to that indicated or specified is directed in order to obtain specified ground resistance, provisions of the contract covering changes shall apply.

3.1.3.1 Grounding Electrode Installation

Grounding electrodes shall be installed as follows:

a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be located approximately 3 feetout from base of the pole and shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade. Multiple rods shall be evenly spaced at least 10 feet apart and connected together 2 feet below grade with a minimum No. 6 bare copper conductor.

3.1.3.2 Grounding Electrode Conductors

On multi-grounded circuits, as defined in IEEE C2, provide a single

continuous vertical grounding electrode conductor. Neutrals, surge arresters, and equipment grounding conductors shall be bonded to this conductor. For single-grounded or ungrounded systems, provide a grounding electrode conductor for the surge arrester and equipment grounding conductors and a separate grounding electrode conductor for the secondary neutrals. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet. On metal poles, a preformed galvanized steel strap, 5/8 inch wide by 22 gaugeminimum by length, secured by a preformed locking method standard with the manufacturer, shall be used to support a grounding electrode conductor installation on the pole and spaced at intervals not exceeding 5 feet with one band not more than 3 inches from each end of the vertical grounding electrode conductor. Grounding electrode conductors shall be sized as indicated. Secondary system neutral conductors shall be connected directly to the transformer neutral bushings, then connected with a neutral bonding jumper between the transformer neutral bushing and the vertical grounding electrode conductor as indicated. Bends greater than 45 degrees in grounding electrode conductor are not permitted.

3.1.3.3 Grounding Electrode Connections

Make above grade grounding connections on pole lines by exothermic weld or by using a compression connector. Make below grade grounding connections by exothermic weld. Make exothermic welds strictly in accordance with manufacturer's written recommendations. Welds which have puffed up or which show convex surfaces indicating improper cleaning, are not acceptable. No mechanical connectors are required at exothermic weldments. Compression connectors shall be type that uses a hydraulic compression tool to provide correct pressure. Provide tools and dies recommended by compression connector manufacturer. An embossing die code or similar method shall provide visible indication that a connector has been fully compressed on ground wire.

3.1.3.4 Grounding and Grounded Connections

a. When a primary or common neutral exists, connect all grounding and grounded conductors to a common grounding electrode.

3.1.3.5 Protective Molding

Protect grounding conductors which are run on surface of wood poles by PVC molding extending from ground line throughout communication and transformer spaces.

3.1.4 CONDUCTOR INSTALLATION

3.1.4.1 Line Conductors

Conductors shall be handled with care necessary to prevent nicking, kinking, gouging, abrasions, sharp bends, cuts, flattening, or otherwise deforming or weakening conductor or any damage to insulation or impairing its conductivity. Remove damaged sections of conductor and splice conductor. Conductors shall be paid out with the free end of conductors fixed and cable reels portable, except where terrain or obstructions make this method unfeasible. Bend radius for any insulated conductor shall not be less than the applicable NEMA specification recommendation. Conductors shall not be drawn over rough or rocky ground, nor around sharp bends. When installed by machine power, conductors shall be drawn from a mounted reel through stringing sheaves in straight lines clear of obstructions.

Initial sag and tension shall be checked by the Contractor, in accordance with the manufacturer's approved sag and tension charts, within an elapsed time after installation as recommended by the manufacturer.

3.1.4.2 Connectors and Splices

Conductor splices, as installed, shall exceed ultimate rated strength of conductor and shall be of type recommended by conductor manufacturer. No splice shall be permitted within 10 feet of a support. Connectors and splices shall be mechanically and electrically secure under tension and shall be of the nonbolted compression type. The tensile strength of any splice shall be not less than the rated breaking strength of the conductor. Splice materials, sleeves, fittings, and connectors shall be noncorrosive and shall not adversely affect conductors. Aluminum-composition conductors shall be wire brushed and an oxide inhibitor applied before making a compression connection. Connectors which are factory-filled with an inhibitor are acceptable. Inhibitors and compression tools shall be of types recommended by the connector manufacturer. Primary line apparatus taps shall be by means of hot line clamps attached to compression type bail clamps (stirrups). Low-voltage connectors for copper conductors shall be of the solderless pressure type. Noninsulated connectors shall be smoothly taped to provide a waterproof insulation equivalent to the original insulation, when installed on insulated conductors. On overhead connections of aluminum and copper, the aluminum shall be installed above the copper.

3.1.4.3 Conductor-To-Insulator Attachments

Conductors shall be attached to insulators by means of clamps, shoes or tie wires, in accordance with the type of insulator. For insulators requiring conductor tie-wire attachments, tie-wire sizes shall be as specified in TABLE I.

TABLE I

TIE-WIRE REQUIREMENTS

CONDUCTOR Copper (AWG)	TIE WIRE Soft-Drawn Copper (AWG)
6	8
4 and 2	6
1 through 3/0	4
4/0 and larger	2
AAC, AAAC, or ACSR (AWG)	AAAC OR AAC (AWG)
Any size	6 or 4

3.1.4.4 Ties

Provide ties on pin insulators tight against conductor and insulator and ends turned down flat against conductor so that no wire ends project.

3.1.4.5 Reinstalling Conductors

Existing conductors to be reinstalled or resagged shall be strung to "final" sag table values indicated for the particular conductor type and

size involved.

3.1.4.6 Fittings

Dead end fittings, clamp or compression type, shall conform to written recommendations of conductor manufacturer and shall develop full ultimate strength of conductor.

3.1.5 Sectionalizer

Install sectionalizer(s) strictly in accordance with manufacturer's instructions.

3.1.6 Risers

Secure galvanized steel conduits on poles by two hole galvanized steel pipe straps spaced as indicated and within 3 feet of any outlet or termination. Ground metallic conduits.

3.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.3 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FIELD QUALITY CONTROL

3.4.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 5 days prior to conducting tests. The Contractor shall furnish materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field reports will be signed and dated by the Contractor.

3.4.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.4.3 Medium-Voltage Preassembled Cable Test

After installation, prior to connection to an existing system, and before the operating test, the medium-voltage preassembled cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors at one terminal and connecting grounds or metallic shieldings or sheaths of the cable at the other terminal for each test. Prior to the test, the cables shall be

isolated by opening applicable protective devices and disconnecting equipment. The method, voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with NEMA WC 74/ICEA S-93-639 for the particular type of cable installed, and shall not exceed the recommendations of IEEE 404 for cable joints unless the cable and accessory manufacturers indicate higher voltages are acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper installation of cable, cable joints, terminations, or other connections, the Contractor shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

3.4.4 Sag and Tension Test

The Contracting Officer shall be given prior notice of the time schedule for stringing conductors or cables serving overhead medium-voltage circuits and reserves the right to witness the procedures used for ascertaining that initial stringing sags and tensions are in compliance with requirements for the applicable loading district and cable weight.

3.4.5 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.4.5.1 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

3.4.6 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least three times, demonstrating satisfactory operation each time.

3.4.7 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating

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condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

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SECTION 33 71 02.00 20

UNDERGROUND ELECTRICAL DISTRIBUTION
03/13

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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges
AASHTO M 198	(2010) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318M	(2011; Errata 2011; Errata 2012) Building Code Requirements for Structural Concrete & Commentary
ACI SP-66	(2004) ACI Detailing Manual

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS8	(2000) Extruded Dielectric Shielded Power Cables Rated 5 Through 46 kV

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B3	(2001; R 2007) Standard Specification for Soft or Annealed Copper Wire
ASTM B496	(2004; E 2010; R 2010) Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM B8	(2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C478	(2012a) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C857	(2012a) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM F512	(2012) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 386	(2006; INT 1 2011) Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V
IEEE 400.2	(2004) Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)
IEEE 404	(2012) Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500,000 V
IEEE 48	(2009) Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
IEEE 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2012; Errata 2012; INT 1 2012; INT 2 2012; INT 3 2012) National Electrical Safety Code

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2009) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C119.1	(2011) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI/NEMA WC 71/ICEA S-96-659	(1999) Standard for Nonshielded Cables Rated 2001-5000 Volts for use in the Distribution of Electric Energy

NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 6 & 8	(2003) Standard for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations
NEMA TC 9	(2004) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation
NEMA WC 70	(2009) Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy--S95-658
NEMA WC 74/ICEA S-93-639	(2006) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011; Errata 2 2012) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

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

UNDERWRITERS LABORATORIES (UL)

UL 1072	(2006; Reprint Oct 2012) Medium-Voltage Power Cables
UL 1242	(2006; Reprint Jul 2012) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 44	(2010) Thermoset-Insulated Wires and Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2003; Reprint Feb 2010) Wire Connectors
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514B	(2012) Conduit, Tubing and Cable Fittings
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 651	(2011; Reprint Mar 2012) Standard for

	Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 83	(2008) Thermoplastic-Insulated Wires and Cables
UL 854	(2004; Reprint Sep 2011) Standard for Service-Entrance Cables

1.2 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast underground structures; G

SD-03 Product Data

Medium voltage cable; G

Medium voltage cable joints; G

Medium voltage cable terminations; G

Precast concrete structures; G

Sealing Material

Handhole frames and covers; G

Cable supports (racks, arms and insulators); G

Pulling in irons; G

SD-06 Test Reports

Arc-proofing test for cable fireproofing materials; G

Medium voltage cable qualification and production tests; G

Field Acceptance Checks and Tests; G

Arc-proofing test for cable fireproofing tape; G

Cable Installation Plan and Procedure

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Public Utility - Electrical Contractor's License; G

Cable splicer/terminator; G

Cable Installer Qualifications

1.4 QUALITY ASSURANCE

1.4.1 Utility Contractor Qualifications

The Contractor must possess a valid North Carolina Public Utility - Electrical Contractor's License or equivalent from another state and be insured to do such work.

1.4.2 Precast Underground Structures

Submittal required for each type used. Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered professional engineer including:

a. Material description (i.e., f'c and Fy)

b. Manufacturer's printed assembly and installation instructions

c. Design calculations

d. Reinforcing shop drawings in accordance with ACI SP-66

e. Plans and elevations showing opening and pulling-in iron locations and details

1.4.3 Certificate of Competency for Cable Splicer/Terminator

Certification of the qualification of the cable splicer/terminator shall be submitted, for approval, 30 days before splices or terminations are to be made in medium voltage (5 kV to 35 kV) cables. The certification shall include the training, and experience of the individual on the specific type and classification of cable to be provided under this contract. The certification shall indicate that the individual has had three or more years recent experience splicing and terminating medium voltage cables. The certification shall also list a minimum of three splices/terminations that have been in operation for more than one year. In addition, the individual may be required to perform a dummy or practice splice/termination in the presence of the Contracting Officer, before being approved as a qualified cable splicer. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice/termination kit, and detailed manufacturer's instructions for the cable to be spliced. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for certification of an alternate cable splicer.

1.4.4 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

1.4.5 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.6 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.6.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is

furnished.

1.4.6.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6.

2.1.2 Intermediate Metal Conduit

UL 1242.

2.1.3 Plastic Conduit for Direct Burial

UL 651,Schedule 40 or Schedule 80NEMA TC 2, EPC-40-PVC or EPC-80-PVC.

2.1.4 Plastic Duct for Concrete Encasement

NEMA TC 6 & 8 and ASTM F512, UL 651, EPC-40-PVC.

2.1.5 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials. Inflatable bladders may be used as an option.

2.1.6 Fittings

2.1.6.1 Metal Fittings

UL 514B.

2.1.6.2 PVC Conduit Fittings

UL 514B, UL 651.

2.1.6.3 PVC Duct Fittings

NEMA TC 9.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors shall be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements, or in accordance with NEMA WC 70. Wires and cables manufactured more than 24 months prior

to date of delivery to the site shall not be accepted. Service entrance conductors shall conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. All conductors shall be copper.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, shall be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW or RHW conforming to UL 44. Copper conductors shall be annealed copper complying with ASTM B3 and ASTM B8. Type EC/1350 is not acceptable. Intermixing of copper and aluminum conductors is not permitted.

2.2.3 In Duct

2.2.4 Cable Marking

Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Each cable shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Control circuit terminations shall be properly identified. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows

a. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Shall provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply ANSI C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation shall not require heat or flame, or any additional materials such as covering or adhesive. It shall be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 MEDIUM VOLTAGE CABLE

Cable (conductor) sizes are designated by American Wire Gauge (AWG) and Thousand Circular Mils (Kcmil). Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than 24 months prior to date of delivery to the site shall not be accepted. Provide single conductor type cables unless otherwise indicated.

2.5.1 Cable Configuration

Provide Type MV cable, conforming to NEMA WC 74/ICEA S-93-639 and UL 1072. Provide cables manufactured for use in duct applications . Cable shall be rated 15 kV with 100 percent insulation level.

2.5.2 Conductor Material

Provide concentric-lay-stranded, Class B compact round conductors. Provide soft drawn copper cables complying with ASTM B3 and ASTM B8 for regular concentric and compressed stranding or ASTM B496 for compact stranding.

2.5.3 Insulation

Provide ethylene-propylene-rubber (EPR) insulation conforming to the requirements of ANSI/NEMA WC 71/ICEA S-96-659 and AEIC CS8 tree-retardant cross-linked thermosetting polyethylene (XLP) insulation conforming to the requirements of NEMA WC 74/ICEA S-93-639 and AEIC CS8.

2.5.4 Shielding

Cables rated for 2 kV and above shall have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper tape shield for each phase.

2.5.5 Neutrals

Neutral conductors of shall be copper, employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is acceptable.

2.5.6 Jackets

Provide PVC jackets with a separator that prevents contact when underlying semiconducting insulating shield.

2.6 MEDIUM VOLTAGE CABLE TERMINATIONS

IEEE 48 Class 1; of the molded elastomer, prestretched elastomer, or heat-shrinkable elastomer. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, or armor. Terminations shall be provided in a kit, including: skirts, stress control terminator, ground clamp, connectors, lugs, and complete instructions for assembly and installation. Terminations shall be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated. Do not use separate parts of copper or copper alloy in contact with aluminum alloy parts in the construction or installation of the terminator.

2.6.1 Cold-Shrink Type

Terminator shall be a one-piece design, utilizing the manufacturer's latest technology, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber. Termination shall not require heat or flame for installation. Termination kit shall contain all necessary materials (except for the lugs). Termination shall be designed for installation in low or highly contaminated indoor and outdoor locations and shall resist ultraviolet rays and oxidative decomposition.

2.6.2 Heat Shrinkable Type

Terminator shall consist of a uniform cross section heat shrinkable polymeric construction stress relief tubing and environmentally sealed outer covering that is nontracking, resists heavy atmospheric contaminants, ultra violet rays and oxidative decomposition. Provide heat shrinkable sheds or skirts of the same material. Termination shall be designed for installation in low or highly contaminated indoor or outdoor locations.

2.6.3 Separable Insulated Connector Type

IEEE 386. Provide connector with steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material. Provide connectors of the loadbreak or deadbreak type as indicated, of suitable construction for the application and the type of cable connected, and that include cable shield adaptors. Provide external clamping points and test points.

a. 200 Ampere loadbreak connector ratings: Voltage: 15 kV, 95 kV BIL. Short time rating: 10,000 rms symmetrical amperes.

2.7 MEDIUM VOLTAGE CABLE JOINTS

Provide joints (splices) in accordance with IEEE 404 suitable for the rated voltage, insulation level, insulation type, and construction of the cable. Joints shall be certified by the manufacturer for waterproof, submersible applications. Upon request, supply manufacturer's design qualification test report in accordance with IEEE 404. Connectors for joint shall be tin-plated electrolytic copper, having ends tapered and having center stops to equalize cable insertion.

2.7.1 Heat-Shrinkable Joint

Consists of a uniform cross-section heat-shrinkable polymeric construction with a linear stress relief system, a high dielectric strength insulating material, and an integrally bonded outer conductor layer for shielding. Replace original cable jacket with a heavy-wall heat-shrinkable sleeve with hot-melt adhesive coating.

2.7.2 Cold-Shrink Rubber-Type Joint

Joint shall be of a cold shrink design that does not require any heat source for its installation. Splice insulation and jacket shall be of a one-piece factory formed cold shrink sleeve made of black EPDM rubber. Splice shall be packaged three splices per kit, including complete installation instructions.

2.8 TAPE

2.8.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.8.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL

2.9 PULL ROPE

Shall be plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.10 GROUNDING AND BONDING

2.10.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.10.2 Grounding Conductors

Stranded-bare copper conductors shall conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors shall conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors shall

be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Aluminum is not acceptable.

2.11 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C857 and ASTM C478. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.

2.11.1 Precast Concrete Structures, Risers and Tops

In lieu of cast-in-place, Contractors, at their option, may provide precast concrete underground structures subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.11.1.1 General

Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.11.1.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads shall include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads shall consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load shall be for H20 highway loading per AASHTO HB-17.

f. Horizontal design loads shall include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, shall be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component shall be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

h. Design shall also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.11.1.3 Construction

Structure top, bottom, and wall shall be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as directed, and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.11.1.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M 198, Type B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.11.2 Handhole Frames and Covers

Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rolled-steel floor plate having an approved antislip surface. Hinges shall be of stainless steel with bronze hinge pin, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and shall be for full surface

application by fillet welding. Hinges shall have nonremovable pins and five knuckles. The surfaces of plates under hinges shall be true after the removal of raised antislip surface, by grinding or other approved method.

2.12 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

The metal portion of racks and arms shall be zinc-coated after fabrication.

2.12.1 Cable Racks

The wall bracket shall be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, 48 inches long (minimum) in manholes. Slots for mounting cable rack arms shall be spaced at 8 inch intervals.

2.12.2 Rack Arms

Cable rack arms shall be steel or malleable iron or glass reinforced nylon and shall be of the removable type. Rack arm length shall be a minimum of 8 inches and a maximum of 12 inches.

2.12.3 Insulators

Insulators for metal rack arms shall be dry-process glazed porcelain. Insulators are not required for nylon arms.

2.13 SOURCE QUALITY CONTROL

2.13.1 Arc-Proofing Test for Cable Fireproofing Tape

Manufacturer shall test one sample assembly consisting of a straight lead tube 12 inches long with a 2 1/2 inch outside diameter, and a 1/8 inch thick wall, and covered with one-half lap layer of arc and fireproofing material per manufacturer's instructions. The arc and fireproofing tape shall withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode shall be obtained from a dc power source of 305 (plus or minus 5) amperes and 20 (plus or minus 1) volts. The arc shall be directed toward the sample assembly accurately positioned 5 (plus or minus 1) millimeters downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Each sample assembly shall be tested at three unrelated points. Start time for tests shall be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time shall be minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape shall indicate that the test has been performed and passed by the manufacturer.

2.13.2 Medium Voltage Cable Qualification and Production Tests

Results of AEIC CS8 qualification and production tests as applicable for each type of medium voltage cable.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758 and RUS Bull 1751F-644.

3.2 CABLE INSPECTION

Prior to installation, each cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable prior to installation in accordance with the cable manufacturer's recommendations.

3.3 CABLE INSTALLATION PLAN AND PROCEDURE

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. The Contractor shall then prepare a checklist of significant requirements which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS. Cable shall be installed strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

3.4 UNDERGROUND STRUCTURE CONSTRUCTION

Provide standard type cast-in-place construction as specified herein and as indicated, or precast construction as specified herein. Horizontal concrete surfaces of floors shall have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound shall conform to ASTM C309. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures shall fit the frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete.

3.4.1 Precast Concrete Construction

Set commercial precast structures on 6 inches of level, 90 percent compacted granular fill, 3/4 inch to 1 inch size, extending 12 inches beyond the structure on each side. Compact granular fill by a minimum of four passes with a plate type vibrator. Installation shall additionally conform to the manufacturer's instructions.

3.4.2 Pulling-In Irons

Provide steel bars bent as indicated, and cast in the walls and floors.

Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices shall be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor the irons shall be a minimum of 6 inches from the edge of the sump, and in the walls the irons shall be located within 6 inches of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron shall not be located within 6 inches of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the 6 inch clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 3 foot length of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner shall be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 3 inches from any edge of the cast-in-place duct bank envelope or any individual duct. Pulling-in irons shall have a clear projection into the structure of approximately 4 inches and shall be designed to withstand a minimum pulling-in load of 6000 pounds. Irons shall be hot-dipped galvanized after fabrication.

3.4.3 Cable Racks, Arms and Insulators

Cable racks, arms and insulators shall be sufficient to accommodate the cables. Racks in power manholes shall be spaced not more than 3 feet apart, and each manhole wall shall be provided with a minimum of two racks. Racks in signal manholes shall be spaced not more than 16 1/2 inches apart with the end rack being no further than 12 inches from the adjacent wall. Methods of anchoring cable racks shall be as follows:

a. Provide a 5/8 inch diameter by 5 inch long anchor bolt with 3 inch foot cast in structure wall with 2 inch protrusion of threaded portion of bolt into structure. Provide 5/8 inch steel square head nut on each anchor bolt. Coat threads of anchor bolts with suitable coating immediately prior to installing nuts.

b. Provide concrete channel insert with a minimum load rating of 800 pounds per foot. Insert channel shall be steel of the same length as "vertical rack channel;" channel insert shall be cast flush in structure wall. Provide 5/8 inch steel nuts in channel insert to receive 5/8 inch diameter by 3 inch long steel, square head anchor bolts.

c. Provide concrete "spot insert" at each anchor bolt location, cast flush in structure wall. Each insert shall have minimum 800 pound load rating. Provide 5/8 inch diameter by 3 inch long steel, square head anchor bolt at each anchor point. Coat threads of anchor bolts with suitable coating immediately prior to installing bolts.

3.4.4 Field Painting

Cast-iron frames and covers not buried in concrete or masonry shall be

cleaned of mortar, rust, grease, dirt and other deleterious materials, and given a coat of bituminous paint.

3.5 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.5.1 Requirements

Depths to top of the conduit shall be in accordance with NFPA 70. Run conduit in straight lines except where a change of direction is necessary. Numbers and sizes of ducts shall be as indicated. Ducts shall have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 3 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in structures.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.5.4 Jacking and Drilling Under Roads and Structures

Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, shall be zinc-coated, rigid steel, jacked into place.Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete,

plastic, or a combination of these materials placed not farther apart than 4 feet on centers.

3.5.5 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations shall be PVC coated and shall extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.5.6 Multiple Conduits

Separate multiple conduits by a minimum distance of 2 1/2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.5.7 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.5.8 Conduit and Duct Without Concrete Encasement

Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Provide color, type and depth of warning tape as specified in Section 31 23 00.00 20 EXCAVATION AND FILL.

3.5.8.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks.

3.5.9 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 1/2 inches, except separate light and power conduits from control, signal, and telecommunications conduits by a minimum concrete thickness of 3 inches.

Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring shall be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide color, type and depth of warning tape as specified in Section 31 23 00.00 20 EXCAVATION AND FILL.

3.5.9.1 Connections to Handholes

Duct bank envelopes connecting to underground structures shall be flared to have enlarged cross-section at the handhole entrance to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding handhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure shall be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

3.6 CABLE PULLING

Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with tape shield shall have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.6.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.7 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.8 CONDUCTORS INSTALLED IN PARALLEL

Conductors shall be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.9 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing

material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes,handholes, or aboveground termination cabinets.

3.10 MEDIUM VOLTAGE CABLE TERMINATIONS

Make terminations in accordance with the written instruction of the termination kit manufacturer.

3.11 MEDIUM VOLTAGE CABLE JOINTS

Provide power cable joints (splices) suitable for continuous immersion in water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions of the joint kit manufacturer.

3.11.1 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods shall be as specified elsewhere in this section. Wire shall be trained to the sides of the enclosure to prevent interference with the working area.

3.12 CABLE END CAPS

Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables ends shall be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps shall remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.13 FIREPROOFING OF CABLES IN UNDERGROUND STRUCTURES

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in underground structures.

3.13.1 Fireproofing Tape

Tightly wrap strips of fireproofing tape around each cable spirally in half-lapped wrapping. Install tape in accordance with manufacturer's instructions.

3.13.2 Tape-Wrap

Tape-wrap metallic-sheathed or metallic armored cables without a nonmetallic protective covering over the sheath or armor prior to application of fireproofing. Wrap shall be in the form of two tightly applied half-lapped layers of a pressure-sensitive 10 mil thick plastic tape, and shall extend not less than one inch into the duct. Even out irregularities of the cable, such as at splices, with insulation putty before applying tape.

3.14 GROUNDING SYSTEMS

Provide grounding system as indicated, in accordance with NFPA 70 and IEEE C2, and as specified herein.

Noncurrent-carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid earth ground not exceeding the following values:

Pad-mounted transformers without protective fences	5 ohms
Grounding other metal enclosures of primary voltage electrical and electrically-operated equipment	5 ohms

3.14.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.
If the specified ground resistance is not met, an additional ground rod shall be provided in accordance with the requirements of NFPA 70 (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.14.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.14.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.14.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.14.5 Fence Grounding

Fences shall be grounded with a ground rod at each fixed gate post and at each corner post. Drive ground rods until the top is 12 inches below grade. Attach a No. 4 AWG copper conductor, by exothermic weld to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 12 inches of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence. Each gate section shall be bonded to its gatepost by a 1/8 by one inch flexible braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

3.15 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 23 00.00 20 EXCAVATION AND FILL.

3.15.1 Reconditioning of Surfaces

3.15.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct . Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.16 FIELD QUALITY CONTROL

3.16.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.16.1.1 Medium Voltage Cables

Perform tests after installation of cable, splices, and terminators and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Inspect for proper shield grounding, cable support, and cable termination.

(4) Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius.

(5) Inspect for proper fireproofing.

(6) Visually inspect jacket and insulation condition.

(7) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform a shield continuity test on each power cable by ohmmeter method. Record ohmic value, resistance values in excess of 10 ohms per 1000 feet of cable must be investigated and justified.

(2) Perform acceptance test on new cables before the new cables are connected to existing cables and placed into service, including terminations and joints. Perform maintenance test on complete cable system after the new cables are connected to existing cables and placed into service, including existing cable, terminations, and joints. Tests shall be very low frequency (VLF) alternating voltage withstand tests in accordance with IEEE 400.2. VLF test frequency shall be 0.05 Hz minimum for a duration of 60 minutes using a sinusoidal waveform. Test voltages shall be as follows:

CABLE RATING	AC TEST VOLTAGE for ACCEPTANCE TESTING
5 kV	10kV rms(peak)
8 kV	13kV rms(peak)
15 kV	20kV rms(peak)
25 kV	31kV rms(peak)
35 kV	44kV rms(peak)

CABLE RATING	AC TEST VOLTAGE for MAINTENANCE TESTING
5 kV	7kV rms(peak)
8 kV	10kV rms(peak)
15 kV	16kV rms(peak)
25 kV	23kV rms(peak)
35 kV	33kV rms(peak)

3.16.1.2 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potentialmethod in accordance with IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable megohmmeter tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

3.16.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating

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condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

APPENDIX A

HYDROGEOLOGIC REPORT
FOR
LANDFILL SITE

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ECS CAROLINAS, LLP
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November 8, 2013

Ms. Anna Lee Bamforth
C. Allan Bamforth, PE, LS
2207 Hampton Blvd
Norfolk, VA 23571

ECS Project No. 22.18460

Reference: Revisions to Report
Phase IV
Municipal Solid Waste Landfill Expansion
U.S.M.C.B. Camp Lejeune, North Carolina

Dear Ms. Bamforth:

As requested, ECS has made the following revisions to the report.

1. For the Phase IV
   A. *The report dated 9 April 2013 first page header states that it is for Phase III when it is for Phase IV, and "CAMPO" should read CAMP".* The corrections were made to the report

   B. *In the 9 April report para. 1.3 deleted the word "site" after the word "subject". Please amend.* The corrections were made to the report

   C. *In the 9 April report para. 3.5.1 reference is made to ECS having an on-site meeting with the NCDENR rep. Please provide a date for this meeting. Also, please verify that "Figures 10" should not be "Figures 10 and 11". Also, please state the methodology used to determine the SHWT with the NCDENR rep. Please state if the NCDENR rep witnessed and concurred with the determinations.* The paragraph in section 3.5.1 was updated to clarify these issues.

   D. There is no mention of organic matter (forest litter, rootmat, etc.) in any the soil borings. Para 7.1 of the report states a general assumption. Please amend the paragraph to be specific to this site. Revise the logs to address the observed conditions. The paragraph in section 7.1 was updated for observed conditions

   E. *Please state the following information for the Infiltration tests of Appendix IV – test method, apparatus used, specific measurements, etc.* A constant head permeameter was used. The paragraph in section 3.5.1 was updated to clarify these issues.

   F. Para. 7.3 states that you will provide additional stability evaluations after the liner system and cap designs have been selected. We would like to discuss this further via conference call – the liner system and cap design have not changed from the prior phase. Stability analysis were performed with the stone and clay line and the results were included in the report in section 7.3.2

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G. *Para. 7.3.1 assumes that we have fill material with a phi value of 32 degrees and a moist unit weight of 125 pcf. Material is likely to come from the Base French Creek Borrow Pit (we understand that previous landfill phases have used this material). We will shortly have data from previous various projects on the properties of this borrow material, and will need to verify that the typical properties will not invalidate any recommendations made in your report. We would like to discuss this further via conference call.* Laboratory data on the soils from French Creek were reviewed and deemed acceptable.

H. *Para. 7.1 states that most of the on-site soils that are sandy (up to approximately 40% fines) can be used for embankment fill. Some of the classified soils in the report have slightly above 40 %. Will the 40% fine material meet the 32 degree phi requirement? Please verify the value for fines %, or atterberg limits, that we need to specify for embankment fill.* The paragraph in section 7.1 was updated to address these issues.

I. *It is anticipated that the customer will ask if the waste fill embankment can be extended to a 70 feet height. Request that an analysis be performed to address the stability and settlement if this is done. We would like to discuss this further via conference call.* Additional stability analysis were performed for a 70 foot height with a slope of 3:1 and the higher unit weight with the new compactor rating of 1400 pounds per cubic yard.

1. For the Recycling Faciity –
   A. *Please provide a revised report for the most recent test pit investigation to replace that of 3 July 2013.*
      a. *Request visual classification of soils iaw ASTM D 2487 supplemented with lab tests. Requested atterberg limits and gradations.*
      b. *Please describe the uppermost material (max dimension of fragments) and "organic grindings" in the logs.*
      c. *Please state the equipment, such as a medium capacity backhoe, excavator, backhoe with ripper teeth, etc., used for digging the pits.*
      d. *For the samples taken on the subgrade soils, request two CBRs (ASTM D 1557) be performed.*

      Report was revised to address issues dated October 9, 2013
   B. *The project involves excavation to approximately 10 feet for a sanitary line. Winslow has stated to Darrell Bryan in a phonecon that there may exist in your files a soil boring in the vicinity of the Recycling Facility that we may find useful for stating the groundwater data and soil character to the depth required for excavation for this piping. Request that you inform us of the existence of this data and applicability. .*
      Report dated October 9, 2013 addresses this issue.

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Respectfully Submitted,

ECS Carolinas, LLC

Winslow E. Goins, P.E.
Engineering Department Manager

Kris Stamm
Principal

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ECS CAROLINAS, LLP
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November 6, 2013

Ms. Anna Lee Bamforth
C. Allan Bamforth, PE, LS
2207 Hampton Blvd
Norfolk, VA 23571

Re: Report of Pavement Analysis
Phase IV
Municipal Solid Waste Landfill Expansion
MCB Camp Lejeune, Onslow County, North Carolina

ECS Project No.: 22.18473

Dear Ms. Bamforth:

As requested, ECS has reviewed and revised the recommendations for the proposed landfill expansion

Case II – Global Stability

This analysis considers the overall stability of the embankment and the waste fill placed in conjunction with each other. We have considered similar properties to the existing landfill side slopes for performing this evaluation. We have considered a maximum waste fill depth of 70 feet and waste fill side slopes of 3:1 (horizontal to vertical) and a maximum embankment height of 25 feet with inside and outside side slopes of 3:1. We assumed the waste fill material will receive some effort of compaction while it is being placed. This is typically accomplished during the standard operation of spreading the waste fill while the cell is in production. We assumed a waste fill moist unit weight of 52 pcf, a cohesion of 500 psf, and an internal angle of friction (∅) of 10 degrees.

Utilizing these parameters, factors of safety of 1.69, 1.67, 2.20 were determined for embankment, global, and waste failures, respectively. We therefore recommend the waste fill embankment be constructed with an exterior sides slope of 3:1 for up to the maximum waste fill height of 70 ft.

ESTIMATED SETTLEMENTS

We have evaluated settlement of the constructed perimeter embankments and interior landfill cell due to the placement of new structural fill and waste fill. Settlement was estimated utilizing test boring data and laboratory test data. The soils underlying the project site generally consisted of sandy soils. However, we did encounter interbedded layers of clayey soils at varying locations and depths below the ground surface. Due to the apparent limited horizontal and vertical extent of the clay layers, we considered the overall settlement behavior to be modeled by the elastic deformation of granular soils for our settlement analysis. Additionally,

we assumed a perimeter embankment height of 25 feet with compacted structural fill unit weight of 125 pcf, and a maximum cell height of 70 feet with a waste fill unit weight of 52 pcf.

We have estimated settlement induced by the weight of the new perimeter embankment fill to be about 3 to 4 inches along the centerline of the embankment and about 1 inch at the toe of the embankment. We expect the settlement due to the weight of the new structural fill for the perimeter embankments to occur rapidly during construction. This settlement will occur prior to the installation the liner and leachate collection systems for the landfill. The quantity of fill estimated to construct the embankment should be increased to allow for this settlement. Once the landfill expansion is ready to accept waste, there will be additional settlement induced by the weight of the waste fill. The settlement due to the weight of the full height of the planned 70 feet of waste fill in the center of the landfill cell is estimated at about 3.5 to 6 inches.

Over the interior toe of the perimeter embankment, the waste fill height is reduced due to the slope of the fill. We estimate the settlement due to the waste fill to be less than 3 inches at this point. The settlement due to the continued placement of the waste fill is expected to occur over the extended period required to fill a cell. The overall differential settlement between the interior toe of the perimeter embankments and the center of the waste fill is expected to be about 3 inches. Total and differential settlements induced by the waste fill must be considered when designing the elevation and slope of the leachate collection system and synthetic or compacted clay liner.

We appreciate the opportunity to be of service to you during the design phase of this project and look forward to our continued involvement during the construction phase. If you have any questions concerning the information and recommendations presented in this report, please contact us at (910) 686-9114 for further assistance.

Respectfully submitted,

ECS CAROLINAS, LLP

Winslow E. Goins, P.E.
Engineering Department Manager
North Carolina License No. 033751

Kris Stamm
Principal

General Conditions

The analysis, conclusions, and recommendations submitted in this report are based on the investigation previously outlined and the data collected at the points shown on the attached location plan. This report does not reflect specific variations that may occur between test locations. The borings were located where site conditions permitted and where it is believed representative conditions occur, but the full nature and extent of variations between borings and of subsurface conditions not encountered by any boring may not become evident until the course of construction. If variations become evident at any time before or during the course of construction, it will be necessary to make a re-evaluation of the conclusions and recommendations of this report and further exploration, observation, and/or testing may be required.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and makes no other warranties, either expressed or implied, as to the professional advice under the terms of our agreement and included in this report. The recommendations contained herein are made with the understanding that the contract documents between the owner and foundation or earthwork contractor or between the owner and the general contractor and the caisson, foundation, excavating and earthwork subcontractors, if any, shall require that the contractor certify that all work in connection with foundations, piles, caissons, compacted fills and other elements of the foundation or other support components are in place at the locations, with proper dimensions and plumb, as shown on the plans and specifications for the project.

Further, it is understood the contract documents will specify that the contractor will, upon becoming aware of apparent or latent subsurface conditions differing from those disclosed by the original soil investigation work, promptly notify the owner, both verbally to permit immediate verification of the change, and in writing, as to the nature and extent of the differing conditions and that no claim by the contractor for any conditions differing from those anticipated in the plans and specifications and disclosed by the soil studies will be allowed under the contract unless the contractor has so notified the owner both verbally and in writing, as required above, of such changed conditions. The owner will, in turn, promptly notify this firm of the existence of such unanticipated conditions and will authorize such further investigation as may be required to properly evaluate these conditions.

Further, it is understood that any specific recommendations made in this report as to on-site construction review by this firm will be authorized and funds and facilities for such review will be provided at the times recommended if we are to be held responsible for the design recommendations.

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ECS CAROLINAS, LLP

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October 4, 2013

Ms. Anna Lee Bamforth
C. Allan Bamforth, PE, LS
2207 Hampton Blvd
Norfolk, VA 23571

ECS Project No. 22.18460

Reference: Design Hydrologic Report Revised
Phase IV
Municipal Solid Waste Landfill Expansion
U.S.M.C.B. Camp Lejeune, North Carolina

Dear Ms. Bamforth:

ECS Carolinas, LLC (ECS) is pleased to submit the following hydrologic assessment for the Phase IV area of the Camp Lejeune Landfill. Attached, please find a copy of the Design Hydrologic Report describing site conditions as they relate to the fourth phase of the landfill.

If there are any questions or comments regarding the contents of this report, or if there is need for further information, please feel free to contact us at 910-686-9114.

Respectfully Submitted,

ECS Carolinas, LLC

Winslow E. Goins, P.E.
Engineering Department Manager

John Stewart, P.G.
Vice President, Principal Geologist

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DESIGN HYDROGEOLOGIC REPORT
GEOTECHNICAL ENGINEERING ANALYSIS
MCB CAMP LEJEUNE, NORTH CAROLINA

PREPARED FOR:

MS. ANNA LEE BAMFORTH, P.E.
C.ALLAN BAMFORTH, JR. ENGINEER-SURVEYOR, LTD.
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PREPARED BY:

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ECS CAROLINAS, LLP PROJECT NO.: 22.18460

FIRM NO. F-1078

WINSLOW E. GOINS, P.E.

NC LICENSE NO. 033751

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DESIGN HYDROLOGIC REPORT
PHASE IV CONSTRUCTION
CAMP LEJEUNE LANDFILL
CAMP LEJEUNE, NORTH CAROLINA

ECS PROJECT NO. 22.18640

1.0 INTRODUCTION

1.1 Site Location

The Proposed Landfill Expansion Site is located in the north-central portion of Camp Lejeune Marine Corps Base in Onslow County, approximately ten miles southeast of Jacksonville, North Carolina. The subject site encompasses approximately 13 acres located immediately north-northeast of the existing Phase III of the landfill. The entire landfill site is bounded by Piney Green Road to the west and Wallace Creek to the north. Figure 1 depicts the site area with respect to the Jacksonville, North Carolina vicinity.

1.2 Project Background

As indicated, the subject site is situated adjacent northeast of the existing Phase III landfill at Camp Lejeune. A number of environmental studies have been completed in support of the siting and design of the Phase I, Phase II and Phase III of the existing landfill. The design Hydrologic Report for Phase I of the landfill was performed by S&ME, dated April 7, 1995. Phase II and III were performed by ECS Mid-Atlantic dated September 19, 2001 and April 9, 2008. That study referenced a site suitability study performed by Westinghouse Environmental and Geotechnical Services, Inc. dated August 1991. The study included the installation of six soil borings and two monitoring wells. The study concluded that the site appeared to be favorable for the construction of a landfill.

The S&ME design hydrological report included the installation of twenty-three soil test borings, seventeen piezometers and ten monitoring wells for the Phase I portion of the landfill. That study concluded that, based upon the hydrogeologic conditions present, the site was suitable for the proposed construction. That study referenced a site suitability study performed by Westinghouse Environmental and Geotechnical Services, Inc. dated August 1991. The study included the installation of six soil borings and two monitoring wells. The study concluded that the site appeared to be favorable for the construction of a landfill.

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The ECS design Hydrological Report performed for Phase II of the landfill, dated September 19, 2001 included the installation of thirty-three soil test borings. Twenty-seven of these borings were drilled within the general limits of the Phase II expansion and converted to piezometers. Four of the piezometers were installed to a depth of 80 feet below land surface with the remaining installed to 25 feet bls. That study concluded that, based upon the geotechnical and hydrogeological conditions present on-site, the site was suitable for expansion for Phase II of the landfill.

The ECS design Hydrological Report performed for Phase III of the landfill, dated March 20, 2008 included the installation of twenty-nine soil test borings. Twenty-eight of these borings were drilled within the general limits of the Phase III expansion and converted to piezometers. Four of the piezometers were installed to a depth of 80 feet below land surface with the remaining installed to 22 feet bls. That study concluded that, based upon the geotechnical and hydrogeological conditions present on-site, the site was suitable for expansion for Phase III of the landfill.

1.3 Current Site Usage

The proposed Phase IV expansion site currently exists as an unimproved, moderately forested parcel with young growth coniferous and deciduous trees. The subject site abuts Phase III of the landfill along its southeastern boundary. The eastern fringe of the subject is currently forested and used as an obstacle course for military physical training (PT). The northern fringe of the subject site is currently being used as a soil stockpile facility and was formerly used for military training activities, specifically mine sweeping and PT.

2.0 REGIONAL AND SITE CONDITIONS

2.1 Physiographic Setting/Regional Geology

The site is located in the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain is composed of seven terraces, each representing a former level of the Atlantic Ocean. Soils in this area generally consist of sedimentary materials transported from other areas by the ocean or rivers. These deposits vary in thickness from a thin veneer along the western edge of the region to more than 10,000 feet near the coast. The sedimentary deposits of the Coastal Plain rest upon consolidated rocks similar to those underlying the Piedmont and Mountain Physiographic Provinces. In general, shallow unconfined groundwater movement within the overlying soils is largely controlled by topographic gradients. Recharge occurs primarily by infiltration along higher elevations and typically discharges into streams or other surface water bodies. The elevation of the shallow water table is transient and can vary greatly with seasonal fluctuations in precipitation.

2.2 Regional Hydrogeology

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The Onslow County area is underlain by seven sand and limestone aquifers. The aquifers are separated by less permeable clay and silt beds that function as confining or semi-confining units that impede the flow of groundwater between adjacent aquifers. The surficial aquifer and the Castle Hayne aquifer are of economic importance as potential water supply sources within the county. The Beaufort aquifer and other aquifers, underlying the Castle Hayne, contain excessive chlorides for use as a source of potable water.

3.0 SITE CONDITIONS

3.1 SURFACE WATER HYDROLOGY OF THE SITE

The Phase IV Landfill site is located in the New River Drainage Basin. It is drained by Wallace Creek and Bear Head Creek, two tributaries of the New River. Wallace Creek is located approximately 1,400 feet north of the site and Bear Head Creek is located approximately 2,500 feet south of the subject site's southern boundary (Figure 1). Bear Head Creek confluences with Wallace Creek approximately 1.0 miles west of the subject site. Wallace Creek flows westward and confluences with the New River approximately 2.0 miles west of the subject site. The New River empties into the Atlantic Ocean through the New River Inlet, approximately twelve miles south of the subject site area. Both of the aforementioned streams are groundwater discharge points as their base flow is attributable to the influx of groundwater. Both Wallace Creek and Bear Head Creek in the vicinity of the subject site are classified by the State of North Carolina as SB Class Waters.

3.2 SITE TOPOGRAPHY AND SURFACE DRAINAGE

3.2.1 Site Topography

The subject site exhibits approximately 10 feet of topographic relief (Figure 3). The highest natural ground elevations occur within the southwestern portion of the subject site area, ranging between 36 and 38 feet (NAVD 88). The ground surface slopes gently downward to the east-northeast to elevation 28 (B-2). The ground surface is generally flat with the exceptions of several small depressions and wooded rises located in the center and northern portions of the site.

3.2.2 Site Drainage

The site is located within the drainage basin of Wallace Creek and a tributary, Bear Head Creek, which flows into Wallace Creek west of the site. Wallace Creek flows to the west and confluences with the New River. The northernmost portions of the site appear to drain to the east-northeast into Wallace Creek. The majority of the site appears to drain to the east-northeast into Bear Head Creek. No standing water was observed on-site during our study. Stormwater runoff is minimal due to the very sandy soils. Most precipitation infiltrates the ground surface.

3.2.3 Site Soil Characteristics

The United States Department of Agriculture (USDA) has mapped the major soil series occurring within Onslow County. Figure 4 shows a reproduction of a soil map generated from the USDA Web Soil Survey for the subject site, and depicts the aerial extent of the soil series mapped within the site area.

The Kureb series dominate throughout the subject site. Onslow and Baymeade series are present along the eastern perimeter. The Leon series is present on the western portion of the site. Mavyn series are along the northeastern perimeter.

The Kureb series soils (KuB) cover approximately 75% of the site area. The Kureb series is characterized by relatively light colored, excessively drained fine sand occurring on broad undulating ridges and short side slopes.

The Leon series soils (Ln) cover approximately 11% of the site area. The Leon series consist of poorly drained sandy soils occurring in Coastal Plain flatwoods. These are rated as hydric soils because of poor drainage, supporting forest vegetation.

The Baymeade series soil (BaB) cover approximately 7% of the site area. The Baymeade series consist of well drained fine sands.

The Marvyn series soils (MaC) cover approximately 4% of the site area. The Marvyn series consists of deep well drained upland soils. Subsoils are brown to light gray fine sandy clay.

The Onslow series soils (On) cover approximately 3% of the site area. They consist of moderately well drained sandy surface soil, on nearly level ground, underlain by somewhat clayey soils.

3.3 GEOLOGY OF THE SITE AREA

The soil borings performed at the site varied in termination depths from 25 feet to 80 feet. Based upon this, our interpretation of the site geology is based on the following:

- The work performed at the site;
- A review of available geologic literature pertaining to the site area;
- A review of the previously conducted S&ME Design Hydrologic Report For the Phase I portion of the landfill. This report incorporates geologic literature generated in a report prepared by Baker Environmental for the OU No. 2 site that exists across Piney Green Road to the west.
- A previously conducted Design Hydrogeologic Report for the Phase II and III portion of the landfill performed by ECS Mid-Atlantic, LLC.

Surficial soil conditions at the subject site were found to be generally similar to those identified at the Phase I Landfill Site, the Phase II Landfill site and the Phase III Landfill Site. Typically, surficial soils, considered to be within 40 feet of the ground surface consist of unconsolidated deposits of sand that range from relatively clean fine sand to silty or clayey fine sand. Occasional thin, discontinuous clay lenses are present in the sands.

Deeper soils were also found to be consistent to the 80 foot termination depth at the Phase III, Phase II and Phase I areas of the landfill. This report classified these soils as the "upper silty sand unit". This unit was described as ranging between 40 and 140 feet in thickness. The upper silty sand unit was reported as having discontinuous lenses of clay and limestone. No limestone was encountered in the 80 foot deep borings completed at the Phase IV subject site, or the Phase I, II or III landfill sites.

The S&ME report referenced two deep borings that were drilled just east of Piney Green Road that encountered predominantly sand to a depth of 115 feet. The sand was dense to very dense from approximately 75 feet. Limestone was encountered in the borings from 115 feet to 122 feet, where the boring was terminated.

The Baker report described a limestone unit present beneath the upper silty sand. This unit was reported to thin from 80 feet at the northern portion of OU No. 2 to five feet in thickness in the southern portion, across Piney Green Road from the subject site. The report described the limestone unit as being underlain by a lower silty sand unit.

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Camp Lejeune Marine base utilizes over 100 water supply wells. Well records data from well acceptance tests and Water Resources Investigations Report 89-4096, "Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina" by Harned, Lloyd and Treece were reviewed during this study.

The Castle Hayne formation is described in the referenced report as being composed primarily of sand and limestone. The upper half of the formation (aquifer) is unconsolidated sand and the lower half of the aquifer is a mix of consolidated to partially consolidated sand and limestone. Thin clay layers occur throughout. The total thickness ranges from 175 to 375 feet.

The Beaufort confining unit and Beaufort aquifer lie beneath the Castle Hayne aquifer. The confining unit is estimated to be between 10 and 15 feet thick and caps the Beaufort aquifer, estimated to be 25 feet thick.

The upper soils associated with the Castle Hayne formation are classified as undifferentiated deposits of Quaternary age. The underlying Cape Fear Formation is of Oligocene age and the Beaufort formation is of Paleocene age.

3.4 HYDROGEOLOGY OF THE SITE AREA

Surficial groundwater patterns for the landfill site area have been evaluated through a series of shallow piezometers and wells finished at depths of 40 feet or less. The depth to groundwater varies between less than two feet in the vicinity of Wallace Creek and Bear Head Creek to 25 feet in better drained portions of the landfill site and the OU No. 2 site. The depth to the water table generally corresponds to topographic variations of the various sites. Groundwater is closest to the ground surface in the north portion of the subject site (B-1) where a land depression exists.

Groundwater levels were obtained by measuring the depth to water from the top of the piezometer. The elevation of the top of the piezometer was determined by survey. Piezometer and water level information is summarized in Table 1. Figure 5 depicts groundwater elevations within the footprint of the proposed landfill site for February 7, 2013. Elevations are highest in the southwestern portion of the site (B-5). Groundwater flows radially away from this area to the north and northeast (Figure 7). It appears that the existing landfill is exerting some influence on the potentiometric surface along the southern boundary of the site where a bending affect occurs to the southeast. The depth to the water table is shown on cross-sections A to A' and B to B' (Figures 8 and 9). The cross-section locations are shown on Figure 10.

Although no deep piezometers or wells were installed on-site during the design work, deep groundwater flow patterns were evaluated from a network of deep monitoring wells primarily located in or around OU No. 2. The Baker report describes deep groundwater flow as having a resultant flow direction toward the west. Figure 6 is a photocopy from the Baker Report depicting deep groundwater flow at the OU No. 2 site. This figure presents groundwater elevations taken on October 26, 1992 from the deep wells. Deep groundwater flow is toward the west at an average gradient of 0.005 feet per foot. Along the north end of the OU No. 2 site, the contours bend toward Wallace Creek denoting discharge into the creek. Slight bending is also depicted near Bear Head Creek, suggesting the possibility of discharge.

Nested well pairs in OU No. 2 and the Phase I landfill site exhibit a downward gradient between the screened intervals in the shallow wells and those in the deeper wells. Nested wells installed in OU No. 2 show vertical gradients decrease to almost zero along the western edge of OU No. 2, where discharge of the deep aquifer occurs into the New River.

Review of Figures 7 indicates that overall groundwater flow is to the north-northeast toward Wallace Creek. The S&ME report suggested that the two aquifers are at least partially hydraulically connected in the subject site area. As such, infiltration recharging the surficial aquifer will eventually migrate downward into deeper soils.

3.5 SITE GROUNDWATER CONDITIONS

Based upon piezometer gauging during the field work, the depth to groundwater varies from 14.05 to 25.47 feet below the existing ground surface (Table 1). As previously indicated, Figures 7 graphically depict the groundwater surface contours within the footprint of the proposed construction.

3.5.1 Seasonal High Water Table Variation

Determination of the seasonal high water table elevation is critical to maintain an adequate separation between the landfill waste and the shallow groundwater. Groundwater level data is not extensive for the subject site. A review of available documents from the ECS Report, S&ME report, the Baker report and the Westinghouse report indicates that groundwater in the site area is typically highest in late March and April. Variations in wells at the adjacent landfill site and the OU No. 2 site ranged from one foot to four feet over a seven month period (September 30, 1992 to April 9, 1993).

On January 8, 2013, ECS met with Mr. Vincent Lewis with NCDENR in order to conduct an exploration of the subsurface soil and seasonal high water conditions at the twelve CPT boring locations shown on the attached Test Location Plan (Figures 10 and 11). ECS and Mr. Lewis explored the subsurface soil and groundwater conditions by advancing one hand auger boring into the existing ground surface at the each boring location. ECS and Mr. Lewis visually classified the subsurface soils and obtained representative samples of each soil type encountered. ECS and Mr. Lewis recorded the seasonal high water table (SHWT) observed at the time of the hand auger borings. The SHWT ranged from 10 inches to 55 inches across the site. This variation is a result of variations in topographic elevations and subsurface conditions.

ECS conducted infiltration tests utilizing a compact constant head permeameter (an amoozemeter) near the SHWT hand auger borings in order to estimate the infiltration rate for the subsurface soils. Infiltration tests are typically conducted at two feet above the SHWT or in the most restrictive soil horizon encountered. The results are measured in inches per hour and are included in Appendix IV.

The Design of the proposed landfill will incorporate this estimation as well as any expected settlement issues identified in our Geotechnical investigation of the proposed construction area.

3.5.2 Influence of the Existing Water Supply Wells on Water Levels

No existing water supply wells are located near the site. As part of a Record of Decision regarding OU-No.2, wells HP-651 and HP-636 have been permanently taken out of service. No other man made activities remain in the vicinity of the site to cause any significant changes in groundwater levels.

3.5.3 Tidal and Other Influences on Groundwater

At Jacksonville, North Carolina, the New River experiences approximately 6 inches of daily tidal fluctuation. During the Baker study, water surface elevations in the New River varied from 1.7 to 1.1 feet MSL. Stream gauges installed in Wallace Creek and Bear Head Creek indicate water surface elevations to be 1.0 to 1.2 feet and 5.2 to 6.2 feet respectively. Thus Wallace Creek could be expected to show some tidal variation from the New River. Bear Head Creek in the vicinity of the site is elevated above normal daily tidal fluctuations that would occur at Wallace Creek.

During the Baker study, one shallow and one deep well were monitored over a 24 hour period to determine if groundwater in the site area was influenced by tidal activity. Groundwater levels in both wells remained constant over the time interval. Groundwater levels at the subject site are not influenced by normal tidal effects. The

New River is located sufficiently far from the site that flood pool or river stage changes will not affect the site.

4.0 SITE INVESTIGATIVE PROCEDURES

This section presents the methods used to evaluate the Phase IV area of the landfill (subject site). This area represents approximately 13 acres located adjacent northeast of the existing landfill (Phase III area). Remaining sections of this report pertain to the Phase IV area.

4.1 FIELD EXPLORATION PROCEDURES

4.1.1 Standard Penetration Test

Fifteen (15) soil test borings were drilled within the general limits of the landfill expansion to aid in the evaluation and design of the landfill expansion (Figure 11).

The soil test borings were performed with an ATV-mounted auger drill rig utilizing an upper casing and mud rotary drilling techniques to advance the boreholes. Drilling fluid was used in this process.

Representative soil samples were obtained by means of the split-barrel sampling procedure in accordance with ASTM Specification D-1586. In this procedure, a 2-inch outside diameter split-barrel sampler is driven into the soil a distance of 24 inches by a 140-pound hammer falling 30 inches. After a 6-inch seating interval, the number of blows required to drive the sampler through the next 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density and relative consistency of cohesionless soils and cohesive soils, respectively. This indication is qualitative, since many factors can significantly affect the standard penetration resistance value and prevent a direct correlation between drill crews, drill rigs, drilling procedures, and hammer-rod-sampler assemblies.

A field log of the soils encountered in the borings was maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were sealed in plastic bags and delivered to our laboratory in Wilmington, North Carolina for further visual examination and classification.

4.1.2 Cone Penetration Test

Twelve electronic cone penetration test soundings (S-1 through S-12) were performed during our field exploration. The cone penetration test soundings were performed in general conformance with ASTM D 5778 by our subcontractor. The

soundings were performed with a track mounted rig. The approximate locations of the CPT soundings are indicated on Figure 11 of this report.

The cone used in the sounding has a tip area of 10 cm^2 and a sleeve area of 150 cm^2. The CPT soundings recorded tip resistance and sleeve friction measurements to assist in determining pertinent index and engineering properties of the site soils. The ratio of the sleeve friction to tip resistance is then used to aid in assessing the soil types through which the tip is advanced. Within the CPT sounding S-2 and S-12, seismic tests were performed at approximately three foot intervals to refusal to measure the shear wave velocity (v_s) of the subsurface materials to aid in assessing the dynamic response properties of the site subsurface materials. The seismic shear waves are generated by making impact with a 20-pound sledgehammer onto a steel beam. The impacts are initiated on the right and left sides of the CPT rig and the corresponding wave traces recorded on an oscilloscope are analyzed to determine the shear wave velocity of the tested material. The waves are measured with three geophones that are installed in the cone. The results of the CPT and seismic testing are presented in Appendix III.

4.1.3 Direct Push Boring

In addition to the CPT soundings, two direct push borings were performed (GP-1, GP-2). The direct push obtains continuous soil samples by driving four foot long sample tubes by means of a percussion hammer. The sample tubes were returned to our soils laboratory for visual classification in Wilmington, North Carolina. The results of the direct push boring are presented in Appendix III and the approximate locations are shown on Figure 11.

4.1.4 Piezometer Installation

Piezometers were installed directly adjacent to the SPT boring locations (Figures 7 and 11). Thirteen of the 15 piezometers were constructed to 25 feet and two piezometers were constructed to 80 feet in order to evaluate vertical gradients at the site. The piezometer borings were installed through mud rotary drilling. Fifteen feet of machine slotted (0.010) PVC screen was attached to 2-inch schedule 40 PVC riser pipe and placed into the borehole. Fine filter sand was placed into the annular space between the outside of the well screen and the borehole. The sand was extended above the top of the screen and sealed with bentonite pellets up to the surface elevation.

The piezometers were fitted with slip on caps. All of the piezometers are considered temporary and will be properly abandoned in accordance with North Carolina regulations prior to construction.

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The completed piezometer locations were surveyed by C. Allen Bamforth, Engineers and Surveyors. Elevations were determined for the top of the PVC riser casing and the average ground surface in the immediate vicinity of each piezometer. Elevation data for the piezometers were utilized to generate groundwater elevations for the site. Table 1 depicts groundwater elevation details from the single gauging event performed on February 18, 2013.

4.1.5 Flat Plate Dilatometer Testing

Three flat plate dilatometer tests were performed at the site in accordance with ASTM D 6635. The test is initiated by forcing the steel, flat plate, dilatometer blade into the soil at one foot increments. The dilatometer blade is 95 millimeters wide, 15 millimeters thick and has a flat, circular, metallic membrane with a diameter of 60 millimeters. At each increment, the metallic membrane is expanded out from the blade using pressurized gas through a pneumatic-electrical cable that connects the dilatometer to the control box. When the blade is advanced in the soil, the soil and water pressure pushes against the membrane which creates a tone in the control box. The gas is applied to the membrane and the pressure required to advance the membrane to a reference point 0.05 millimeters above the plane of the dilatometer blade (no-tone event) and is recorded as the “A” reading. The pressure is increased to expand the membrane to a reference point 1.1 millimeters above the plane of the dilatometer blade (tone event) and is recorded as the “B” reading. The pressure is removed and a third reading (“C” reading) is recorded when the membrane returns to its initial lift off reference point (tone event). The penetration resistance and subsequent membrane expansion are used for soil classification and correlation with engineering properties of soils.

4.2 SLUG-TESTS

Estimates of hydraulic conductivity were calculated from slug tests performed in each of the piezometers. The slug tests were performed by adding a sealed section of smaller diameter PVC pipe filled with sand into the piezometer and recording the change in groundwater level with time. Time and water depth measurements were gathered during the test using a pressure transducer and electronic recording equipment. Recovery tests (slug-out tests) were also performed on each of the piezometers. In these tests, hydraulic conductivity (K) is estimated by conducting a slug removal ("recovery") test. This is done because the introduction of a slug or weighted cylinder ("injection test") would force the displaced water into the unsaturated zone above the water table leading to potentially erroneous results. The results of the slug test in a well screened above the water table would then include not only the contribution from the aquifer, but also the delayed drainage which enters the well from the unsaturated zone.

During the recovery tests, the slug was removed from the piezometer. Time and water depth measurements were gathered during the test using a pressure transducer and electronic recording equipment until the piezometer recovered to >76 percent of the initial static head. Hydraulic conductivity for the aquifer was determined from graphical analysis of the semi-log plot change in water level over time.

Slug test data were evaluated the Bouwer-Rice techniques. The Bouwer-Rice technique was developed specifically for partially penetrating wells in unconfined aquifers. The analysis requires a linear regression through relative draw down data plotted versus time with the most emphasis placed on early time-response data.

4.3 LABORATORY ANALYSIS PROGRAM

Experienced personnel from our office visually classified each soil sample from the test borings on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS) and ASTM D-2488 (Description and Identification of Soils-Visual/Manual Procedures). Select soil samples were subjected to moisture content, Atterberg Limits, and sieve analysis for use in developing design parameters. In addition, we performed consolidation testing on samples of the cohesive soils obtained from the undisturbed Shelby tube samples that were collected in our subsurface exploration program. The laboratory test results and the soil classification are included on the summary sheets in Appendix II of this report.

The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the USCS is included in Appendix III. The geotechnical engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual.

The soil samples will be retained in our laboratory for a period of 60 days, after which they will be discarded unless other instructions are received as to their disposition.

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5.0 LABORATORY RESULTS

Laboratory testing was conducted on select samples obtained during the subsurface exploration program. The results of our laboratory testing are provided in Appendix II.

5.1 GRAIN SIZE DETERMINATION

The samples selected for testing classified as SAND (SP), Clayey SAND (SC), slightly Clayey SAND (SP-SC), Silty SAND (SM), slightly Silty SAND (SP-SM), Silty CLAY (CL-ML) and Sandy CLAY (CL). Classification was based on the percent of fines passing the No. 200 sieve and hydrometer analysis. The samples generally had percent fines passing the No. 200 sieve ranging from about 1.6 to 54.9.

5.2 NATURAL MOISTURE CONTENT

The natural moisture content test was conducted on seven samples collected from the split-spoon sample during drilling operations. Natural moisture contents ranged from about 5.9 to 66.3 percent by weight.

5.3 ATTERBERG LIMITS

The Atterberg Limit test was conducted to evaluate the plasticity of fine-grained soils. Liquid and plastic limits were performed on one sample, with values of 23 and 37 percent. The plasticity index of the tested sample was 14.

6.0 EVALUATION OF SITE CONDITIONS

6.1 SUBSURFACE CONDITIONS

An experienced geotechnical engineer classified each splitspoon soil sample on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. The geotechnical engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate; in situ, the transitions may be gradual. A brief explanation of the USCS, as well as a Reference Notes for Boring Logs sheet, are provided in Appendix II of this report.

SPT and Direct Push Borings: Beginning at the ground surface in the soil borings, we generally encountered a very loose to very dense consistency silty, slightly silty, clayey, slightly clayey and clean, fine to medium SAND (SM, SP-SM, SC, SC-SP and SP) to depths of approximately 30 to 80 feet (boring termination depth) below existing site grades. The Standard Penetration Test (SPT) N-values recorded within these soils varied from W.O.H. to in excess of 100 blows-per-foot (BPF). At the direct push boring location G-1, thin layers of silty and sandy CLAY (ML-CL, CL) at depths of approximately 10 to 20 feet, below the existing ground surface.

The groundwater level was observed at a depth of approximately 11.6 to 22.7 feet below the existing surface grade at the boring locations. The results of the groundwater level readings are discussed in the geohydrology section of this report. More detailed subsurface conditions are provided on the boring logs included in Appendix III of this report.

CPT Soundings. Beneath the surface to depths of about 47 feet, the soundings typically encountered intermittent layers of loose to very dense silty, slightly silty, clayey and clean sands (SM, SP-SM, SP) and interbedded layers of very soft to very stiff sandy clay, clays, silty clays and sandy silts (CL, ML-CL, ML). The equivalent corrected standard penetration test resistances (N*-values) in these soils generally ranged from 2 to 90 blows per foot (bpf).

6.2 HYDROLOGIC CONDITIONS

6.2.1 Hydraulic Conductivity

Estimates of hydraulic conductivity were determined from the slug test data. The surficial aquifer is comprised of fine sand with varying amounts of silt and clay. Published values of hydraulic conductivity for fine sands range from 10^{-5} to 10^{-3} cm/sec. (Freeze and Cherry, 1979).

Estimates of hydraulic conductivity were calculated from the slug in and slug out tests performed in the site piezometers. The data is summarized in Table 2. Calculated values using the Bouwer-Rice approximation range from $1.13X10^{-5}$ cm/sec to $1.45x10^{-3}$ cm/sec (0.032 to 4.1 ft/day). The average value was $3.42x10^{-4}$ cm/sec or about 0.96 feet/day. Hydraulic conductivities are within the published range for sandy materials.

Estimates of hydraulic conductivity of the Castle Hayne aquifer were derived from transmissivity values (Harned 1989). The values range from 14 to 82 feet per day and average 35 feet/day ($1.2x10^{-2}$ cm/sec).

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6.2.2 Aquifer Thickness

The thickness of the surficial aquifer ranges from approximately 40 to 80 feet, based upon published literature and a review of previous reports. For the purpose of evaluating site conditions, a thickness of 80 feet was used based upon the homogeneity of the soils encountered in the site borings.

The thickness of the Castle Hayne is estimated to be between 175 and 375 feet from published literature. The referenced Harned report indicates that at the east end of section C-C, the Beaufort confining unit is estimated to lie approximately 200 feet below sea level. Thus, the Castle Hayne thickness in the site area is approximately 160 feet.

6.2.3 Transmissivity

Transmissivity is a measurement of the rate at which water will move through a unit thickness of an aquifer. For the surficial aquifer, transmissivity values were determined from the slug test data. Based on the aquifer thickness of 80 feet, calculated transmissivities ranged from 2.56 ft^2/day to 328 ft^2/day. Transmissivity in the Castle Hayne ranges from 1300 to 24,000 ft^2/day.

6.2.4 Groundwater Flow Gradients

Water table gradients were steepest in the western portion of the site (0.09 feet/feet) as measured between B-1 through B-5 and shallower to the north and east as measured between B-5 and B-13 (0.04 feet/feet). For the surficial aquifer, an average gradient of 0.07 feet/feet was used.

Groundwater gradients in the Castle Hayne reportedly range from 5 to 15 ft/mile (0.0009 to 0.003 ft/ft) in areas unaffected by pumping. Groundwater gradients in the surficial aquifer are strongly downward as would be expected in an area of groundwater recharge.

6.2.5 Groundwater Velocity

Groundwater velocities are estimated from Darcy's equation by multiplying the hydraulic conductivity by the hydraulic gradient. Based on the calculated average values, velocity in the surficial aquifer would be approximately 0.19 feet per day. Groundwater velocity in the Castle Hayne Aquifer would be approximately 0.17 feet per day. Advective transport of potential contaminants following the water table surface could be expected to require a time period of approximately 0.5 years to move from the center of the landfill to the proposed compliance wells, located approximately 40 feet away. In reality, contaminant transport would occur at a slower rate due to adsorption and dispersion of contaminants.

7.0 GEOTECHNICAL RECOMMENDATIONS

7.1 SUBGRADE PREPARATION AND EARTHWORK OPERATIONS

The subgrade preparation should consist of removing all surficial organic material. The site was sparsely to heavily wooded. Typically, on wooded sites, the depth of grubbing operations disturbs the soils deeper than the topsoil depth encountered. No topsoil was encountered in the borings. There were areas of pine straw accumulation at the site of depths of 2 to 4 inches. Around trees and brush, organic accumulations may increase in depth to 6 to 8 inches. We recommend stripping of any organic or unstable material. The stripping depth should be evaluated at the time of construction by representatives of the Geotechnical Engineer. If additional stripping becomes necessary, suitable methods should be employed to determine additional stripping depths beyond the contract depth (such as elevations determined before and after additional stripping, etc.).

After stripping or cutting to the desired grade, and prior to fill placement, subgrades should be observed by the Geotechnical Engineer. In an effort to densify any loose surficial subgrade soils, the stripped area should be proofrolled with a smooth drum roller with a minimum of two passes in two perpendicular directions, provided in-situ moisture contents are within $\pm$3% of optimum in order to facilitate compaction.

Any soft or unsuitable materials encountered, which cannot be stabilized by reworking the soil, should be removed and replaced with an approved structural fill. Undercut volumes should be determined by cross-sectioning the area before and after undercut. We have found that calculating undercut volumes by truck counts is less accurate and generally results in additional expense to the owner. In order to minimize undercutting and issues during earthwork activities, we recommend earthwork operations be performed during the drier times of the year.

We recommend the contract documents include an allowance for undercutting and/or reworking soft near surface soils (if encountered) and replacement with engineered fill. Add/deduct unit prices should also be established so adjustment for the actual volume of undercut can be made.

Most of the on-site Sandy soils can be reused if the soils are moisture conditioned to within ±3% of the soils optimum moisture content. On site soils to be re-used as structural fill and all proposed select fill soils should be submitted to the geotechnical engineer for approval prior to their use on the project. We recommend imported engineered fill (select) material consisting of approved inorganic material classified as SM, SM-SP, SP, SC or better containing less than about 40% by weight Silt or Clay and free of debris. All fill for support of the proposed construction and for backfill of utility lines within expanded building and pavement limits should consist of an approved material, free of organic matter and debris and cobbles greater than 3 inches, and have a Liquid Limit (LL) and Plasticity Index (PI) less than 30 and 9, respectively. This material should be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to within +/- 3% of the optimum moisture content, and compacted to a minimum of 98% of the maximum dry density obtained in accordance with ASTM D-698, Standard Proctor method. The material located at the French Creek borrow pit is suitable for use as fill at the project site.

7.2 CONSTRUCTION CONSIDERATIONS

The subgrade materials are moisture sensitive, and exposure to the environment may weaken the soils at the bearing level if the excavations remain open for too long a time. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the excavation bottom immediately prior to placement of the next layer of materials. In a dry and undisturbed state, the soil at the site will provide good subgrade support for fill placement and construction operations; however, when wet, this soil will degrade quickly with disturbance from contractor operations. Good site drainage should be maintained during earthwork operations which would help maintain the integrity of the soil.

Proper compaction control of fill is an important aspect of this project. Therefore, we recommend that all fill operations be observed full-time by a qualified soil technician to determine if minimum compaction requirements are being met.

We encountered groundwater during drilling of the borings. We do not anticipate that ground water will impact construction unless the landfill operations extend below the depths groundwater was encountered. If ground water is encountered, we expect that dewatering with well points may be required to draw the water level down below the bottom of the cell in order to construct in the dry. The specifications should, however, alert the contractor to the potential presence of subsurface water,

and it should be incumbent on the contractor to provide the means by which to satisfactorily dewater the site.

However, please note that we understand that the bottom excavation of the landfill will not extend below the normalized ground water level.

7.3 SLOPE STABILITY

A slope stability analysis was performed using the computer program TENSAR Slope to determine the maximum allowable side slope with the lowest allowable factor of safety to prevent slope failure. Typically, side slopes of this type of construction should be designed for a factor of safety of 1.5 or greater. Factors of safety less than 1.5 are at an increased risk for potential slope failure. We have evaluated two cases for the design of the landfill and calculated the factor of safety for each case. Case I considers the embankment only. Case II considers global stability of the embankment slope and the waste fill slope.

7.3.1 Case I – Embankment Only

The perimeter embankments will be constructed using compacted structural fill prior to the installation of the liner and placement of waste. We have evaluated these perimeter embankments for slope stability independently of the waste fill. For the purposes of our analysis, we have considered a maximum structural fill embankment height of 25 feet. The existing landfill currently utilizes inside and outside side slopes of 3:1 (horizontal to vertical). We assumed similar side slopes for our analysis. We also assumed that select cohesionless compacted structural fill will be utilized to construct the embankment. We assumed that the fill material compacted to the requirements recommended in our Subgrade Preparation and Earthwork Operations Section will have an internal angle of friction (∅) of 32 degrees and a moist unit weight of 125 pcf. The material on-site and the material from the French Creek borrow pit should be suitable for use as fill

Utilizing the parameters mentioned above, a minimum factor of safety of 1.7 was determined. We therefore recommend the embankment be constructed with interior and exterior sides slopes of 3:1 for up to the maximum fill height of 25 ft.

7.3.2 Case II – Global Stability

This analysis considers the overall stability of the embankment and the waste fill placed in conjunction with each other. We have considered similar properties to the existing landfill side slopes for performing this evaluation. We have considered a maximum waste fill depth of 60 feet and waste fill side slopes of 4:1 (horizontal to vertical) and a maximum embankment height of 25 feet with inside and outside side slopes of 3:1. We assumed the waste fill material will receive some effort of

compaction while it is being placed. This is typically accomplished during the standard operation of spreading the waste fill while the cell is in production. We assumed a waste fill moist unit weight of 45 pcf, a cohesion of 500 psf, and an internal angle of friction (∅) of 10 degrees.

Utilizing these parameters, factors of safety of 1.84, 1.68, 3.0 were determined for embankment, global, and waste failures, respectively. We therefore recommend the waste fill embankment be constructed with an exterior sides slope of 4:1 for up to the maximum waste fill height of 60 ft.

Utilizing these parameters, factors of safety of 1.68, 1.55, 2.9 were determined for embankment, global, and waste failures, respectively. We therefore recommend the waste fill embankment be constructed with an exterior sides slope of 4:1 for up to the maximum waste fill height of 70 ft.

7.4 ESTIMATED SETTLEMENTS

We have evaluated settlement of the constructed perimeter embankments and interior landfill cell due to the placement of new structural fill and waste fill. Settlement was estimated utilizing test boring data and laboratory test data. The soils underlying the project site generally consisted of sandy soils. However, we did encounter interbedded layers of clayey soils at varying locations and depths below the ground surface. Due to the apparent limited horizontal and vertical extent of the clay layers, we considered the overall settlement behavior to be modeled by the elastic deformation of granular soils for our settlement analysis. Additionally, we assumed a perimeter embankment height of 25 feet with compacted structural fill unit weight of 125 pcf, and a maximum cell height of 60 feet with a waste fill unit weight of 45 pcf.

We have estimated settlement induced by the weight of the new perimeter embankment fill to be about 3 to 4 inches along the centerline of the embankment and about 1 inch at the toe of the embankment. We expect the settlement due to the weight of the new structural fill for the perimeter embankments to occur rapidly during construction. This settlement will occur prior to the installation the liner and leachate collection systems for the landfill. The quantity of fill estimated to construct the embankment should be increased to allow for this settlement. Once the landfill expansion is ready to accept waste, there will be additional settlement induced by the weight of the waste fill. The settlement due to the weight of the full height of the planned 60 feet of waste fill in the center of the landfill cell is estimated at about 3 to 5 inches. If the cell height is increased to 70 feet of waste fill in the center of the landfill, the settlement is estimated at about 3 to 5.5 inches.

Over the interior toe of the perimeter embankment, the waste fill height is reduced due to the slope of the fill. We estimate the settlement due to the waste fill to be less than 3 inches at this point. The settlement due to the continued placement of the waste fill is expected to occur over the extended period required to fill a cell. The overall differential settlement between the interior toe of the perimeter embankments and the center of the waste fill is expected to be about 3 inches. Total and differential settlements induced by the waste fill must be considered when designing the elevation and slope of the leachate collection system and synthetic or compacted clay liner.

7.5 SEISMIC SITE CLASS DETERMINATION AND LIQUEFACTION POTENTIAL

The North Carolina Building Code (2009 International Building Code with North Carolina Amendments) requires that a seismic Site Class be assigned for new structures. The seismic Site Class for the site was determined by calculating a weighted average of the shear velocities of the overburden to the depth of refusal. The CPT test data indicates that the existing natural, overburden soils at the site have shear velocities ranging from approximately 297 ft/sec to 1,277 ft/sec. The method for determining the weighted average value is presented in Section 1613.1.5 of the IBC 2009. The weighted average value for the site is 859 ft/sec. Based on the results of the CPT soundings and our evaluation of the site, the site shall be assigned a seismic class “D”.

Based on the USGS Seismic Hazard Curves and Uniform Hazard Response Spectra 2003 NEHRP Seismic Design Provisions and the IBC 2009, for a seismic site class “D” at latitude 34.6932° and longitude -77.3195°, the S_{DS} value is 0.208 and the S_{D1} value is 0.118. The seismic design category depends on the design use of the building and should be determined by the structural engineer.

The potential for liquefaction at the site is considered low based upon the CPT results and the liquefaction index procedure developed by Iwasaki (1982). Based on our CPT results and our evaluation using a site peak ground acceleration of 0.08 g, an earthquake event with a magnitude of 7.0 and procedures developed by Robertson and Wride (1998), the liquefaction induced settlement at the subject site is estimated to be less than 1 inch.

APPENDIX I

FIGURES

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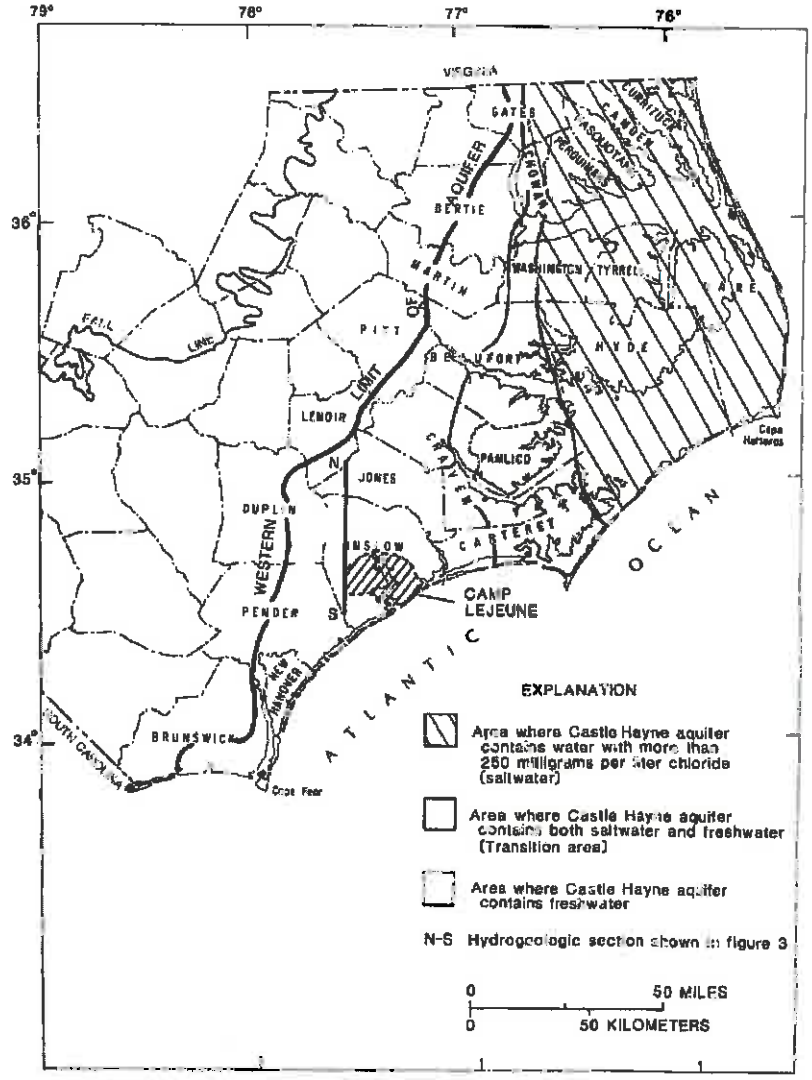
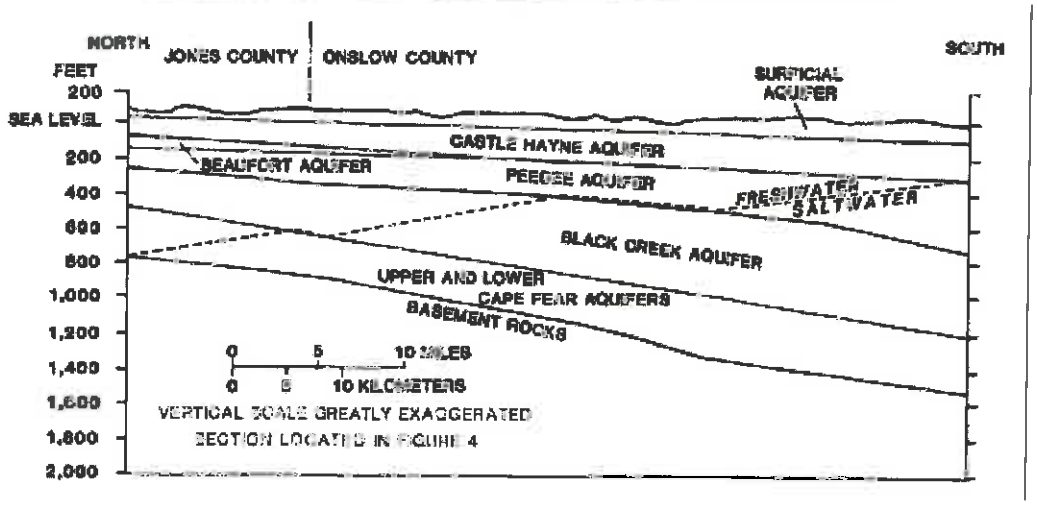
SITE LOCATION MAP	ECS	**Camp Lejeune Landfill Phase IV** **MCB Camp Lejeune, NC**	ENGINEER WEG DRAFTSMAN WEG REVISIONS	SCALE NTS PROJECT NO. 22.18460 SHEET FIG. 1 DATE 03/01/13





REFERENCE: Water Resources Investigation Report 89-4096

STRATIGRAPHIC SECTION	ECS	**Camp Lejeune Landfill Phase IV**	ENGINEER WEG	SCALE NTS
			DRAFTSMAN WEG	PROJECT NO. 22.18460
			REVISIONS	SHEET FIG. 2
		MCB Camp Lejeune, NC		DATE 03/01/13

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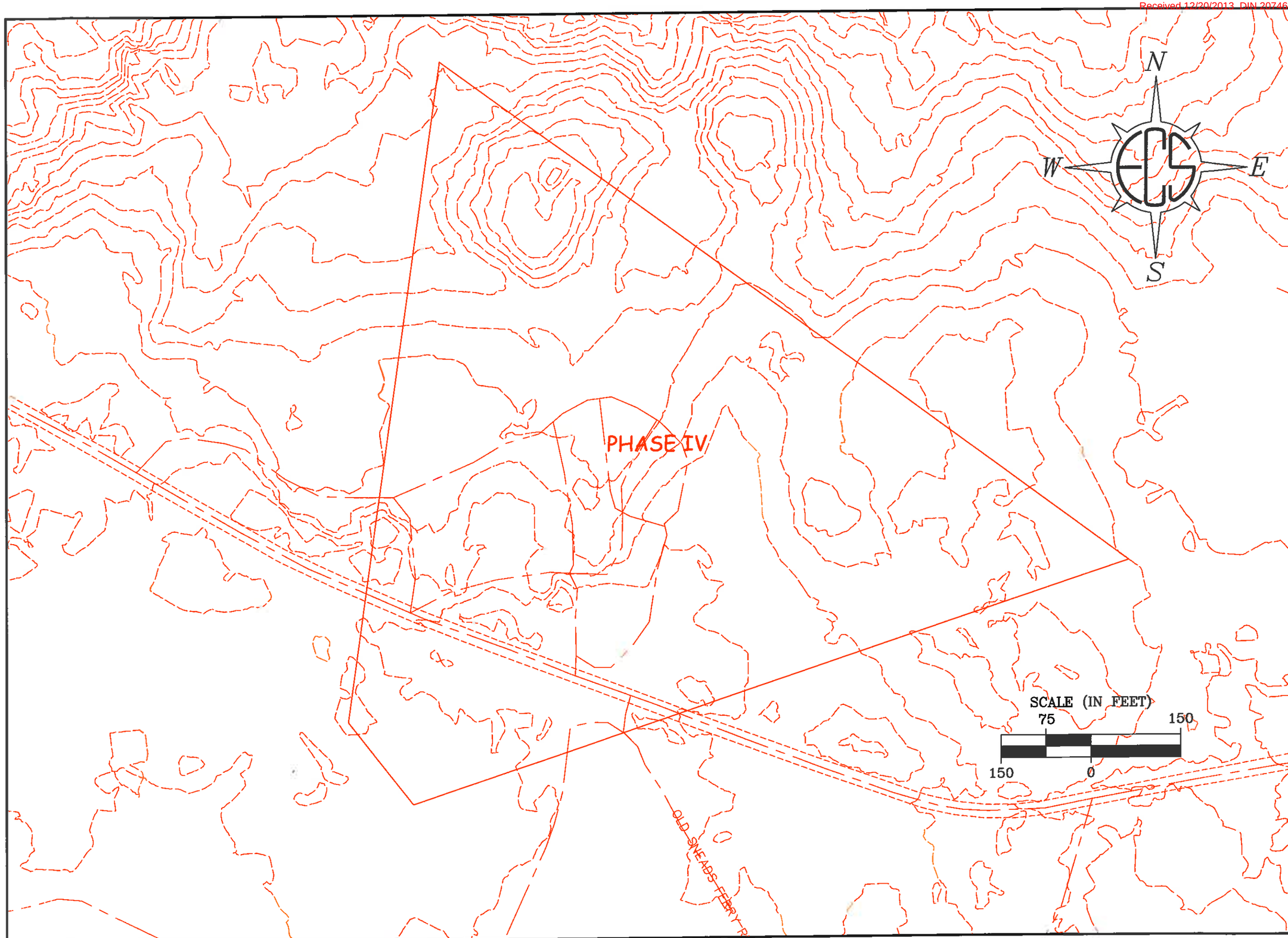

MCB Camp Lejeune Phase IV

MCB Camp Lejeune, NC

TOPOGRAPHIC MAP

ECS REVISIONS

ENGINEER	DRAFTING
WEG	WEG

SCALE 1" = 150'

PROJECT NO. 22.18460

SHEET FIG 3

DATE 03/19/13

REFERENC: USDA

USDA SOIL MAP DIAGRAM	ECS	**Camp Lejeune Landfill Phase IV**	ENGINEER WEG	SCALE NTS
			DRAFTSMAN WEG	PROJECT NO. 22.18460
			REVISIONS	SHEET FIG. 4
		MCB Camp Lejeune, NC		DATE 03/01/13

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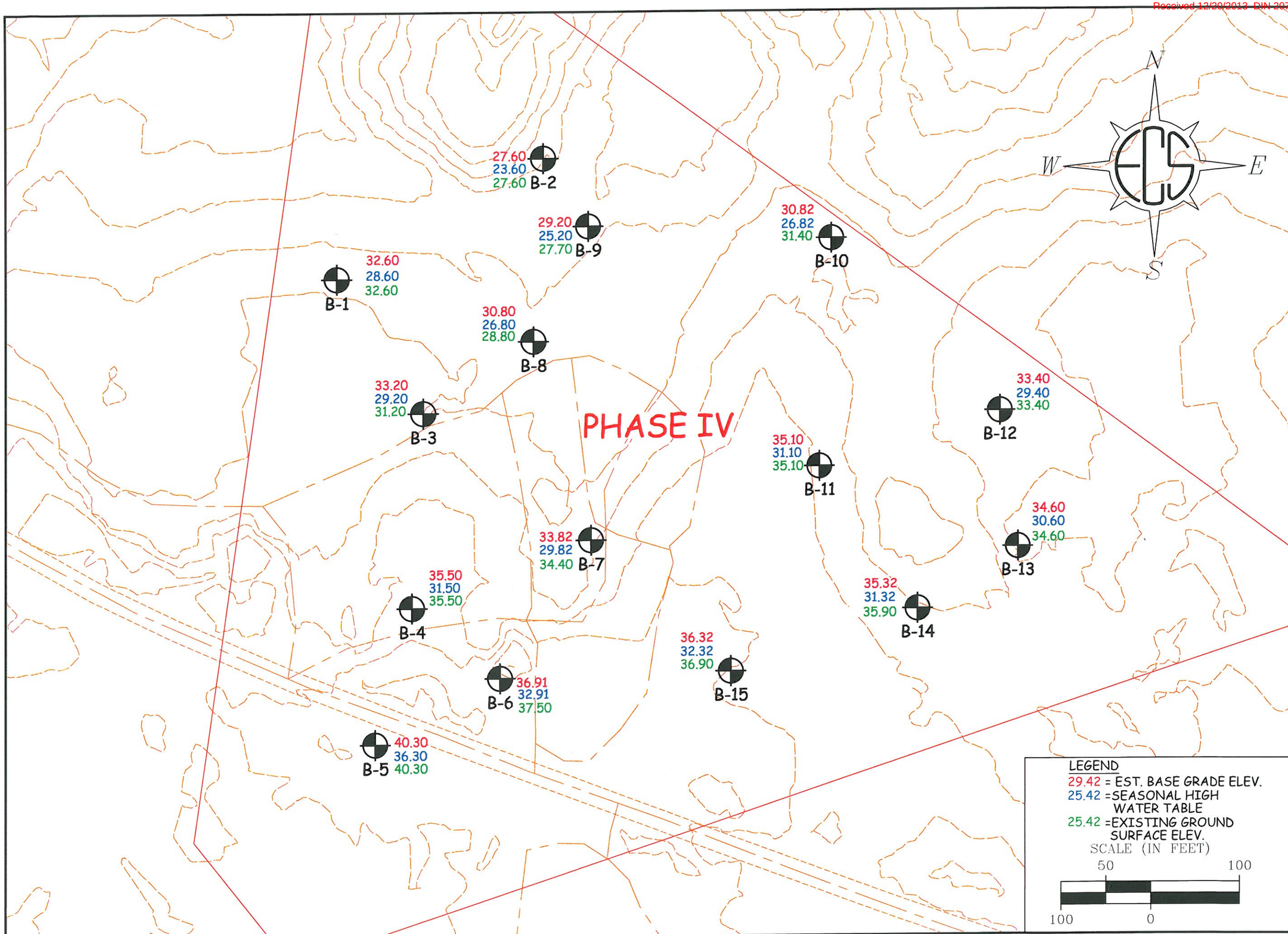


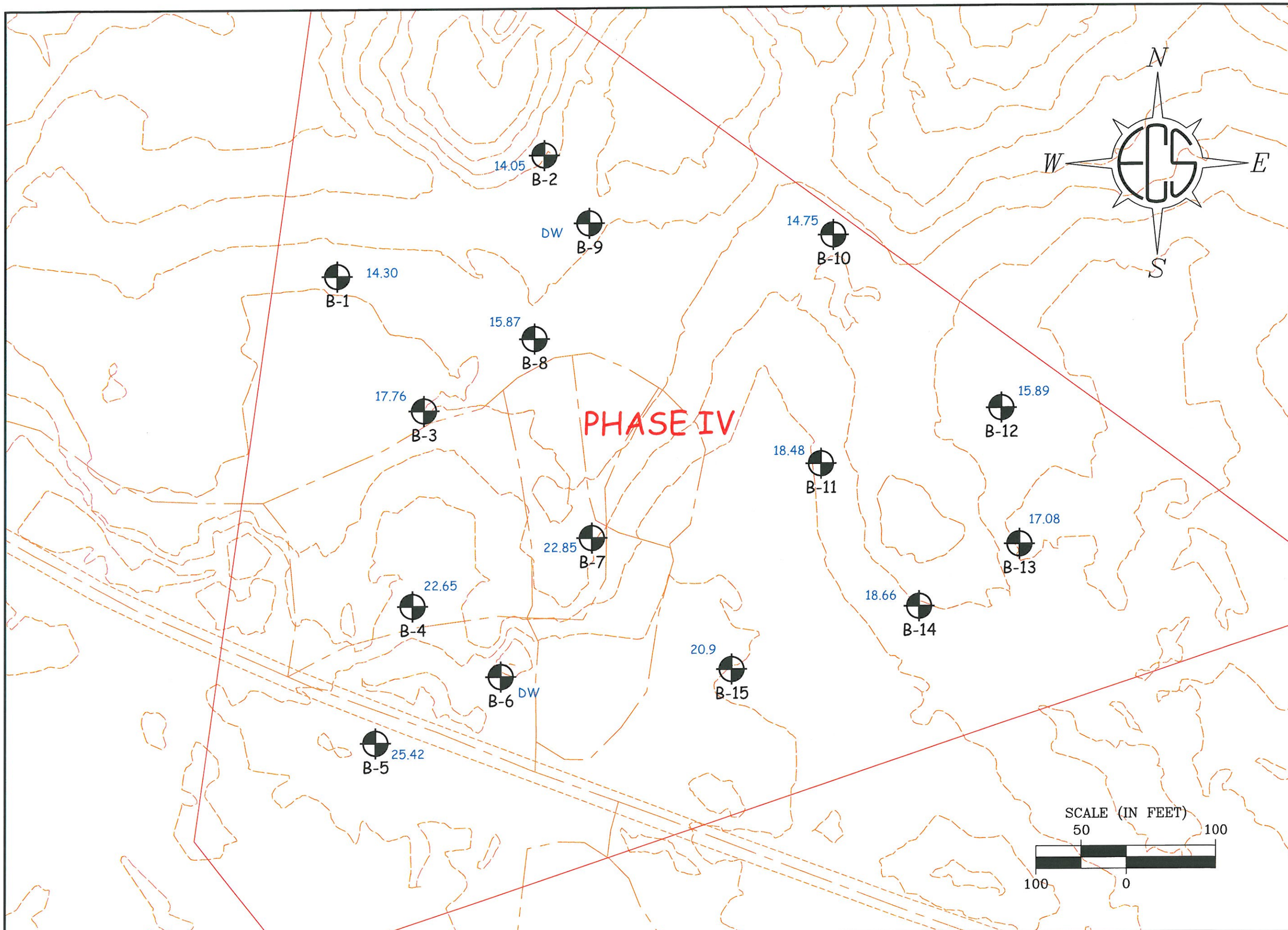
MCB Camp Lejeune Phase IV

MCB Camp Lejeune, NC

SHWT ELEVATIONS

ECS REVISIONS

ENGINEER WEG	DRAFTING WEG
SCALE 1" = 100'	
PROJECT NO. 22.18460	
SHEET FIG 5	
DATE 03/19/13	



MCB Camp Lejeune Phase IV

MCB Camp Lejeune, NC

GROUNDWATER ELEVATIONS

ECS REVISIONS

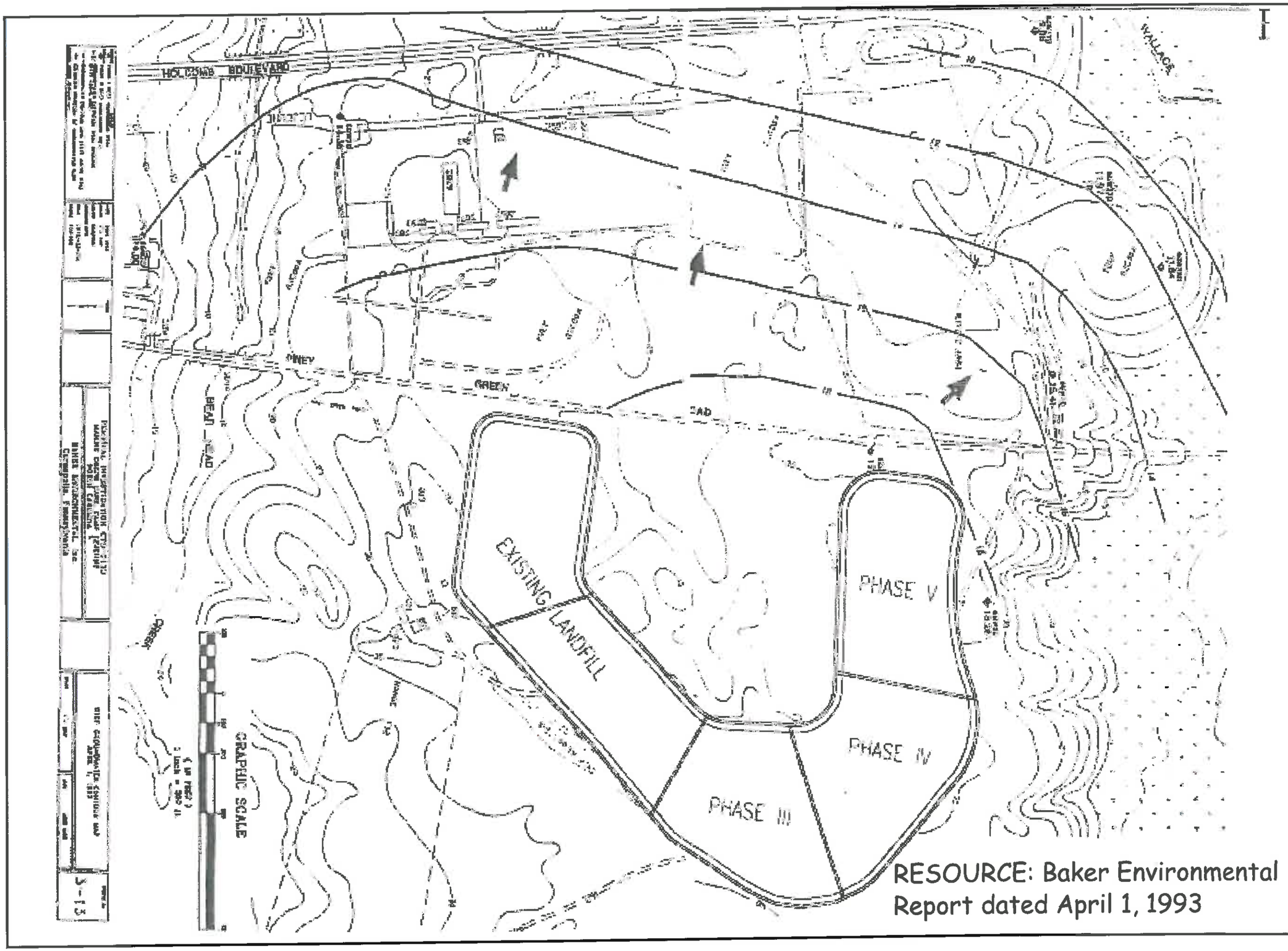
ENGINEER	DRAFTING
WEG	WEG

SCALE 1" = 100'

PROJECT NO. 22.18460

SHEET FIG 5A

DATE 03/19/13



MCB Camp Lejeune Phase IV

MCB Camp Lejeune, NC

DEEP GROUNDWATER CONTOUR MAP

ECS REVISIONS

ENGINEER WEG	DRAFTING WEG
SCALE NTS	
PROJECT NO. 22.18460	
SHEET FIG 6	
DATE 03/19/13	

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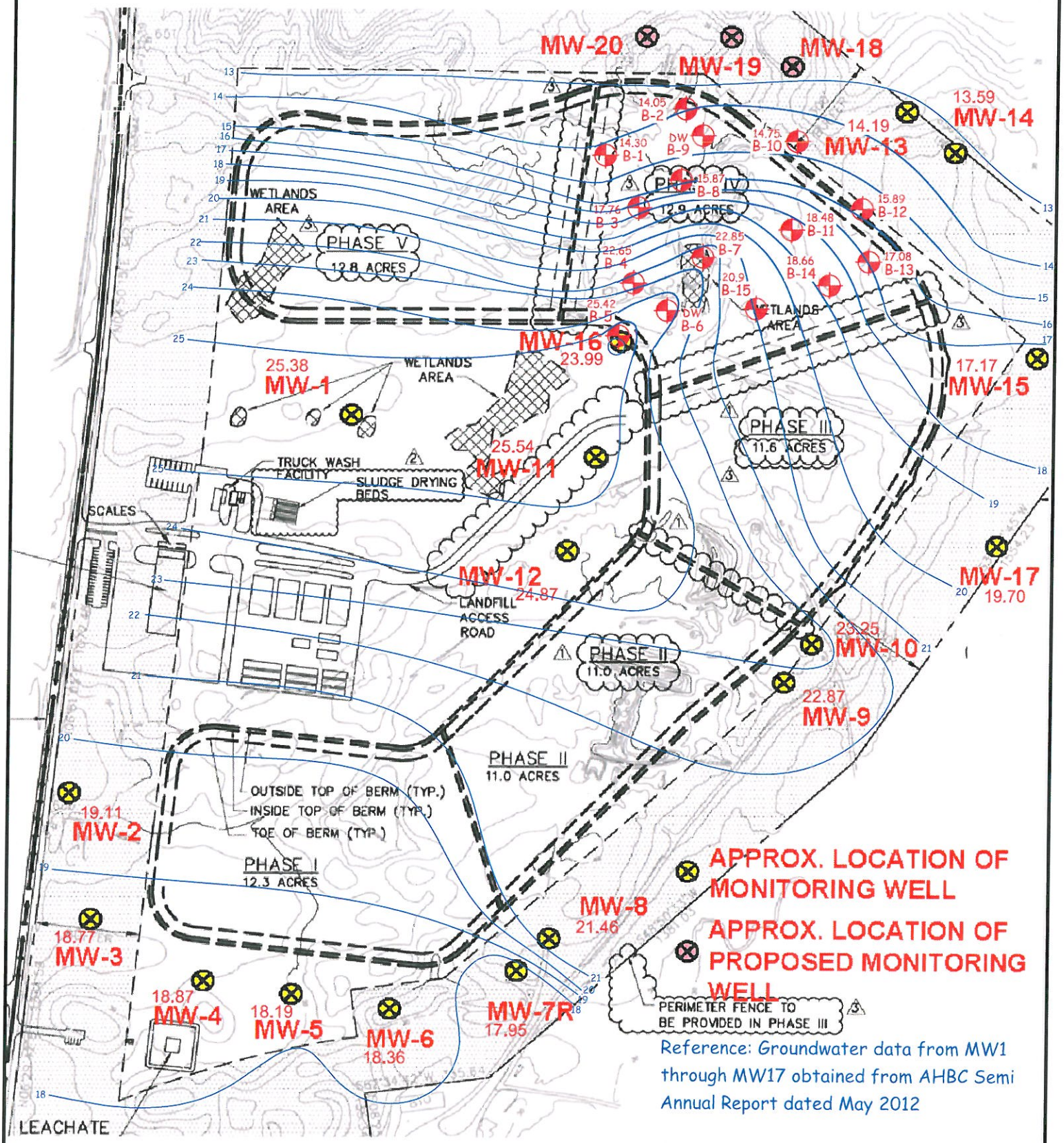

Reference: Groundwater data from MW1 through MW17 obtained from AHBC Semi Annual Report dated May 2012

POTENTIOMETRIC MAP	ECS	**Water Quality Monitoring Report**	ENGINEER WEG	SCALE 1" = 200'
			DRAFTSMAN WEG	PROJECT NO. 22.18460
Phase IV Cell		**Jacksonville, NC**	REVISIONS	SHEET Fig. 6A
				DATE 06/10/13

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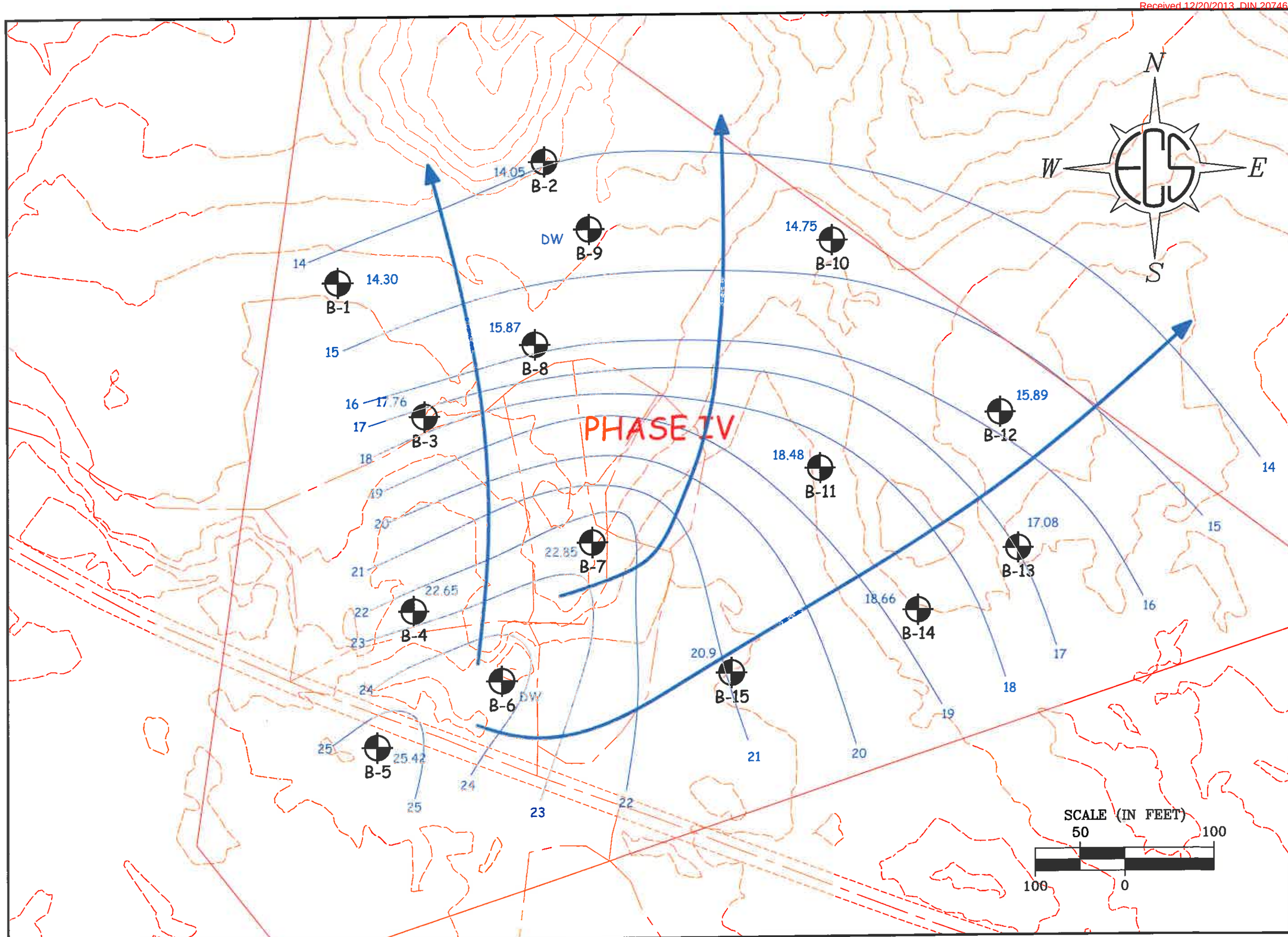

MCB Camp Lejeune Phase IV

MCB Camp Lejeune, NC

ECS

GROUNDWATER CONTOUR DIAGRAM

ECS REVISIONS

ENGINEER	DRAFTING
WEG	WEG

SCALE 1" = 100'

PROJECT NO. 22.18460

SHEET FIG 7

DATE 03/19/13

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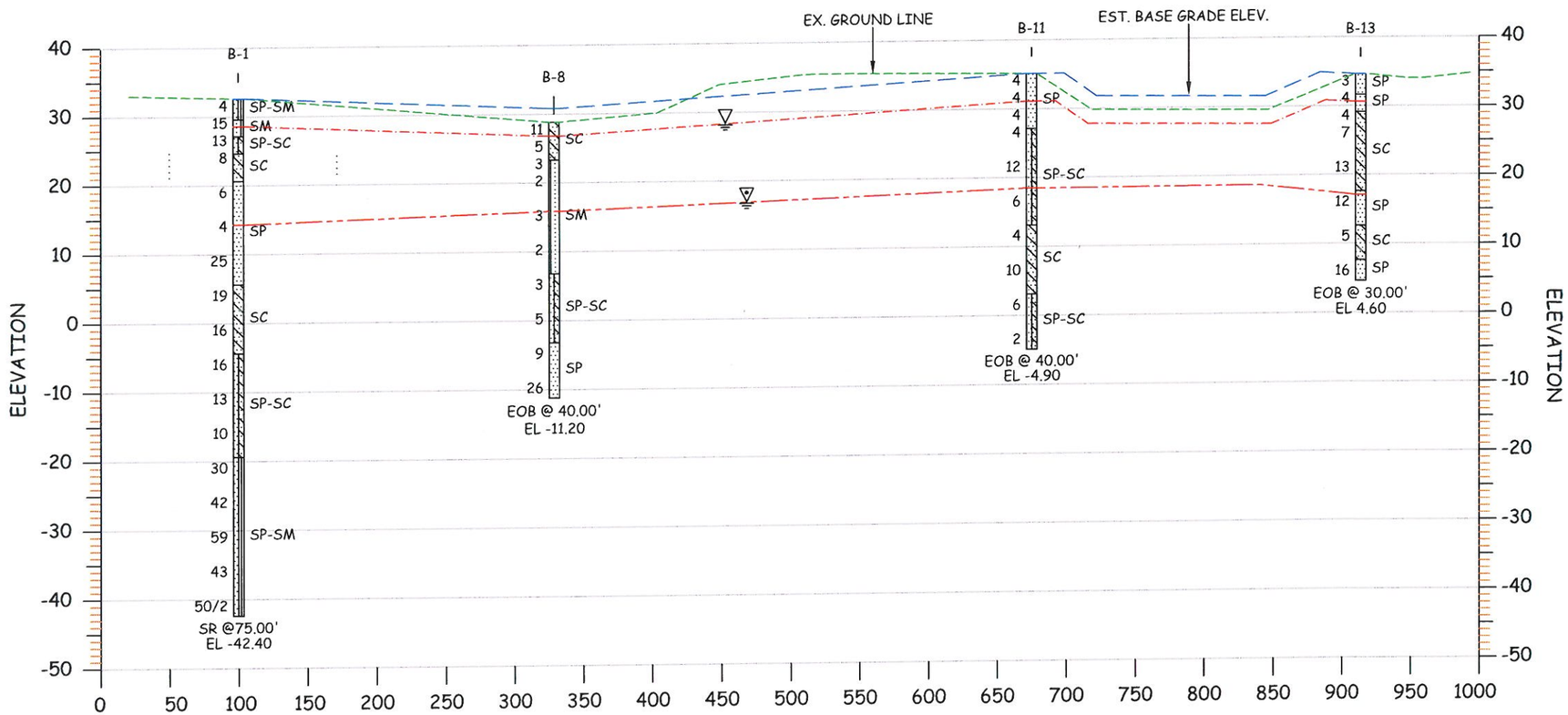

SOIL CLASSIFICATION LEGEND

- FILL - FILL (POSS/PROB) OF ALL TYPES
- GW - WELL GRADED GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GC - CLAYEY GRAVEL
- SW - WELL GRADED SAND
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- SC - CLAYEY SAND
- ML - LOW PLASTICITY SILT
- CL - LOW PLASTICITY CLAY
- MH - HIGH PLASTICITY SILT
- CH - HIGH PLASTICITY CLAY
- ALLUV - ALLUVIUM
- RC - ROCK CORE
- WR - PARTIALLY WEATHERED ROCK
- TOPSOIL
- AP - AUGER PROBE

EOB - END OF BORING
AR - AUGER REFUSAL
SP - SPOON REFUSAL

= SEASONAL HIGH WATER TABLE

= 168 HOUR WATER LEVEL

HORIZONTAL SCALE
1" = 100'

VERTICAL SCALE
1" = 20'

MCB Camp Lejeune Phase IV

MCB Camp Lejeune, NC

ECS

CROSS SECTION A - A'

ECS REVISIONS

ENGINEER	DRAFTING
JMS	JMR

SCALE: SEE PLAN

PROJECT NO. 22.18460

SHEET: FIGURE 8

DATE: 04/04/13

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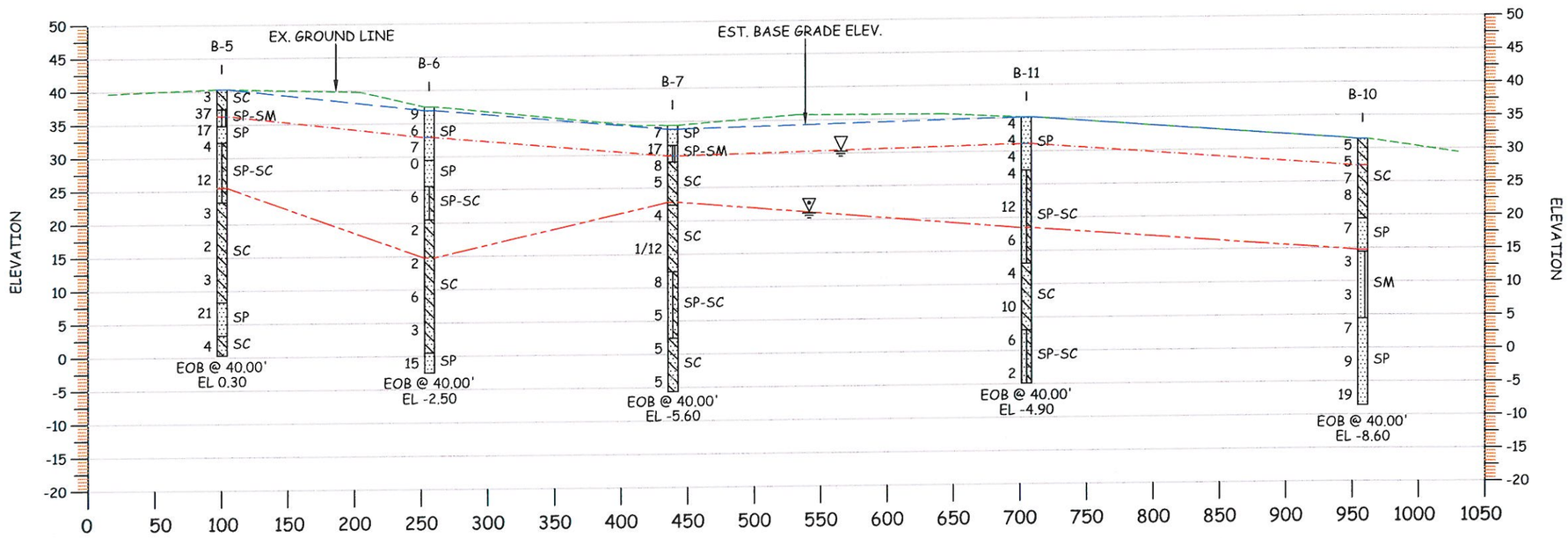


SOIL CLASSIFICATION LEGEND

- FILL - FILL (POSS/PROB) OF ALL TYPES
- GW - WELL GRADED GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GC - CLAYEY GRAVEL
- SW - WELL GRADED SAND
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- SC - CLAYEY SAND
- ML - LOW PLASTICITY SILT
- CL - LOW PLASTICITY CLAY
- MH - HIGH PLASTICITY SILT
- CH - HIGH PLASTICITY CLAY
- ALLUV - ALLUVIUM
- RC - ROCK CORE
- WR - PARTIALLY WEATHERED ROCK
- TOPSOIL
- AP - AUGER PROBE

EOB - END OF BORING
AR - AUGER REFUSAL
SP - SPOON REFUSAL

= SEASONAL HIGH WATER TABLE

= 168 HOUR WATER LEVEL

HORIZONTAL SCALE
1" = 100'

VERTICAL SCALE
1" = 20'

MCB Camp Lejeune Phase IV

MCB Camp Lejeune, NC

ECS

CROSS SECTION B - B'

ECS REVISIONS

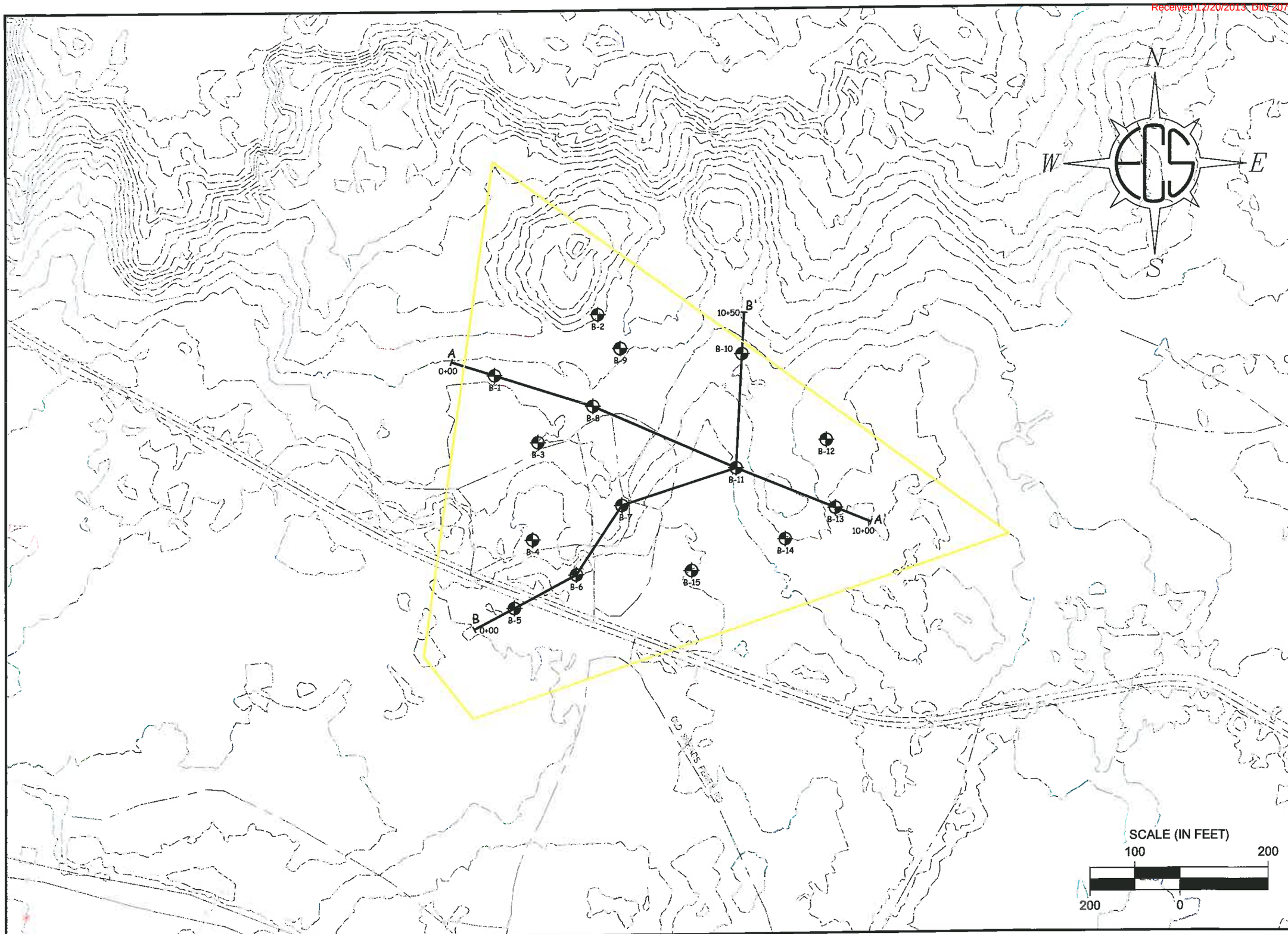
ENGINEER	DRAFTING
JMS	JMR

SCALE: SEE PLAN

PROJECT NO. 22.18460

SHEET: FIGURE 9

DATE: 04/04/13



MCB Camp Lejeune Phase IV

MCB Camp Lejeune, NC

ECS

CROSS SECTION LOCATION DIAGRAM

ECS REVISIONS

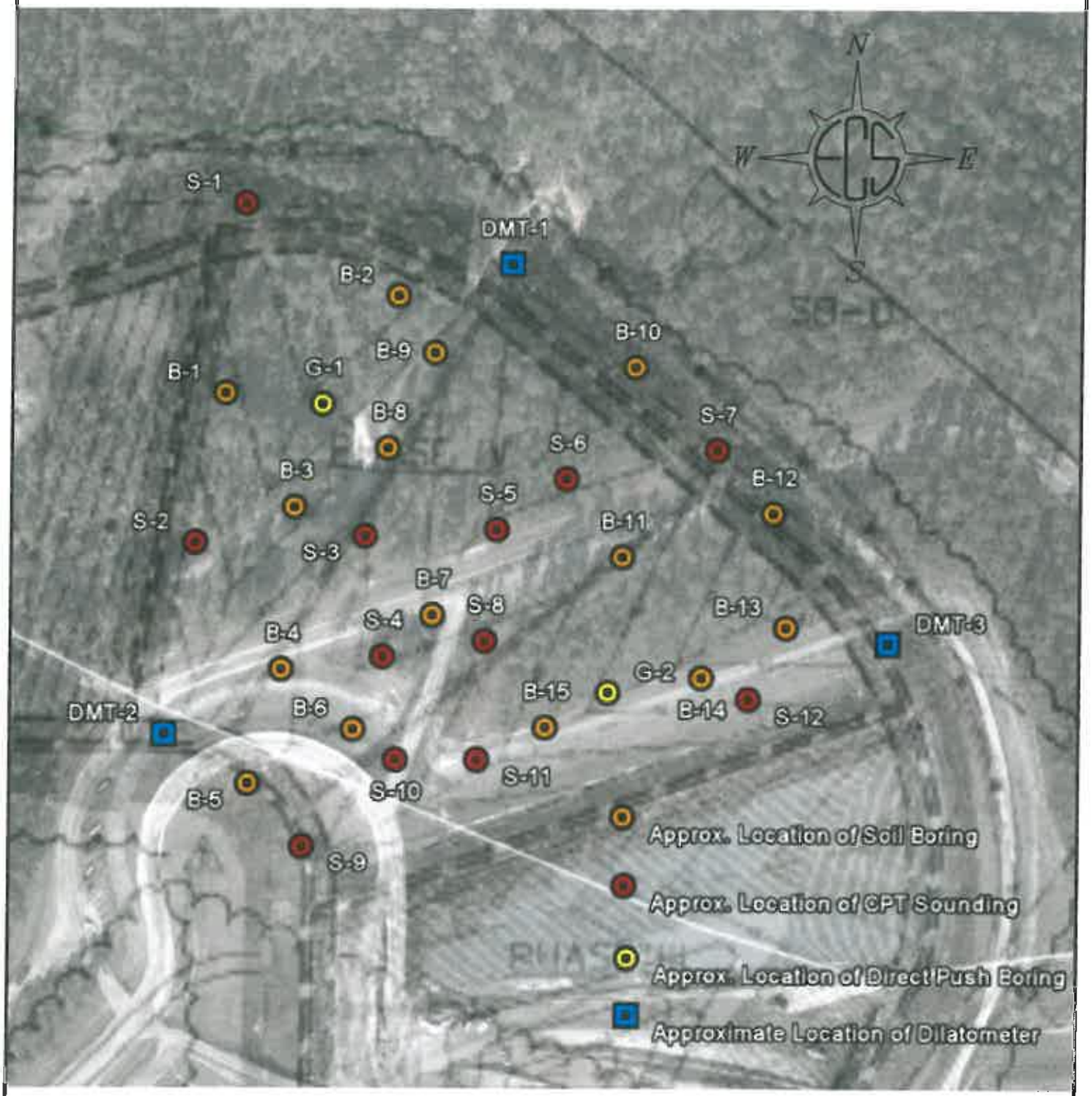
ENGINEER	DRAFTING
JMS	JMR

SCALE 1" = 50'

PROJECT NO. 22.18460

SHEET FIGURE 10

DATE 04/04/13



REFERENC: GOOGLE EARTH

BORING LOCATION DIAGRAM	ECS	**Camp Lejeune Landfill Phase IV** **MCB Camp Lejeune, NC**	ENGINEER WEG DRAFTSMAN WEG REVISIONS	SCALE NTS PROJECT NO. 22.18460 SHEET FIG. 11 DATE 03/01/13

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SOIL CLASSIFICATION LEGEND

- FILL - FILL (POSS/PROB) OF ALL TYPES.
- GW - WELL GRADED GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GC - CLAYEY GRAVEL
- SW - WELL GRADED SAND
- ST - SHELBY TUBE
- ML - LOW PLASTICITY SILT
- CL - LOW PLASTICITY CLAY
- MH - HIGH PLASTICITY SILT
- RC - ROCK CORE
- SM - SILTY SAND
- SP - POORLY GRADED SAND
- SC - CLAYEY SAND
- PM - PRESSURE METER
- CH - HIGH PLASTICITY CLAY
- OH - HIGH PLASTICITY ORGANIC SILTS AND CLAYS
- OL - LOW PLASTICITY ORGANIC SILTS AND CLAY
- PT - PEAT
- WR - WEATHERED ROCK
- PWR - PARTIALLY WEATHERED ROCK
- HWR - HIGHLY WEATHERED ROCK
- DR - DECOMPOSED ROCK

SURFACE MATERIALS

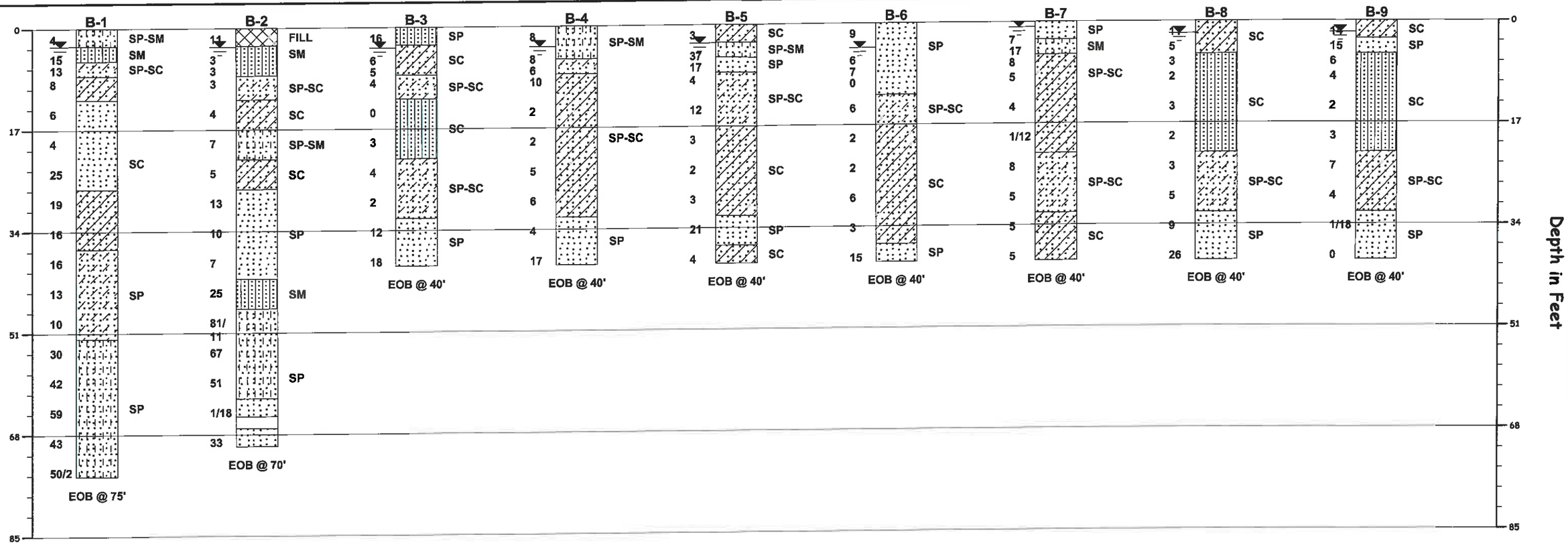
- TOPSOIL
- ASPHALT
- GRAVEL
- CONCRETE
- VOID

ROCK TYPES

- IGNEOUS
- METAMORPHIC
- SEDIMENTARY

SYMBOL LEGEND

- WATER LEVEL - DURING DRILLING/SAMPLING
- WATER LEVEL - BEFORE CASING REMOVAL
- WATER LEVEL - AFTER CASING REMOVAL
- WATER LEVEL - AFTER 24 HOURS



NOTES:
1 SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL REPORT FOR ADDITIONAL INFORMATION.
2 PENETRATION TEST RESISTANCE IN BLOWS PER FOOT (ASTM D1586).
3 HORIZONTAL DISTANCES ARE NOT TO SCALE.

GENERALIZED SUBSURFACE SOIL PROFILE

Camp Lejeune Landfill Phase IV - Geo
C. Allan Bamforth, PE, LS
Piney Green Road, MCB Camp Lejeune, Onslow County,

PROJECT NO.: 18473	DATE: 3/29/2013	VERTICAL SCALE: 1"=17'

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SOIL CLASSIFICATION LEGEND

- FILL - FILL (POSS/PROB) OF ALL TYPES.
- GW - WELL GRADED GRAVEL
- GM - SILTY GRAVEL
- GP - POORLY GRADED GRAVEL
- GC - CLAYEY GRAVEL
- SW - WELL GRADED SAND

ST - SHELBY TUBE

- ML - LOW PLASTICITY SILT
- CL - LOW PLASTICITY CLAY
- MH - HIGH PLASTICITY SILT

RC - ROCK CORE

- SM - SILTY SAND
- SP - POORLY GRADED SAND
- SC - CLAYEY SAND

PM - PRESSURE METER

- CH - HIGH PLASTICITY CLAY
- OH - HIGH PLASTICITY ORGANIC SILTS AND CLAYS
- OL - LOW PLASTICITY ORGANIC SILTS AND CLAY

- PT - PEAT
- WR - WEATHERED ROCK
- PWR - PARTIALLY WEATHERED ROCK
- HWR - HIGHLY WEATHERED ROCK
- DR - DECOMPOSED ROCK

SURFACE MATERIALS

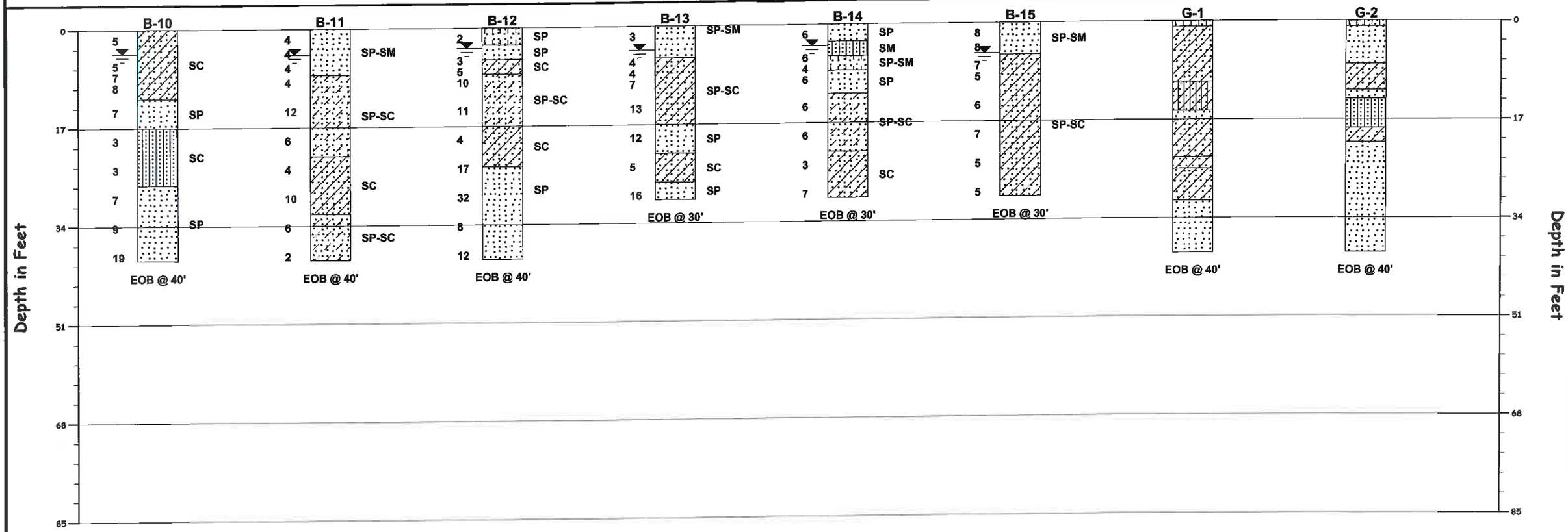
- TOPSOIL
- ASPHALT
- GRAVEL
- CONCRETE
- VOID

ROCK TYPES

- IGNEOUS
- METAMORPHIC
- SEDIMENTARY

SYMBOL LEGEND

- WATER LEVEL - DURING DRILLING/SAMPLING
- WATER LEVEL - BEFORE CASING REMOVAL
- WATER LEVEL - AFTER CASING REMOVAL
- WATER LEVEL - AFTER 24 HOURS



NOTES:
1 SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL REPORT FOR ADDITIONAL INFORMATION.
2 PENETRATION TEST RESISTANCE IN BLOWS PER FOOT (ASTM D1586).
3 HORIZONTAL DISTANCES ARE NOT TO SCALE.

GENERALIZED SUBSURFACE SOIL PROFILE

Camp Lejeune Landfill Phase IV - Geo
C. Allan Bamforth, PE, LS
Piney Green Road, MCB Camp Lejeune, Onslow County,

PROJECT NO.: 18473 | DATE: 3/29/2013 | VERTICAL SCALE: 1"=17'

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APPENDIX II

LABORATORY TEST RESULTS

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Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-1												
	S-2	3.5-5.0	13.8	SM				29.7				
	S-4	8.5-10.0	21.8	SM				29.8				
	S-8	28.5-30.0	24.6	SC				26.5				
	S-11	43.5-45.0	26.7	SP-SC				5.8				
	S-14	58.5-60.0	25.8	SP-SM				5.5				
	S-16	68.5-70.0	23.8	SP-SM				7.7				
B-2												
	S-3	6.0-7.5	27.1	SM				46.0				
	S-5	13.5-15.0	33.9	SC				36.8				
	S-6	18.5-20.0	26.0	SP-SM				10.8				
	S-7	23.5-25.0	46.6	SC				27.4				
	S-10	38.5-40.0	27.2	SP				4.3				
	S-13	53.5-55.0	22.4	SP-SM				7.4				
B-3												
	S-1	1.0-2.5	12.4	SM				26.3				
	S-5	13.5-15.0	35.6	SM				44.1				
	S-8	28.5-30.0	31.0	SP-SC				9.7				
B-4												
	S-2	3.5-5.0	21.2	SP-SM				10.8				
	S-4	8.5-10.0	25.3	SC				18.1				
	S-7	23.5-25.0	26.3	SC				15.4				
B-5												
	S-1	1.0-2.5	17.8	SC				35.8				
	S-6	18.5-20.0	31.9	SC				27.5				
	S-10	38.5-40.0	24.2	SC				15.4				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 18473
Project Name: Camp Lejeune Landfill Phase IV - Geo
PM: Winslow E. Goins
PE: Walid M. Sobh
Printed On: Wednesday, March 6, 2013

ECS Carolinas, LLP

Wilmington, NC

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Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-6												
	S-3	6.0-7.5	16.0	SP				1.5				
	S-5	13.5-15.0	28.1	SP-SC				11.7				
	S-8	28.5-30.0	30.0	SC				31.6				
B-7												
	S-2	3.5-5.0	22.8	SP-SM				6.1				
	S-4	8.5-10.0	19.1	SC				19.2				
	S-9	33.5-35.0	47.4	SC				26.6				
B-8												
	S-3	6.0-7.5	26.3	SM				42.1				
	S-6	18.5-20.0	42.4	SM				38.2				
	S-9	33.5-35.0	21.7	SP				4.1				
B-9												
	S-5	13.5-15.0	33.3	SM				40.0				
	S-7	23.5-25.0	25.5	SC				15.2				
	S-10	38.5-40.0	26.1	SP				3.9				
B-10												
	S-4	8.5-10.0	19.9	SC				23.6				
	S-6	18.5-20.0	30.9	SM				22.3				
	S-7	23.5-25.0	27.3	SC				25.7				
B-11												
	S-2	3.5-5.0	24.1	SP				3.5				
	S-8	28.5-30.0	29.0	SC				20.4				
	S-9	33.5-35.0	23.3	SP-SC				9.3				
B-12												
	S-1	1.0-2.5	7.9	SP-SM				5.3				
	S-3	6.0-7.5	16.5	SC				30.7				
	S-10	38.5-40.0	25.5	SP				4.7				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 18473
Project Name: Camp Lejeune Landfill Phase IV - Geo
PM: Winslow E. Goins
PE: Walid M. Sobh
Printed On: Wednesday, March 6, 2013

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Laboratory Testing Summary

Sample Source	Sample Number	Depth (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Other
					LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-13												
	S-1	1.0-2.5	5.9	SP				3.6				
	S-4	8.5-10.0	15.4	SC				18.9				
	S-7	23.5-25.0	28.0	SC				26.4				
B-14												
	S-3	6.0-7.5	25.2	SP-SM				11.1				
	S-6	18.5-20.0	28.3	SP-SC				11.9				
	S-8	28.5-30.0	30.0	SC				18.8				
B-15												
	S-2	3.5-5.0	20.1	SP				1.6				
	S-4	8.5-10.0	22.4	SC				15.5				
	S-5	13.5-15.0	25.3	SC				24.2				
G-1												
	S-1	3.0-4.0	12.8	SC				33.3				
	S-2	6.5-7.5	18.9	SC				27.6				
	S-3	14.0-15.0	39.7	CL-ML				54.9				
	S-4	24.5-25.5	66.3	CL	37	23	14					
G-2												
	S-1	7.5-8.5	13.6	SC				27.4				
	S-2	14.5-15.5	18.8	SM				13.8				
	S-3	18.5-19.5	25.9	SC				27.7				
	S-4	28.5-29.5	29.6	SC				15.7				
	S-5	36.5-37.5	6.1	SP				3.9				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No. 18473
Project Name: Camp Lejeune Landfill Phase IV - Geo
PM: Winslow E. Goins
PE: Walid M. Sobh
Printed On: Wednesday, March 6, 2013

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Wilmington, NC

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APPENDIX III

BORING LOGS

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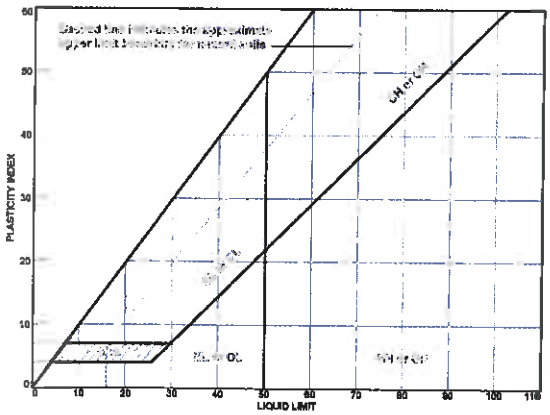
Unified Soil Classification System
(ASTM Designation D-2487)

Major Division		Group Symbol	Typical Names	Classification Criteria
Coarse-grained soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = (D_{30})^2/(D_{10} x D_{60})$ Between 1 and 3
		GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	Not meeting both criteria for GW
		GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limits plot below "A" line or plasticity index less than 4
		GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits plot above "A" line and plasticity index greater than 7
	Sands More than 50% of coarse fraction passes No. 4 sieve	SW	Well-graded sands and gravelly sands, little or no fines	$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = (D_{30})^2/(D_{10} x D_{60})$ Between 1 and 3
		SP	Poorly graded sands and gravelly sands, little or no fines	Not meeting both criteria for SW
		SM	Silty sands, sand-silt mixtures	Atterberg limits plot below "A" line or plasticity index less than 4
		SC	Clayey sands, sand-clay mixtures	Atterberg limits plot above "A" line and plasticity index greater than 7
Fine-grained soils 50% or more passing No. 200 sieve	Silts and Clays Liquid limit 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		OL	Organic silts and organic silty clays of low plasticity	
	Silts and Clays Liquid limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
		CH	Inorganic clays of high plasticitiy, fat clays	
		OH	Organic clays of medium to high plasticity	
Highly organic soils		Pt	Peat, muck and other highly organic soils	Fibrous organic matter; will char, burn, or glow

Classification on basis of percentage of fines

Less than 5% Pass No. 200 sieve	GW, GP, SW, SP
More than 12% Pass No. 200 sieve	GM, GC, SM, SC
5% to 12% Pass No. 200 sieve	Borderline classification requiring use of dual symbol

Note: U-line represents approximate upper limit of LL and PI combinations for natural soils (empirically determined). ASTM-D2487.

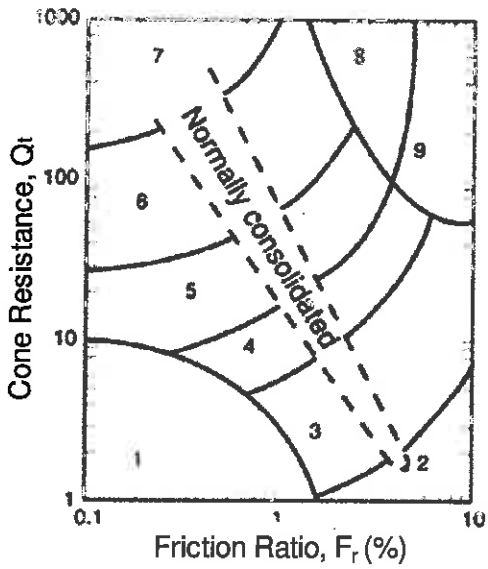


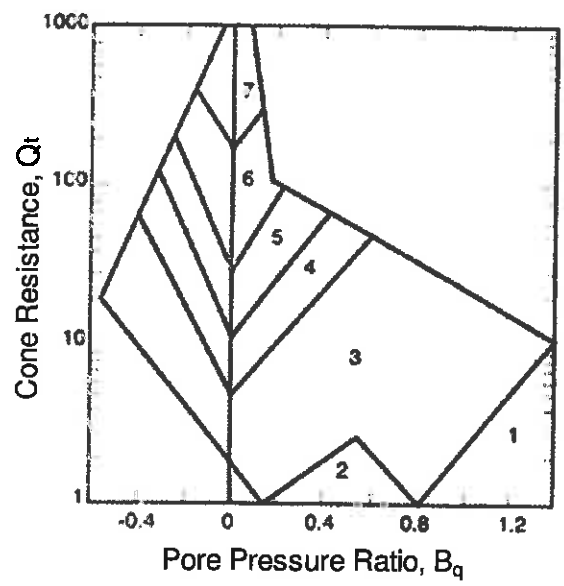
Plasticity chart for the classification of fine-grained soils. Tests made on fraction finer than No. 40 sieve

UNIFIED SOIL CLASSIFICATION SYSTEM

REFERENCE NOTES FOR CONE PENETRATION TEST (CPT) SOUNDINGS

In the CPT sounding procedure (ASTM-D-5778), an electronically instrumented cone penetrometer is hydraulically advanced through soil to measure point resistance (q_c), pore water pressure (u_2), and sleeve friction (f_s). These values are recorded continuously as the cone is pushed to the desired depth. CPT data is corrected for depth and used to estimate soil classifications and intrinsic soil parameters such as angle of internal friction, preconsolidation pressure, and undrained shear strength. The graphs below represent one of the accepted methods of CPT soil behavior classification (Robertson, 1990).





1. Sensitive, Fine Grained
2. Organic Soils-Peats
3. Clays; Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sands to Silty Sands
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

The following table presents a correlation of corrected cone tip resistance (q_c) to soil consistency or relative density:

SAND		SILT/CLAY	
Corrected Cone Tip Resistance (q_c) (tsf)	**Relative Density**	**Corrected Cone Tip Resistance (q_c) (tsf)**	**Relative Density**
<20	Very Loose	<5	Very Soft
20-40	Loose	5-10	Soft
40-120	Medium Dense	10-15	Medium Stiff
		15-30	Stiff
120-200	Dense	30-45	Very Stiff
>200	Very Dense	45-60	Hard
		>60	Very Hard

REFERENCE NOTES FOR BORING LOGS

I. Drilling and Sampling Symbols:

SS:	Split Spoon Sampler	RB:	Rock Bit Drilling
ST:	Shelby Tube Sampler	BS:	Bulk Sample of Cuttings
RC:	Rock Core; NX, BX, AX	PA:	Power Auger (no sample)
PM:	Pressuremeter	HSA:	Hollow Stem Auger
DC:	Dutch Cone Penetrometer	WS:	Wash Sample

Standard Penetration (Blows/Ft) refers to the blows per foot of a 140 lb. hammer falling 30 inches on a 2 inch O.D. split spoon sample, as specified in ASTM D-1586. The blow count is commonly referred to as the N value.

II. Correlation of Penetration Resistances to Soil Properties:

Relative Density of Cohesionless Soils

SPT-N	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
51 or more	Very Dense

Consistency of Cohesive Soils

SPT-N	Consistency
0 - 2	Very Soft
3 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Very Stiff
31 - 50	Hard
50 or more	Very Hard

III. Unified Soil Classification Symbols:

GP:	Poorly Graded Gravel	ML:	Low Plasticity Silts
GW:	Well Graded Gravel	MH:	High Plasticity Silts
GM:	Silty Gravel	CL:	Low Plasticity Clays
GC:	Clayey Gravel	CH:	High Plasticity Clays
SP:	Poorly Graded Sands	OL:	Low Plasticity Organics
SW:	Well Graded Sands	OH:	High Plasticity Organics
SM:	Silty Sands	CL - ML:	Dual Classification (Typical)
SC:	Clayey Sands		

IV. Water Level Measurement Symbols:

WL:	Water Level	BCR:	Before Casing Removal
WS:	While Sampling	ACR:	After Casing Removal
WD:	While Drilling	WCI:	Wet Cave In
		DCI:	Dry Cave In

The water levels are those water levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when auguring, without adding fluids, in a granular soil. In clays and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

The elevations indicated on the boring logs should be considered approximate and were not determined using accepted surveying techniques.

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-1	1 OF 3

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · — REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Very Loose, Gray, Fine SAND, With Silt (SP-SM)		
	S-1	SS	18	18		2 2 2	4
	S-2	SS	18	18	Medium Dense, Brown, Silty, Fine SAND, With Clay Lense (SM)	3 4 11	13.8 15
5	S-3	SS	18	18	Medium Dense, Tan-Gray, Fine SAND, With Clay (SP-SC)	4 5 8	13
	S-4	SS	18	18	Loose, Tan-Gray, Clayey, Fine SAND (SC)	3 4 4	8 21.8
10					Very Loose, Loose and Medium Dense, Tan-Gray to Gray, Fine SAND (SP)		
	S-5	SS	18	18		3 3 3	6
15							
	S-6	SS	18	18		1 2 2	4
20							
	S-7	SS	18	18		9 11 14	25
25					Medium Dense, Gray, Clayey, Fine to Medium SAND (SC)		
	S-8	SS	18	18		5 8 11	19 24.6
30							

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 2.98' WS☐ WD☐	BORING STARTED 01/28/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/28/13		CAVE IN DEPTH
WL 18.30' After 168 Hours	RIG 45B ATV	FOREMAN BF	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-1	2 OF 3

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

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DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
30					Medium Dense, Gray, Clayey, Fine to Medium SAND (SC)				
	S-9	SS	18	18				9 8 8	16
35					Medium Dense to Loose, Gray, Fine SAND, With Clay Lenses (SP-SC)				
	S-10	SS	18	18				6 6 10	16
40									
	S-11	SS	18	18				5 6 7	13, 26.7
45									
	S-12	SS	18	18				6 5 5	10
50					Medium Dense to Very Dense, Gray, Fine SAND, With Silt (SP-SM)				
	S-13	SS	18	18				12 15 15	30
55									
	S-14	SS	18	18				15 20 22	25.8, 42
60									

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 2.98' WS☐ WD☐	BORING STARTED 01/28/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/28/13	CAVE IN DEPTH
WL 18.30' After 168 Hours	RIG 45B ATV FOREMAN BF	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-1	3 OF 3

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

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DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
60					Medium Dense to Very Dense, Gray, Fine SAND, With Silt (SP-SM)				
	S-15	SS	18	18				16 26 33	59
65									
	S-16	SS	18	18				20 23 20	23.8 43
70									
	S-17	SS	8	0				50 50/2	50/2
75					SPOON REFUSAL @ 75.00'				
80									
85									
90									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 2.98' WS ☐ WD ☐	BORING STARTED 01/28/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/28/13	CAVE IN DEPTH
WL 18.30' After 168 Hours	RIG 45B ATV FOREMAN BF	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-2	1 OF 3

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

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DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Medium Dense, Brown, Fine SAND, With Silt, Clay and Brick Fragments (FILL)		
	S-1	SS	18	18		2 4 7	11
	S-2	SS	18	18	Very Loose, Dark Brown, Silty, Fine SAND, With Wood Debris (SM)	4 1 2	3
5	S-3	SS	18	18	Very Loose, Tan-Gray, Silty, Fine SAND (SM)	1 2 1	3, 27.1
	S-4	SS	18	18	Very Loose, Tan-Gray, Fine SAND, With Clay (SP-SC)	1 1 2	3
10							
	S-5	SS	18	18	Very Loose, Tan-Gray, Clayey, Fine SAND (SC)	1 2 2	4, 33.9
15							
	S-6	SS	18	18	Loose, Tan to Gray, Fine SAND, With Silt (SP-SM)	3 3 4	7, 26.0
20							
	S-7	SS	18	18	Loose, Gray, Clayey, Fine SAND (SC)	3 3 2	5, 46.6
25							
	S-8	SS	18	18	Medium Dense to Loose, Gray, Fine to Medium SAND, With Clay Lenses (SP)	6 6 7	13
30							

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.13' WS☐ WD☐	BORING STARTED 01/25/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/25/13		CAVE IN DEPTH
WL 13.55' After 168 Hours	RIG 45B ATV	FOREMAN MC	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-2	2 OF 3

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · — REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

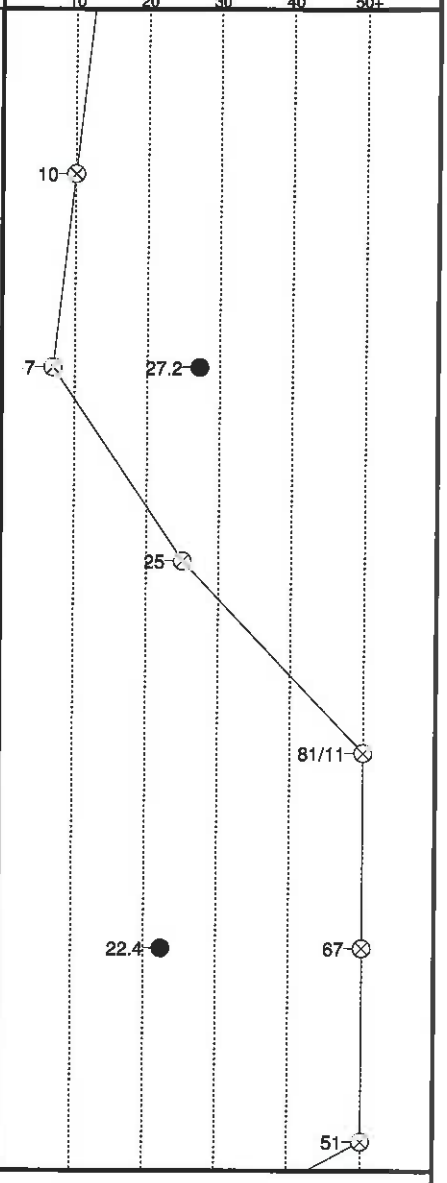
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
30					Medium Dense to Loose, Gray, Fine to Medium SAND, With Clay Lenses (SP)			
	S-9	SS	18	18				4 4 6
35								
	S-10	SS	18	18				5 4 3
40								
					Medium Dense, Gray, Silty, Fine to Medium SAND, With Shell Fragments (SM)			
	S-11	SS	18	18				4 5 20
45								
					Very Dense, Gray, Fine SAND, With Silt (SP-SM)			
	S-12	SS	17	17				19 31 50/5
50								
	S-13	SS	18	18				17 28 39
55								
	S-14	SS	18	18				18 21 30
60								



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.13' WS☐ WD☐	BORING STARTED 01/25/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/25/13	CAVE IN DEPTH
WL 13.55' After 168 Hours	RIG 45B ATV FOREMAN MC	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-2	3 OF 3

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · — REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

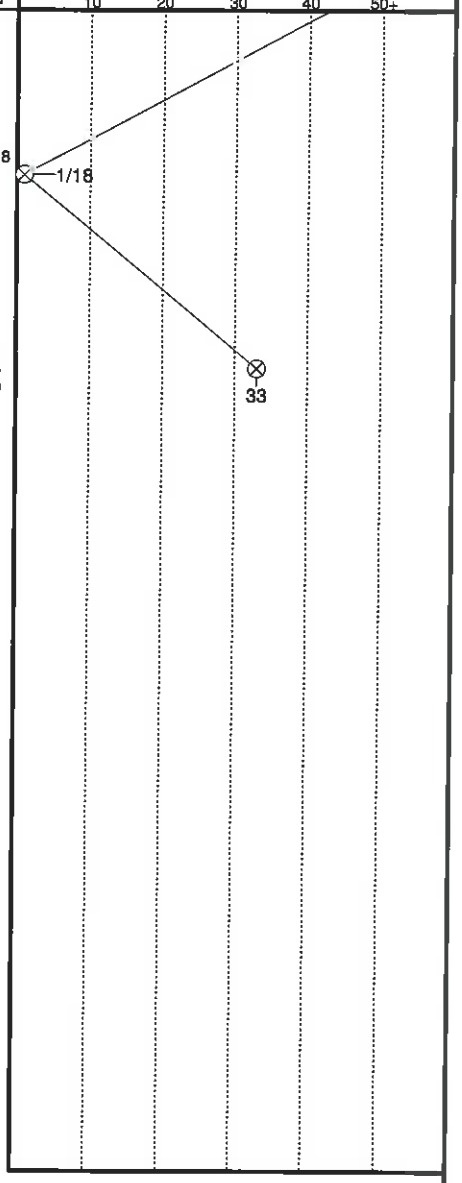
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
60					Very Dense, Gray, Fine SAND, With Silt (SP-SM)			
					Very Loose, Gray, Fine to Medium SAND, With Shell Fragments (SP)			
	S-15	SS	18	18				1/18
65					Possible Void			
					Dense, Gray, Fine to Medium SAND, Trace Shell Fragments (SP)			
	S-16	SS	18	18				7 14 19
70					END OF BORING @ 70.00'			
75								
80								
85								
90								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.13' WS☐ WD☐	BORING STARTED 01/25/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/25/13	CAVE IN DEPTH
WL 13.55' After 168 Hours	RIG 45B ATV FOREMAN MC	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-3	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2 (1, 2, 3, 4, 5+)

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — • — REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT % (20%, 40%, 60%, 80%, 100%)

STANDARD PENETRATION BLOWS/FT (10, 20, 30, 40, 50+)

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	PENETROMETER	STANDARD PENETRATION BLOWS/FT
0	S-1	SS	18	18	Medium Dense, Tan-Brown, Silty, Fine to Medium SAND, Trace Clay (SM)	3 6 10	12.4	16
	S-2	SS	18	18	Loose, Tan-Gray, Clayey, Fine SAND (SC)	3 3 3	6	
5	S-3	SS	18	18		3 3 2	5	
	S-4	SS	18	18	Very Loose, Tan-Gray, Fine SAND, With Clay (SP-SC)	2 2 2	4	
10								
	S-5	SS	18	18	Very Loose, Tan-Gray, Silty, Fine SAND (SM)	WOH WOH WOH	0	35.6
15								
	S-6	SS	18	18		2 2 1	3	
20								
	S-7	SS	18	18	Very Loose, Tan-Gray, Fine to Medium SAND, With Clay (SP-SC)	1 2 2	4	
25								
	S-8	SS	18	18		1 1 1	2	31.0
30								

WATER LEVELS / ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.44'	WS ☐ WD ☐	BORING STARTED 01/24/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/24/13	CAVE IN DEPTH
WL 13.44'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-3	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT / WATER CONTENT % / LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
30					Very Loose, Tan-Gray, Fine to Medium SAND, With Clay (SP-SC)				
					Medium Dense, Gray, Fine to Medium SAND, With Clay Lenses (SP)				
	S-9	SS	18	18				9 6 6	12
35									
	S-10	SS	18	18				7 7 11	18
40					END OF BORING @ 40.00'				
45									
50									
55									
60									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.44' WS ☐ WD ☐	BORING STARTED 01/24/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/24/13		CAVE IN DEPTH
WL 13.44' After 168 Hours	RIG 45B ATV	FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-4	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% - REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

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DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Loose, Brown to Tan-Gray, Fine SAND, With Silt (SP-SM)		
	S-1	SS	18	18		3 3 5	8
	S-2	SS	18	18		2 4 4	8, 21.2
5					Loose, Tan-Gray, Fine SAND, With Clay (SP-SC)		
	S-3	SS	18	18		2 3 3	6
	S-4	SS	18	18	Very Loose and Loose, Tan-Gray, Clayey, Fine SAND (SC)	4 5 5	10, 25.3
10							
	S-5	SS	18	18		1 1 1	2
15							
	S-6	SS	18	18		1 1 1	2
20							
	S-7	SS	18	18		3 2 3	5, 26.3
25							
	S-8	SS	18	18		7 4 2	6
30							

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.40'	WS ☐ WD ☐	BORING STARTED 01/21/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/21/13	CAVE IN DEPTH
WL 12.85'	After 168 Hours	RIG 45B ATV FOREMAN MC	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-4	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

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ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

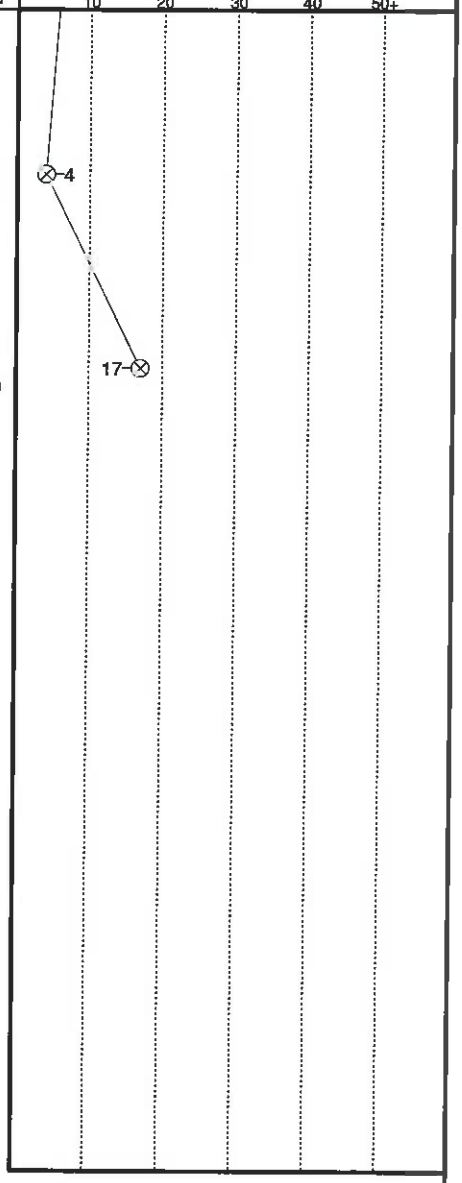
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
30					Very Loose and Loose, Tan-Gray, Clayey, Fine SAND (SC)			
					Very Loose to Medium Dense, Light Gray to Gray, Fine SAND, Trace Clay (SP)			
	S-9	SS	18	18				3 2 2
35								
	S-10	SS	18	18				4 7 10
40					END OF BORING @ 40.00'			
45								
50								
55								
60								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.40' WS ☐ WD ☐	BORING STARTED 01/21/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/21/13	CAVE IN DEPTH	
WL 12.85' After 168 Hours	RIG 45B ATV FOREMAN MC	DRILLING METHOD Mud Rotary	

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-5	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — • REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	PENETROMETER	STANDARD PENETRATION BLOWS/FT
0	S-1	SS	18	18	Very Loose, Tan-Brown, Clayey, Fine to Medium SAND, With Roots (SC)	2 1 2	17.8	3
5	S-2	SS	18	18	Dense, Brown, Fine SAND, With Silt (SP-SM)	12 15 22		37
	S-3	SS	18	18	Medium Dense, Tan, Fine SAND (SP)	7 8 9		17
10	S-4	SS	18	18	Very Loose to Medium Dense, Tan-Gray, Fine SAND, With Clay (SP-SC)	2 2 2		4
15	S-5	SS	18	18		6 6 6		12
20	S-6	SS	18	18	Very Loose, Tan-Gray to Gray, Clayey, Fine SAND (SC)	3 1 2	31.9	3
25	S-7	SS	18	18		WOH 1 1		2
30	S-8	SS	18	18		2 1 2		3

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.13' WS☐ WD☐	BORING STARTED 01/22/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/22/13	CAVE IN DEPTH
WL 14.83' After 168 Hours	RIG 45B ATV FOREMAN MC	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-5	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT / WATER CONTENT % / LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
30					Very Loose, Tan-Gray to Gray, Clayey, Fine SAND (SC)				
					Medium Dense, Gray, Fine SAND, Trace Clay (SP)				
	S-9	SS	18	18				9 9 12	21
35									
					Very Loose, Gray, Clayey, Fine to Coarse SAND (SC)				
	S-10	SS	18	18				2 2 2	4 24.2
40					END OF BORING @ 40.00'				
45									
50									
55									
60									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.13' WS☐ WD☐	BORING STARTED 01/22/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/22/13	CAVE IN DEPTH
WL 14.83' After 168 Hours	RIG 45B ATV FOREMAN MC	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-6	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0						
	S-1	SS	18	18	2 4 5	9
	S-2	SS	18	18	2 3 3	6
5	S-3	SS	18	18	2 3 4	7 — 18.0
	S-4	SS	18	18	WOH WOH WOH	0
10						
	S-5	SS	18	18	3 2 4	6 — 28.1
15						
	S-6	SS	18	18	1 1 1	2
20						
	S-7	SS	18	18	1 1 1	2
25						
	S-8	SS	18	18	3 2 4	6 — 30.0
30						

Loose, Tan-Brown, Fine SAND, Trace Silt (SP)

Very Loose, Tan, Fine SAND, Trace Clay (SP)

Loose, Tan-Gray, Fine SAND, With Clay (SP-SC)

Very Loose and Loose, Light Gray to Gray, Clayey, Fine to Medium SAND (SC)

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 4.14'	WS ☐ WD ☐	BORING STARTED 01/22/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/22/13	CAVE IN DEPTH
WL 22.69'	After 168 Hours	RIG 45B ATV FOREMAN MC	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-6	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

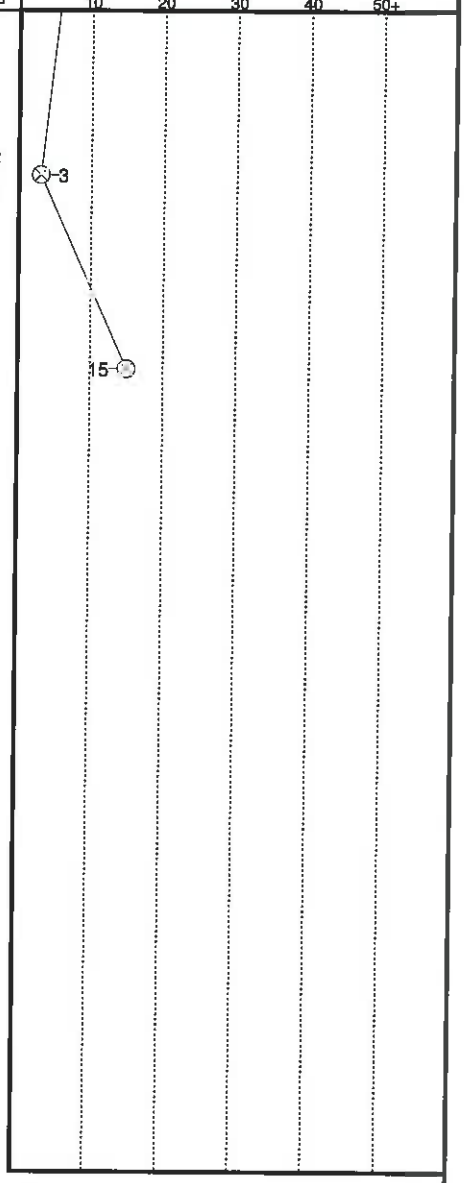
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
30					Very Loose and Loose, Light Gray to Gray, Clayey, Fine to Medium SAND (SC)			
	S-9	SS	18	18				2 1 2
35					Medium Dense, Gray, Fine to Medium SAND (SP)			
	S-10	SS	18	18				8 7 8
40					END OF BORING @ 40.00'			
45								
50								
55								
60								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 4.14' WS ☐ WD ☐	BORING STARTED 01/22/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/22/13	CAVE IN DEPTH	
WL 22.69' After 168 Hours	RIG 45B ATV	FOREMAN MC	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-7	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — • REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Loose, Brown-Tan, Fine SAND, Trace Silt (SP)		
	S-1	SS	18	18		3 3 4	7
	S-2	SS	18	18	Medium Dense, Brown, Fine SAND, With Silt (SP-SM)	4 7 10	17 (22.8)
5	S-3	SS	18	18	Loose, Tan to Brown-Gray, Clayey, Fine SAND (SC)	4 5 3	8
	S-4	SS	18	18		2 2 3	5 (19.1)
10					Very Loose, Tan-Gray to Gray, Clayey, Fine SAND (SC)		
	S-5	SS	18	18		1 2 2	4
15							
	S-6	SS	18	18		1 1/12	1/12
20					Loose, Gray, Fine SAND, With Clay (SP-SC)		
	S-7	SS	18	18		3 3 5	8
25							
	S-8	SS	18	18		3 2 3	5
30							

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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 0.92' WS☐ WD☐	BORING STARTED 01/23/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/23/13	CAVE IN DEPTH
WL 11.55' After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-7	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — • REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	CALIBRATED PENETROMETER TONS/FT2	STANDARD PENETRATION BLOWS/FT
30					Loose, Gray, Fine SAND, With Clay (SP-SC)					
					Loose, Tan-Gray to Gray, Clayey, Fine to Medium SAND (SC)					
	S-9	SS	18	18				1 2 3	5	47.4
35										
	S-10	SS	18	18				1 2 3	5	
40					END OF BORING @ 40.00'					
45										
50										
55										
60										

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 0.92'	WS ☐ WD ☐	BORING STARTED 01/23/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/23/13	CAVE IN DEPTH
WL 11.55'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-8	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	BLOWS/6"	PENETROMETER	STANDARD PENETRATION
0	S-1	SS	18	18	5 5 6	11	
	S-2	SS	18	18	2 2 3	5	
5	S-3	SS	18	18	2 2 1	3	26.3
	S-4	SS	18	18	1 1 1	2	
10	S-5	SS	18	18	2 2 1	3	
15	S-6	SS	18	18	1 1 1	2	42.4
20	S-7	SS	18	18	1 2 1	3	
25	S-8	SS	18	18	2 2 3	5	
30							

Medium Dense to Loose, Brown-Tan, Clayey, Fine SAND (SC)

Very Loose, Tan-Gray, Silty, Fine SAND (SM)

Very Loose to Loose, Tan-Gray, Fine SAND, With Clay (SP-SC)

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 2.07'	WS ☐ WD ☐	BORING STARTED 01/24/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/24/13	CAVE IN DEPTH
WL 12.93'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-8	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
30					Very Loose to Loose, Tan-Gray, Fine SAND, With Clay (SP-SC)				
					Loose to Medium Dense, Gray, Fine to Medium SAND (SP)				
	S-9	SS	18	18				3 3 6	9, 21.7
35									
	S-10	SS	18	18				7 7 19	26
40					END OF BORING @ 40.00'				
45									
50									
55									
60									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 2.07' WS ☐ WD ☐	BORING STARTED 01/24/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/24/13	CAVE IN DEPTH	
WL 12.93' After 168 Hours	RIG 45B ATV	FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-9	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Medium Dense, Tan-Brown, Clayey, Fine SAND (SC)		
	S-1	SS	18	18		11 5 9	14
					Medium Dense, Tan, Fine SAND (SP)		
	S-2	SS	18	18		7 9 6	15
5					Loose to Very Loose, Tan-Gray, Silty, Fine SAND (SM)		
	S-3	SS	18	18		3 3 3	6
	S-4	SS	18	18		2 2 2	4
10							
	S-5	SS	18	18		1 1 1	2 33.3
15							
	S-6	SS	18	18		2 1 2	3
20					Loose to Very Loose, Gray, Clayey, Fine to Medium SAND (SC)		
	S-7	SS	18	18		3 3 4	7 25.5
25							
	S-8	SS	18	18		2 2 2	4
30							

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 1.95' WS☐ WD☐	BORING STARTED 01/22/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/22/13	CAVE IN DEPTH
WL 14.74' After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-9	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — • REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
30					Loose to Very Loose, Gray, Clayey, Fine to Medium SAND (SC)				
					Very Loose, Gray, Fine to Medium SAND (SP)				
	S-9	SS	18	18				1/18	1/18
35									
	S-10	SS	18	18				WOH WOH WOH	0
40					END OF BORING @ 40.00'				26.1
45									
50									
55									
60									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 1.95' WS☐ WD☐	BORING STARTED 01/22/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/22/13		CAVE IN DEPTH
WL 14.74' After 168 Hours	RIG 45B ATV	FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-10	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0						
	S-1	SS	18	18	1 3 2	5
	S-2	SS	18	18	2 2 3	5
5						
	S-3	SS	18	18	3 3 4	7
	S-4	SS	18	18	4 4 4	8, 19.9
10						
	S-5	SS	18	18	3 4 3	7
15						
	S-6	SS	18	18	3 1 2	3, 30.9
20						
	S-7	SS	18	18	2 1 2	3, 27.3
25						
	S-8	SS	18	18	5 3 4	7
30						

Loose, Tan-Brown, Clayey, Fine SAND (SC)

Loose, Tan-Gray, Fine SAND, With Clay Lenses (SP)

Very Loose, Tan-Gray, Silty, Fine SAND (SM)

Loose to Medium Dense, Tan-Orange, Fine to Medium SAND, Trace Clay (SP)

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 4.19' WS☐ WD☐	BORING STARTED 01/24/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/24/13		CAVE IN DEPTH
WL 16.65' After 168 Hours	RIG 45B ATV	FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-10	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

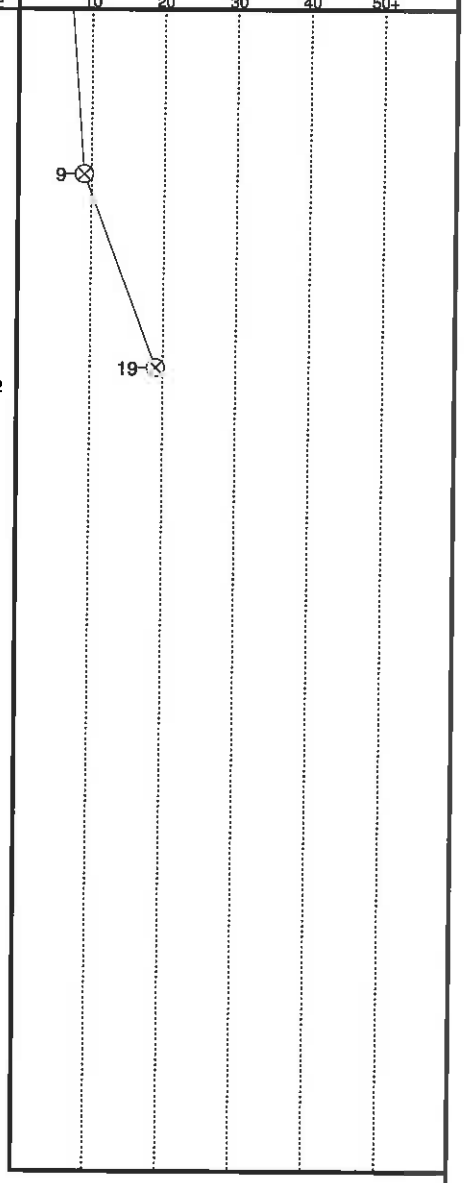
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
30					Loose to Medium Dense, Tan-Orange, Fine to Medium SAND, Trace Clay (SP)			
	S-9	SS	18	18				5 4 5
35								
	S-10	SS	18	18				7 7 12
40					END OF BORING @ 40.00'			
45								
50								
55								
60								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 4.19'	WS ☐ WD ☐	BORING STARTED 01/24/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/24/13	CAVE IN DEPTH
WL 16.65'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-11	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

20% 40% 60% 80% 100%

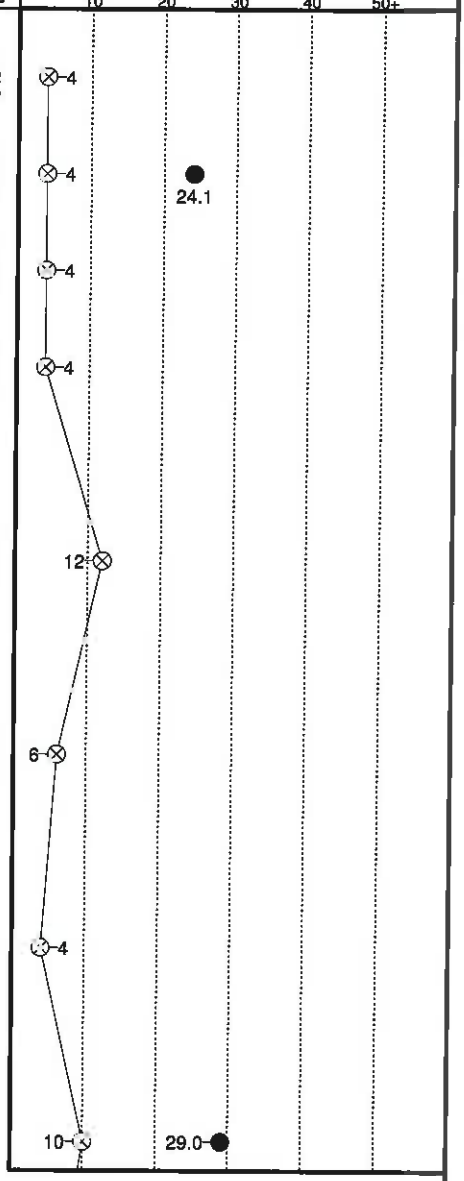
STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"
0					Very Loose, Light Gray to Tan, Fine SAND (SP)	
	S-1	SS	18	18		1 2 2
	S-2	SS	18	18		1 2 2
5						
	S-3	SS	18	18		2 2 2
	S-4	SS	18	18	Very Loose, Loose and Medium Dense, Light Gray to Tan-Gray, Fine SAND, With Clay (SP-SC)	2 2 2
10						
	S-5	SS	18	18		4 6 6
15						
	S-6	SS	18	18		3 3 3
20						
					Very Loose to Loose, Light Gray to Tan-Gray, Clayey, Fine SAND (SC)	
	S-7	SS	18	18		1 3 1
25						
	S-8	SS	18	18		2 5 5
30						



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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 4.43'	WS ☐ WD ☐	BORING STARTED 01/23/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/23/13	CAVE IN DEPTH
WL 16.62'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-11	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	Penetrometer	Standard Penetration
30					Very Loose to Loose, Light Gray to Tan-Gray, Clayey, Fine SAND (SC)			
					Loose to Very Loose, Tan-Gray to Gray-Orange, Fine to Medium SAND, With Clay (SP-SC)			
	S-9	SS	18	18		4 4 2	6	23.3
35								
	S-10	SS	18	18		2 1 1	2	
40					END OF BORING @ 40.00'			
45								
50								
55								
60								

WATER LEVELS — ELEVATION (FT)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 4.43'	WS ☐ WD ☐	BORING STARTED 01/23/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/23/13	CAVE IN DEPTH
WL 16.62'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-12	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT² (1, 2, 3, 4, 5+)

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — • REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT % (20%, 40%, 60%, 80%, 100%)

STANDARD PENETRATION BLOWS/FT (10, 20, 30, 40, 50+)

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0	S-1	SS	18	18	Very Loose, Tan-Gray, Fine SAND, With Silt (SP-SM)	1 1 1	2, 7.9
	S-2	SS	18	18	Very Loose, Tan, Fine SAND, With Clay Lense (SP)	2 1 2	3
5	S-3	SS	18	18	Loose, Tan, Clayey, Fine SAND (SC)	2 3 2	5, 16.5
	S-4	SS	18	18	Loose to Medium Dense, Tan to Tan-Gray, Fine SAND, With Clay (SP-SC)	5 5 5	10
10							
	S-5	SS	18	18		4 5 6	11
15							
					Very Loose, Tan-Gray, Clayey, Fine SAND (SC)		
	S-6	SS	18	18		3 2 2	4
20							
	S-7	SS	18	18	Medium Dense to Dense, Light Gray, Fine SAND (SP)	3 5 12	17
25							
	S-8	SS	18	18		8 14 18	32
30							

WATER LEVELS — ELEVATION (FT)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.52'	WS ☐ WD ☐	BORING STARTED 01/23/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/23/13	CAVE IN DEPTH
WL 17.51'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-12	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

BOTTOM OF CASING — LOSS OF CIRCULATION 100%

SURFACE ELEVATION

ENGLISH UNITS

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
30					Medium Dense to Dense, Light Gray, Fine SAND (SP)				
					Loose to Medium Dense, Light Gray, Fine to Medium SAND (SP)				
	S-9	SS	18	18				7 3 5	8
35									
	S-10	SS	18	18				3 5 7	12 25.5
40					END OF BORING @ 40.00'				
45									
50									
55									
60									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.52' WS ☐ WD ☐	BORING STARTED 01/23/13		
WL(BCR) WL(ACR)	BORING COMPLETED 01/23/13	CAVE IN DEPTH	
WL 17.51' After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary	

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-13	1 OF 1

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · — REC.%

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Very Loose, Brown-Gray, Fine SAND (SP)		
	S-1	SS	18	18		1 1 2	3 5.9
					Very Loose, Tan, Fine SAND (SP)		
	S-2	SS	18	18		1 2 2	4
5					Very Loose to Medium Dense, Tan to Tan-Gray, Clayey, Fine SAND (SC)		
	S-3	SS	18	18		2 2 2	4
	S-4	SS	18	18		3 3 4	7 15.4
10							
	S-5	SS	18	18		4 6 7	13
15					Medium Dense, Light Gray, Fine SAND, Trace Clay (SP)		
	S-6	SS	18	18		4 5 7	12
20					Loose, Light Gray, Clayey, Fine SAND (SC)		
	S-7	SS	18	18		3 2 3	5 28.0
25					Medium Dense, Light Gray, Fine SAND (SP)		
	S-8	SS	18	18		7 6 10	16
30					END OF BORING @ 30.00'		

WATER LEVELS — ELEVATION (FT)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 4.14'	WS ☐ WD ☐	BORING STARTED 01/21/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/21/13	CAVE IN DEPTH
WL 17.52'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-14	1 OF 1

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	BLOWS/6"	STANDARD PENETRATION BLOWS/FT	
0					Loose, Brown, Fine SAND, Trace Silt (SP)			
	S-1	SS	18	18		2 3 3	6	
	S-2	SS	18	18	Loose, Black, Silty, Fine SAND, With Clay (SM)	3 3 3	6	
5	S-3	SS	18	18	Very Loose, Brown, Fine SAND, With Silt (SP-SM)	1 2 2	4	25.2
	S-4	SS	18	18	Loose, Tan-Gray, Fine SAND (SP)	2 3 3	6	
10								
	S-5	SS	18	18	Loose, Tan-Gray, Fine SAND, With Clay (SP-SC)	3 3 3	6	
15								
	S-6	SS	18	18		3 3 3	6	28.3
20					Very Loose to Loose, Light Gray, Clayey, Fine SAND (SC)			
	S-7	SS	18	18		4 1 2	3	
25								
	S-8	SS	18	18		3 3 4	7	30.0
30					END OF BORING @ 30.00'			

WATER LEVELS — ELEVATION (FT)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.71'	WS ☐ WD ☐	BORING STARTED 01/21/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/21/13	CAVE IN DEPTH
WL 17.24'	After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	B-15	1 OF 1

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %

20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT	
0							Loose, Tan, Fine SAND, Trace Silt (SP)
	S-1	SS	18	18	2 3 5	8	
	S-2	SS	18	18	2 3 5	8	20.1
5							Loose, Tan-Gray to Gray, Clayey, Fine SAND (SC)
	S-3	SS	18	18	3 3 4	7	
	S-4	SS	18	18	2 2 3	5	22.4
10							
	S-5	SS	18	18	2 3 3	6	25.3
15							
	S-6	SS	18	18	2 4 3	7	
20							
	S-7	SS	18	18	2 2 3	5	
25							
	S-8	SS	18	18	4 2 3	5	
30							END OF BORING @ 30.00'

WATER LEVELS — ELEVATION (FT)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 5.24' WS☐ WD☐	BORING STARTED 01/21/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/21/13	CAVE IN DEPTH
WL 16.00' After 168 Hours	RIG 45B ATV FOREMAN MW	DRILLING METHOD Mud Rotary

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	G-1	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT / WATER CONTENT % / LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL (ENGLISH UNITS) | WATER LEVELS | ELEVATION (FT) | BLOWS/6"

BOTTOM OF CASING ▶ LOSS OF CIRCULATION

SURFACE ELEVATION

Depth (FT)	Description
0	Brown, Fine SAND, With Silt (SP-SM)
	Brown-Tan, Clayey, Fine SAND (SC)
	Tan-Gray, Clayey, Fine SAND With Clean Sand Lenses (SC)
	Gray, Fine Sandy Silty CLAY (CL-ML)
	Light Gray, Fine SAND (SP)
	Gray, Clayey, Fine SAND (SC)
	Dark Gray, Fine Sandy CLAY (CL)
	Gray-Brown, Clayey, Fine SAND (SC)

Sample points: S-1 (12.8), S-2 (18.9), S-3 (39.7), S-4 (23, 37, 66.3)

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS☐ WD☐	BORING STARTED 01/18/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/18/13	CAVE IN DEPTH
WL	RIG GeoProbe FOREMAN JS	DRILLING METHOD Direct Push

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	G-1	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION — SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
30					Gray-Brown, Clayey, Fine SAND (SC)			
					Gray, Fine to Medium SAND (SP)			
35								
40					END OF BORING @ 40.0'			
45								
50								
55								
60								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL	WS ☐ WD ☐	BORING STARTED 01/18/13	
WL(BCR)	WL(ACR)	BORING COMPLETED 01/18/13	CAVE IN DEPTH
WL		RIG GeoProbe FOREMAN JS	DRILLING METHOD Direct Push

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	G-2	1 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — · REC.% —

PLASTIC LIMIT — WATER CONTENT % — LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	STANDARD PENETRATION BLOWS/FT
0					Brown, Fine SAND, With Silt (SP-SM)				
					Tan, Fine SAND (SP)				
5									
	S-1				Gray-Brown to Tan-Gray, Clayey, Fine SAND (SC)				13.6
10									
					Tan-Gray, Fine SAND (SP)				
					Black, Silty, Fine SAND (SM)				
15	S-2				Tan-Gray-Brown, Silty, Fine SAND (SM)				18.8
	S-3				Gray-Brown, Clayey, Fine SAND (SC)				25.9
20									
					Orange-Light Gray, Fine SAND, With Clayey Sand Lenses (SP)				
25									
	S-4								29.6
30									

CONTINUED ON NEXT PAGE.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/18/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/18/13	CAVE IN DEPTH
WL	RIG GeoProbe FOREMAN JS	DRILLING METHOD Direct Push

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	18473	G-2	2 OF 2

PROJECT NAME: Camp Lejeune Landfill Phase IV - Geo

ARCHITECT-ENGINEER:

SITE LOCATION: Piney Green Road, MCB Camp Lejeune, Onslow County, North Carolina

CALIBRATED PENETROMETER TONS/FT2: 1 2 3 4 5+

ROCK QUALITY DESIGNATION & RECOVERY: RQD% — - REC.% —

PLASTIC LIMIT / WATER CONTENT % / LIQUID LIMIT %: 20% 40% 60% 80% 100%

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50+

ENGLISH UNITS

BOTTOM OF CASING / LOSS OF CIRCULATION / SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
30					Orange-Light Gray, Fine SAND, With Clayey Sand Lenses (SP)			
					Tan-Light Gray, Fine SAND (SP)			
35	S-5							
					Tan-Light Gray, Fine to Medium SAND (SP)			
40					END OF BORING @ 40.0'			
45								
50								
55								
60								

S-5: 6.1

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 01/18/13	
WL(BCR) WL(ACR)	BORING COMPLETED 01/18/13	CAVE IN DEPTH
WL	RIG GeoProbe FOREMAN JS	DRILLING METHOD Direct Push

APPENDIX B

GEOTECHNICAL REPORT FOR RECYCLING FACILITY SITE

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ECS CAROLINAS, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities
NC Registered Engineering Firm F-1078

October 9, 2013

Ms. Anna Lee Bamforth
C. Allan Bamforth, PE, LS
2207 Hampton Blvd
Norfolk, VA 23571

Re: Report of Pavement Analysis
Phase IV
Municipal Solid Waste Landfill Expansion
MCB Camp Lejeune, Onslow County, North Carolina

ECS Project No.: 22.18473

Dear Ms. Bamforth:

As requested, ECS has reviewed and revised the recommendations for the proposed concrete paved area across Piney Green Road from the Landfill Phase IV. The area currently consists of mostly open, ABC stone covered areas underlain by crushed aggregate, crushed concrete and rubble to depths of 2 to 3 feet of unknown compaction. A GPR scan was performed at twenty locations to verify the stone thickness. In addition to the GPR scans, eight test pits were performed to a depth of 6 feet using a 10,000 pound excavator with a 24 inch bucket.

ECS collected two composite samples of near surface soils from areas not covered with concrete pavement or crushed stone, one sample below the stone and one sample of the existing stone. The samples were tested in accordance with test procedures ASTM D-1557 entitled "Laboratory Compaction Characteristics of Soil Using Modified Effort" and ASTM D-1883 entitled "Standard Test Method for California Bearing Ratio (CBR) of Laboratory Compacted Soils". The results for the proctor curve analysis and the results for the California Bearing Ratio test are attached.

ECS used the lower CBR value of the three soil tests for its design. The value of 16 was reduced 2/3 for a design of 10 which is the highest recommended CBR value for pavement design. An equivalent K-value of 200 pci for a CBR of 10 was used in the rigid pavement calculation. For the existing stone, the CBR value of 126 was reduced to 80 for the design

ECS was instructed to use four traffic conditions for a 25 year design life. Condition 1 was 1,000,000 18k Tractor Trailer passes. Condition 2 was 1,000,000 18k Tractor Trailer passes and 250,000 Front-End Loader passes. Condition 3 was 1,000, 000 18k Tractor Trailer passes and 250,000 Wheel Loader passes. Condition 4 was 1,000,000 18k Tractor Trailer passes, 250,000 Front-End Loader passes, and 250,000 Wheel Loader passes. The Front End Loader (CAT988k) has an operational weight of 112,000 pounds. The Wheel Loader (CAT 962H) has an operational weight of 65,000 pounds.

Condition 1&3: Based on the results of the pavement design program PCASE, we recommend 6.5 inches of concrete with a design flexural strength of 650 psi. The concrete pavement should be underlain by 8 inches of aggregate base course. The existing aggregate base course can be re-used, provided it meets project specifications. Unless there is documentation of compaction during placement, ECS recommends that the existing aggregate in the upper 10 inches be re-compacted in place to project specifications.

Condition 2&4: Based on the results of the pavement design program PCASE, we recommend 9.0 inches of concrete with a design flexural strength of 650 psi. The concrete pavement should be underlain by 8 inches of aggregate base course. The existing aggregate base course can be re-used, provided it meets project specifications. Unless there is documentation of compaction during placement, ECS recommends that the existing aggregate in the upper 10 inches be re-compacted in place to project specifications.

The ABC stone should be compacted to an average value of 98 percent of its modified Proctor (ASTM D-1557) maximum dry density with no tests less than 95 percent of the modified Proctor maximum dry density.

Subgrade Preparation

The first step in preparing the site for the proposed construction should be to remove all stone, deleterious materials, existing pavement, foundations, utilities, and any other soft or unsuitable materials from the existing ground surface. These operations should extend at least 10 feet, where possible, beyond the planned limits of the proposed building and pavements. The existing stone and crushed concrete should be stockpile for re-use at the site.

After stripping and prior to fill placementor pavement construction, the exposed subgrade soils should be evaluated by an experienced geotechnical engineer to identify any localized unstable or otherwise unsuitable materials. After evaluating the exposed soils, proofrolling using a smooth **static** drum roller, having an axle weight of at least 10 tons, is suggested to be used at this time to aid in identifying localized soft or unsuitable material which should be removed. The proofrolling will also help densify the upper exposed subgrade soils. During this process, it may be necessary to allow groundwater brought to the surface during densification to recede prior to continued densification or subsequent fill placement. Vibratory rolling should not be performed in the vicinity of existing structures. Any soft or unsuitable materials identified during proofrolling operations should be either repaired in-place or removed and replaced with an approved backfill placed and compacted in accordance with recommendations of this report. Significant densification of surface soils or repair of the same should be anticipated.

Site subgrade conditions will be significantly influenced by weather conditions. Subgrades that are evaluated after periods of rainfall will not respond as well to proofrolling as subgrades that are evaluated after periods of more favorable weather. The contractor should use tracked equipment to minimize the degradation of stable subgrade.

The preparation of fill subgrades, as well as proposed building subgrades, should be observed on a full-time basis by ECS personnel. These observations should be performed by an experienced geotechnical engineer, or his representative, to ensure that the unsuitable materials have been removed and that the prepared subgrade is suitable for support of the proposed construction and/or fills.

Fill Placement

Following the removal of deleterious surface and subsurface materials, and after achieving a stable subgrade, engineered fills can be placed and compacted to achieve the desired site grades. Fill for support of the proposed construction and for backfill of utility lines within expanded pavement limits should consist of an approved material, free of organic matter and debris and cobbles greater than 3 inches, less than 35% material passing the No. 200 sieve by weight, and have a Liquid Limit (LL) and Plasticity Index (PI) less than 35 and 9, respectively. We also recommend that fills within structural areas have a modified Proctor (ASTM D 1557) maximum dry density of at least 100 pounds per cubic foot (pcf).

Unsuitable fill materials include topsoil, organic materials (OH, OL), and high plasticity clays and silts (CH, MH). Such materials removed during grading operations should be either stockpiled for later use in landscape fills, or placed in approved on or off-site disposal areas.

Existing soils containing significant amounts of organic matter will not be suitable for re-use as engineered fill. As such, the organic content of the near surface soils should be evaluated to determine if some of these soils will be suitable for re-use as engineered fill. Natural fine-grained soils classified as clays or silts (CL, ML) with LL and PI greater than 35 and 9, respectively, should be evaluated by the geotechnical engineer at the time of construction to determine their suitability for use as engineered fill.

Prior to the commencement of fill operations and/or utilization of any off-site borrow materials, the contractor should provide representative samples of the proposed fill soils to the geotechnical engineer. The geotechnical engineer can determine the material's suitability for use as an engineered fill and develop moisture-density relationships in accordance with the recommendations provided herein. Samples should be provided to the geotechnical engineer at least 3 to 5 days prior to their use in the field to allow for the appropriate laboratory testing to be performed.

Fill materials placed within the pavement areas should be placed in lifts not exceeding 8 inches in loose lift thickness and moisture conditioned to within their working range of optimum moisture content. The fills should then be compacted to a minimum of 95 percent of the soil's modified Proctor (ASTM D 1557) maximum dry density to within 12 inches below finished subgrade. The upper 12 inches of fills placed beneath the roadway should be compacted to 98 percent of the soil's modified Proctor (ASTM D 1557) maximum dry density. The typical working range of optimum moisture for the natural Coastal Plain soils at the site is expected to be within approximately 3 percent of the optimum moisture content. Care should also be taken to provide a smooth, gently sloping ground surface at the end of each day's earthwork activities to help reduce the potential for ponding and absorption of surface water.

Grade controls should also be maintained throughout the filling operations. Filling operations should be observed on a full-time basis by a qualified representative of ECS to determine that the required degrees of compaction are being achieved. We recommend that a minimum of one compaction test per 2,000 square feet of roadway be performed for each lift of controlled fill. Within trench or other localized excavations at least one test shall be performed for each 200 linear feet of each lift of fill. The elevation and location of the tests should be clearly identified at the time of fill placement. Areas which fail to achieve the required degree of compaction should be re-worked until the specified degree of compaction is achieved. Failing test areas may require moisture adjustments or other suitable remedial activities in order to achieve the required compaction.

Fill materials should not be placed on frozen, frost-heaved, and/or soils which have been recently subjected to precipitation. Wet or frozen soils should be removed prior to the continuation of site grading and fill placement. Borrow fill materials, if required, should not contain excessively wet or frozen materials at the time of placement. Additionally, if grading operations occur during the winter months, frost-heaved soils should be removed prior to placement of engineered fill, granular sub-base materials, foundation or slab concrete, and asphalt pavement materials.

If problems are encountered during the site grading operations, or if the actual site conditions differ from those encountered during our subsurface exploration, the geotechnical engineer should be notified immediately.

Regardless of the section and type of construction utilized, saturation of the subgrade materials and pavement areas results in a softening of the subgrade material and shortened life span for the pavement. Therefore, we recommend that both the surface and subsurface materials for the pavement be properly graded to enhance surface and subgrade drainage. A subsurface collection system is not required. By quickly removing surface and subsurface water, softening of the subgrade can be reduced and the performance of the pavement area can be improved.

Excavation Conditions

The site soils are OSHA Type B and C soils for the purpose of temporary excavation support. We recommend that permanent cut slopes through undisturbed residual soils be constructed at 3:1 (horizontal: vertical) or flatter. Permanent fill slopes may be constructed using compacted on-site soils at a slope of 3:1 or flatter. A slope of 3:1 or flatter may be desirable to permit establishment of vegetation, safe mowing, and maintenance. The surface of cut and fill slopes should be adequately compacted. P ermanent slopes should be protected using vegetation or other means to prevent erosion.

Based on the findings of the test pits and the results of soundings performed at the LMCC building adjacent to the site, the below surface soils consist of medium dense to dense silty and clean sands (SM, SP). At the time of the exploration at the LMCC building (9/9/09), the groundwater level was approximately 7 to 8 feet below the existing grades.

We appreciate the opportunity to be of service to you during the design phase of this project and look forward to our continued involvement during the construction phase. If you have any questions concerning the information and recommendations presented in this report, please contact us at (910) 686-9114 for further assistance.

Respectfully submitted,

ECS CAROLINAS, LLP

Winslow E. Goins, P.E.
Engineering Department Manager
North Carolina License No. 033751

Kris Stamm
Principal

APPENDIX A-SITE MAPS
APPENDIX B-TEST PIT LOGS
APPENDIX C-CALCULATIONS
APPENDIX C-LABORATORY DATA
APPENDIX D-GENERAL CONDITIONS

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APPENDICES

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APPENDIX A

SITE MAPS

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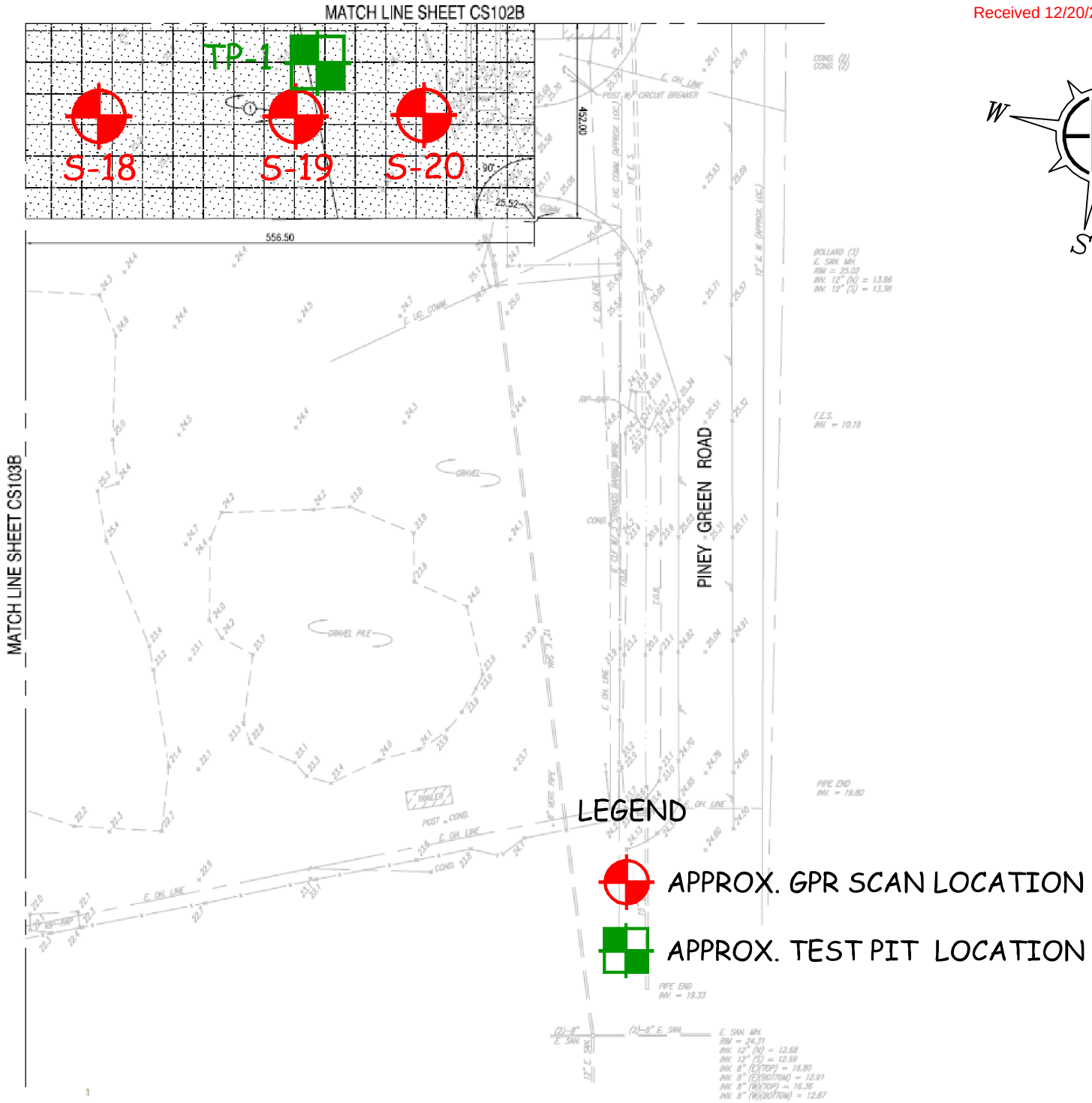


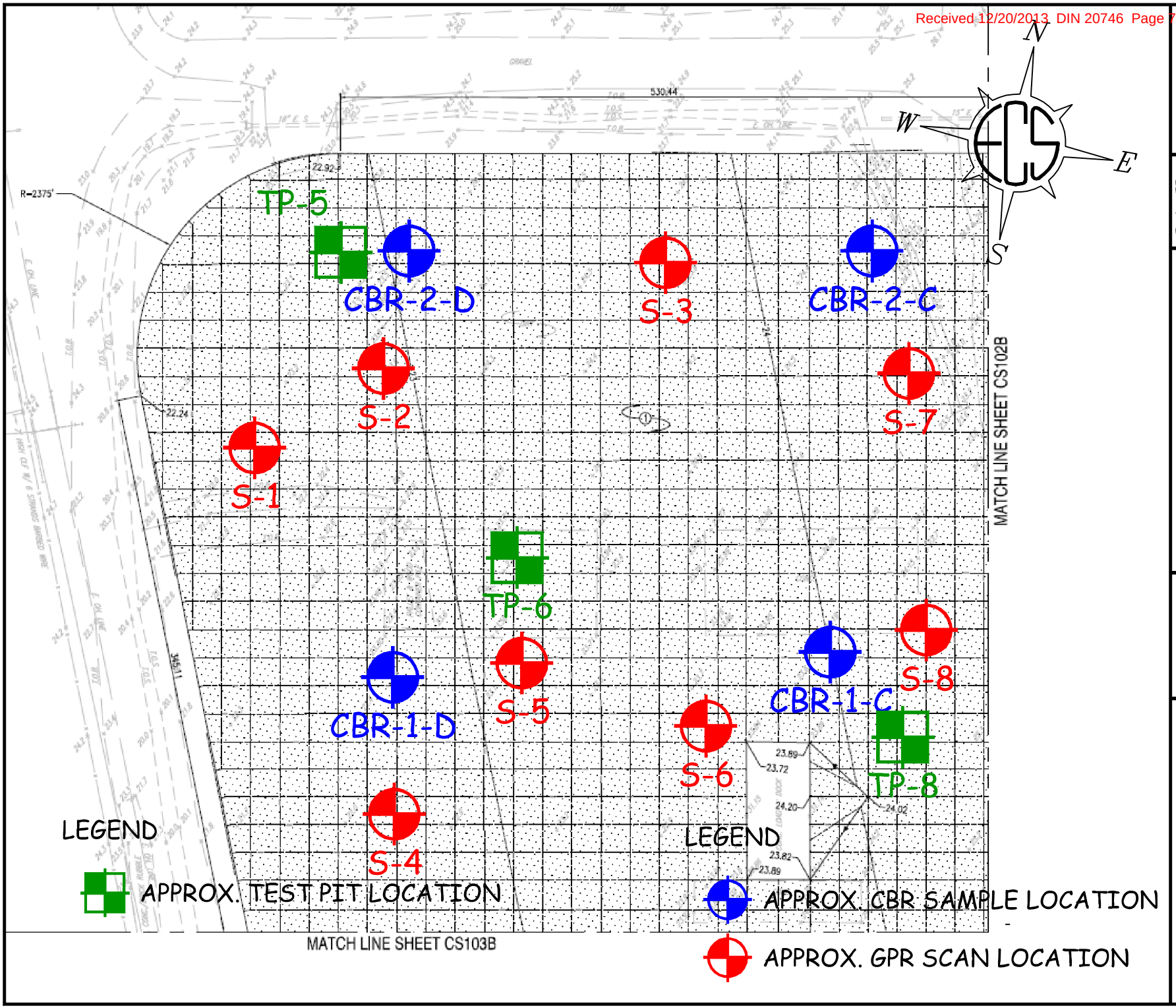
SCALE	NTS
PROJECT NO.	22.18473
SHEET	4
DATE	06/28/13
ENGINEER	WEG
DRAFTSMAN	WEG
REVISIONS	

Landfill Phase IV

MCB Camp Lejeune, NC

SAMPLE LOCATION DIAGRAM

Received 12/20/2013 DIN 20746 Page 726 of 763



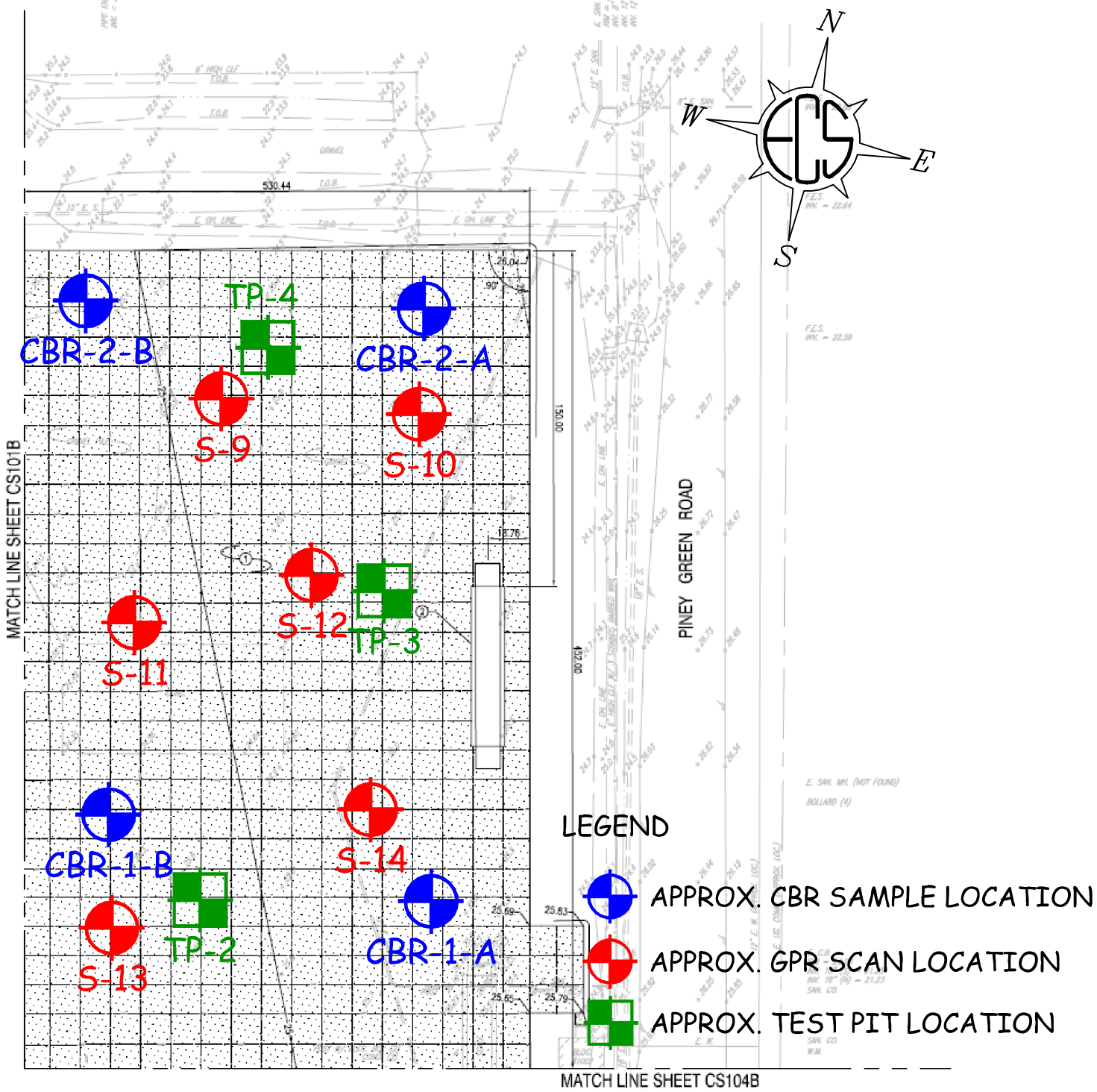
SCALE	NTS
PROJECT NO.	22.18473
SHEET	1
DATE	06/28/13
ENGINEER	WEG
DRAFTSMAN	WEG
REVISIONS	

Landfill Phase IV

MCB Camp Lejeune, NC

SAMPLE LOCATION DIAGRAM

Received 12/20/2013 DIN 20746 Page 727 of 763



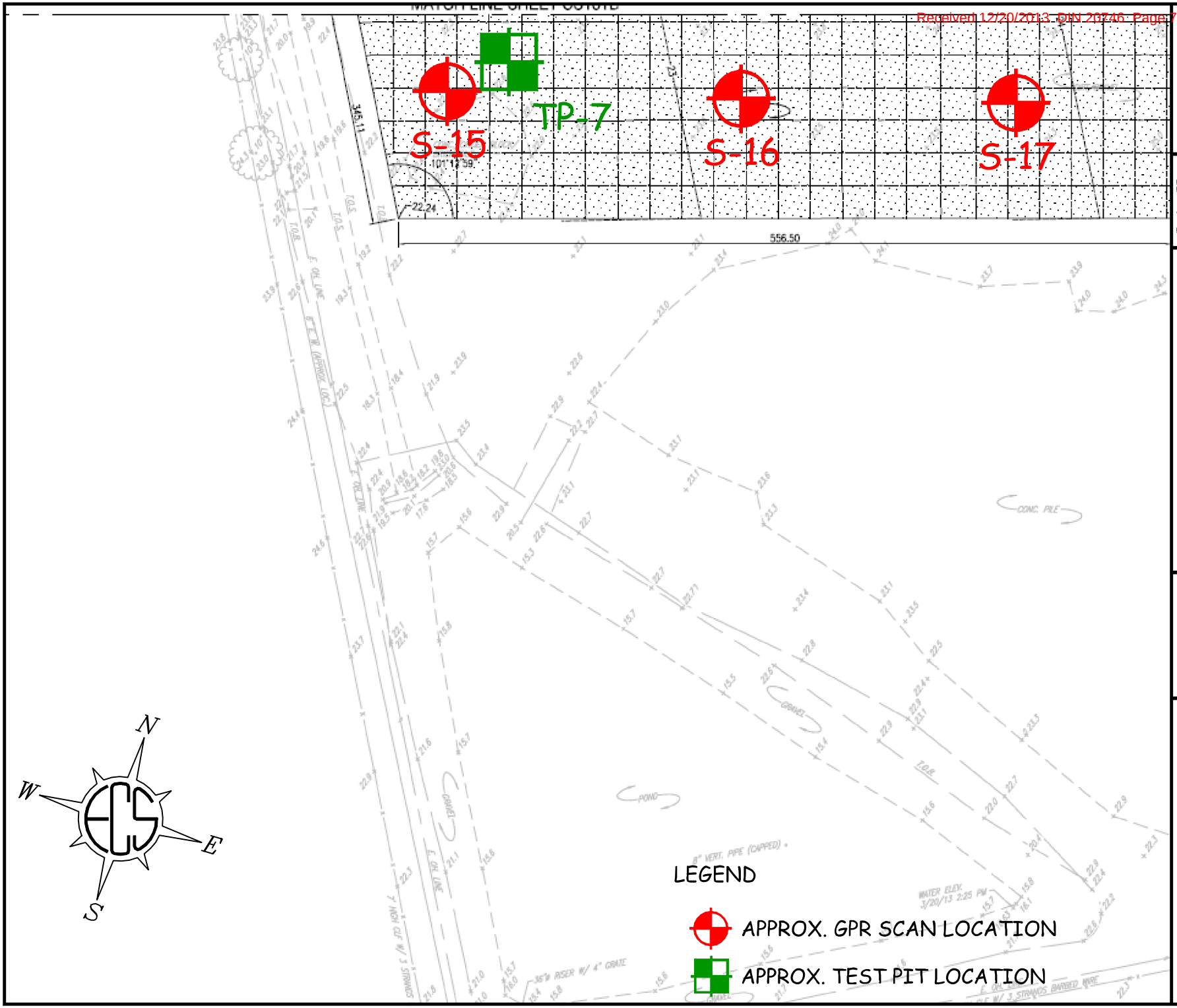
SCALE	NTS
PROJECT NO.	22.18473
SHEET	2
DATE	06/28/13
ENGINEER	WEG
DRAFTSMAN	WEG
REVISIONS	

Landfill Phase IV

MCB Camp Lejeune, NC

SAMPLE LOCATION DIAGRAM

Received 12/20/2013 DIN 20746 Page 728 of 763



SCALE	NTS
PROJECT NO.	22.18473
SHEET	3
DATE	06/28/13
ENGINEER	WEG
DRAFTSMAN	WEG
REVISIONS	

Landfill Phase IV

MCB Camp Lejeune, NC

SAMPLE LOCATION DIAGRAM

APPENDIX B

TEST PIT LOGS

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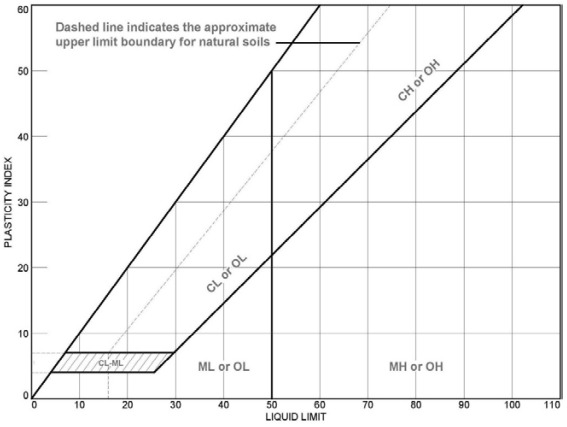
Unified Soil Classification System
(ASTM Designation D-2487)

Major Division		Group Symbol	Typical Names	Classification Criteria	
Coarse-grained soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% Pass No. 200 sieve	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = (D_{30})^2/(D_{10}xD_{60})$ Between 1 and 3
		GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW
		GM	Silty gravels, gravel-sand-silt mixtures	More than 12% Pass No. 200 sieve GW, GP, SW, SP GM, GC, SM, SC	Atterberg limits plot below "A" line or plasticity index less than 4
		GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7
	Sands More than 50% of coarse fraction passes No. 4 sieve	SW	Well-graded sands and gravelly sands, little or no fines	5% to 12% Pass No. 200 sieve Borderline classification requiring use of dual symbol	$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = (D_{30})^2/(D_{10}xD_{60})$ Between 1 and 3
		SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW
		SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4
		SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7
Fine-grained soils 50% or more passing No. 200 sieve	Silts and Clays Liquid limit 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands		
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
		OL	Organic silts and organic silty clays of low plasticity		
	Silts and Clays Liquid limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts		
		CH	Inorganic clays of high plasticitiy, fat clays		
		OH	Organic clays of medium to high plasticity		
Highly organic soils		Pt	Peat, muck and other highly organic soils		Fibrous organic matter; will char, burn, or glow

Note: U-line represents approximate upper limit of LL and PI combinations for natural soils (empircally determined). ASTM-D2487.



Plasticity chart for the classification of fine-grained soils. Tests made on fraction finer than No. 40 sieve

UNIFIED SOIL CLASSIFICATION SYSTEM

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	22.18473	TP-1	1 OF 1

PROJECT NAME: Phase IV - Municipal Solid Waste Landfill Expansion

ARCHITECT-ENGINEER:

SITE LOCATION: MCB Camp Lejeune, Onslow County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2: 1 2 3 4 5+

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

AVERAGE DCP BLOW COUNT: 5 10 15 20 25+

ENGLISH UNITS

BOTTOM OF CASING

SURFACE ELEVATION

DEPTH (FT)	TEST NO.	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	DCP BLOW COUNTS
0		Brown Sand with Brick/Concrete			
		Brown Clayey SAND (SC)			
2		Organic Grindings(2 to 3 inches in diameter)			
		Tan SAND (SP)			
4					
6		End of Test Pit			
8					
10					
12					

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 09/10/13	DRILLING METHOD Test Pit
WL(BCR) WL(ACR)	BORING COMPLETED 09/10/13	CAVE IN DEPTH
WL		

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	22.18473	TP-2	1 OF 1

PROJECT NAME: Phase IV - Municipal Solid Waste Landfill Expansion

ARCHITECT-ENGINEER:

SITE LOCATION: MCB Camp Lejeune, Onslow County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2: 1 2 3 4 5+

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

AVERAGE DCP BLOW COUNT: 5 10 15 20 25+

ENGLISH UNITS

BOTTOM OF CASING

SURFACE ELEVATION

DEPTH (FT)	TEST NO.	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	DCP BLOW COUNTS
0		Brown Clayey SAND (SC)			
		Organic Grindings(2 to 3 inch in diameter)			
		Black Sandy CLAY (CL) with Organics			
2		Tan SAND (SP)			
4					
6		End of Test Pit			
8					
10					
12					

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 09/10/13	DRILLING METHOD Test Pit
WL(BCR) WL(ACR)	BORING COMPLETED 09/10/13	CAVE IN DEPTH
WL		

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	22.18473	TP-3	1 OF 1

PROJECT NAME: Phase IV - Municipal Solid Waste Landfill Expansion

ARCHITECT-ENGINEER:

SITE LOCATION: MCB Camp Lejeune, Onslow County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2: 1 2 3 4 5+

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

AVERAGE DCP BLOW COUNT: 5 10 15 20 25+

ENGLISH UNITS

BOTTOM OF CASING

SURFACE ELEVATION

DEPTH (FT)	TEST NO.	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	DCP BLOW COUNTS
0		ABC Stone			
		Brown Sandy CLAY (CL) with Organics & Grindings			
2		Tan SAND (SP)			
4					
6		End of Test Pit			
8					
10					
12					

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 09/10/13	DRILLING METHOD Test Pit
WL(BCR) WL(ACR)	BORING COMPLETED 09/10/13	CAVE IN DEPTH
WL		

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	22.18473	TP-4	1 OF 1

PROJECT NAME: Phase IV - Municipal Solid Waste Landfill Expansion

ARCHITECT-ENGINEER:

SITE LOCATION: MCB Camp Lejeune, Onslow County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2: 1 2 3 4 5+

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

AVERAGE DCP BLOW COUNT: 5 10 15 20 25+

ENGLISH UNITS

BOTTOM OF CASING

SURFACE ELEVATION

DEPTH (FT)	TEST NO.	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	DCP BLOW COUNTS
0		ABC Stone			
		Brown Clayey SAND (SC)			
		Organic Grindings(2 to 3 inch in diameter)			
2		White SAND (SP)			
4					
6		End of Test Pit			
8					
10					
12					

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 09/10/13	DRILLING METHOD Test Pit
WL(BCR) WL(ACR)	BORING COMPLETED 09/10/13	CAVE IN DEPTH
WL		

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	22.18473	TP-5	1 OF 1

PROJECT NAME: Phase IV - Municipal Solid Waste Landfill Expansion

ARCHITECT-ENGINEER:

SITE LOCATION: MCB Camp Lejeune, Onslow County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2: 1 2 3 4 5+

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

AVERAGE DCP BLOW COUNT: 5 10 15 20 25+

ENGLISH UNITS

BOTTOM OF CASING

SURFACE ELEVATION

DEPTH (FT)	TEST NO.	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	DCP BLOW COUNTS
0		Crushed Concrete			
		Brown Clayey SAND (SC)			
2		Black Sandy CLAY (CL) with Grindings			
		White SAND (SP)			
4					
6		End of Test Pit			
8					
10					
12					

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 09/10/13	DRILLING METHOD Test Pit
WL(BCR) WL(ACR)	BORING COMPLETED 09/10/13	CAVE IN DEPTH
WL		

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	22.18473	TP-6	1 OF 1

PROJECT NAME: Phase IV - Municipal Solid Waste Landfill Expansion

ARCHITECT-ENGINEER:

SITE LOCATION: MCB Camp Lejeune, Onslow County, North Carolina

NORTHING | EASTING | STATION

ENGLISH UNITS

BOTTOM OF CASING

SURFACE ELEVATION

DEPTH (FT)	TEST NO.	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	DCP BLOW COUNTS
0		ABC Stone			
		Brown Clayey SAND (SC)			
2		Black Sandy CLAY (CL) with Organics			
		Tan SAND (SP)			
4					
6		End of Test Pit			
8					
10					
12					

CALIBRATED PENETROMETER TONS/FT^2: 1, 2, 3, 4, 5+

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

AVERAGE DCP BLOW COUNT: 5, 10, 15, 20, 25+

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 6.0' WS ☐ WD ☐	BORING STARTED 09/10/13	DRILLING METHOD Test Pit
WL(BCR) WL(ACR)	BORING COMPLETED 09/10/13	CAVE IN DEPTH
WL		

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	22.18473	TP-7	1 OF 1

PROJECT NAME: Phase IV - Municipal Solid Waste Landfill Expansion

ARCHITECT-ENGINEER:

SITE LOCATION: MCB Camp Lejeune, Onslow County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2: 1 2 3 4 5+

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

AVERAGE DCP BLOW COUNT: 5 10 15 20 25+

ENGLISH UNITS

BOTTOM OF CASING

SURFACE ELEVATION

DEPTH (FT)	TEST NO.	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	DCP BLOW COUNTS
0		Crushed Concrete			
		Black Sandy CLAY (CL) with Organics			
2					
		Tan SAND (SP)			
4					
6		End of Boring			
8					
10					
12					

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 6.0' WS ☐ WD ☐	BORING STARTED 09/10/13	DRILLING METHOD Test Pit
WL(BCR) WL(ACR)	BORING COMPLETED 09/10/13	CAVE IN DEPTH
WL		

CLIENT	JOB #	BORING #	SHEET
C. Allan Bamforth, PE, LS	22.18473	TP-8	1 OF 1

PROJECT NAME: Phase IV - Municipal Solid Waste Landfill Expansion

ARCHITECT-ENGINEER:

SITE LOCATION: MCB Camp Lejeune, Onslow County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2: 1 2 3 4 5+

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

AVERAGE DCP BLOW COUNT: 5 10 15 20 25+

ENGLISH UNITS

BOTTOM OF CASING

SURFACE ELEVATION

DEPTH (FT)	TEST NO.	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	DCP BLOW COUNTS
0		Tan SAND (SP) with Concrete			
		Black Sandy CLAY (CL) with Organics			
		Tan SAND (SP)			
2					
4					
6		End of Boring			
8					
10					
12					

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 09/10/13	DRILLING METHOD Test Pit
WL(BCR) WL(ACR)	BORING COMPLETED 09/10/13	CAVE IN DEPTH
WL		

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APPENDIX C

CALCULATIONS

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Pavement Thickness Report
U.S. Army Corps of Engineers
PCASE Version 2.09.02
Date : 6/28/2013

Design Name :	CONDITION1
Design Type :	Roads
Pavement Type :	Rigid
Road Type :	Road
Terrain Type :	Flat
Analysis Type :	K
Depth of Frost (in) :	0
Wander Width (in) :	33.35
% Load Transfer :	0
Effective K (pci) :	279
Reduced Sub Effective K (pci) :	0
Joint Spacing :	10 to 15 ft
Dowel Spacing :	12.00 in
Dowel Length :	16.00 in
Dowel Diameter:	.75 in

Layer Information

Layer Type	Material Type	Frost Code	Flexural Strength (psi)	% Steel	Analysis	Non frost Design Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Penetration (in)	K Strength (pci)
PCC	N/A	NFS	650	0	Compute	6.45	0	0	0
Base	bound Crushed Stc	NFS	0	0	Manual	8	0	0	0
Natural Subgrade	Cohesive Cut	NFS	0	0	Manual	0	0	0	200

Traffic Information

Pattern Name : CONDITION1

Vehicles	Weight (lb)	Passes per Life Span	Equivalent Passes
AXLE, 18 KIP	18000	1000000	1000000
Equivalent Single Axle Loads			1000000

Pavement Thickness Report
U.S. Army Corps of Engineers
PCASE Version 2.09.02
Date : 6/28/2013

Design Name :	CONDITION2
Design Type :	Roads
Pavement Type :	Rigid
Road Type :	Road
Terrain Type :	Flat
Analysis Type :	K
Depth of Frost (in) :	0
Wander Width (in) :	33.35
% Load Transfer :	0
Effective K (pci) :	279
Reduced Sub Effective K (pci) :	0
Joint Spacing :	15 to 20 ft
Dowel Spacing :	12.00 in
Dowel Length :	16.00 in
Dowel Diameter:	1.00 in

Layer Information

Layer Type	Material Type	Frost Code	Flexural Strength (psi)	% Steel	Analysis	Non frost Design Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Penetration (in)	K Strength (pci)
PCC	N/A	NFS	650	0	Compute	9.01	0	0	0
Base	bound Crushed Stc	NFS	0	0	Manual	8	0	0	0
Natural Subgrade	Cohesive Cut	NFS	0	0	Manual	0	0	0	200

Traffic Information

Pattern Name : CONDITION2

Vehicles	Weight (lb)	Passes per Life Span	Equivalent Passes
AXLE, 18 KIP	18000	10000000	68
RT240 KALMAR RTCH FORKLFT UNLOADED	65000	250000	250000
Equivalent Single Axle Loads			3.714E+10

Pavement Thickness Report
U.S. Army Corps of Engineers
PCASE Version 2.09.02
Date : 6/28/2013

Design Name :	CONDITION3
Design Type :	Roads
Pavement Type :	Rigid
Road Type :	Road
Terrain Type :	Flat
Analysis Type :	K
Depth of Frost (in) :	0
Wander Width (in) :	33.35
% Load Transfer :	0
Effective K (pci) :	279
Reduced Sub Effective K (pci) :	0
Joint Spacing :	10 to 15 ft
Dowel Spacing :	12.00 in
Dowel Length :	16.00 in
Dowel Diameter:	.75 in

Layer Information

Layer Type	Material Type	Frost Code	Flexural Strength (psi)	% Steel	Analysis	Non frost Design Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Penetration (in)	K Strength (pci)
PCC	N/A	NFS	650	0	Compute	6.55	0	0	0
Base	bound Crushed Stc	NFS	0	0	Manual	8	0	0	0
Natural Subgrade	Cohesive Cut	NFS	0	0	Manual	0	0	0	200

Traffic Information

Pattern Name : CONDITION3

Vehicles	Weight (lb)	Passes per Life Span	Equivalent Passes
AXLE, 18 KIP	18000	1000000	1000000
M1A1, MAIN TANK TRACKED	120000	250000	452004
Equivalent Single Axle Loads			1452004

Pavement Thickness Report
U.S. Army Corps of Engineers
PCASE Version 2.09.02
Date : 6/28/2013

Design Name :	CONDITION4
Design Type :	Roads
Pavement Type :	Rigid
Road Type :	Road
Terrain Type :	Flat
Analysis Type :	K
Depth of Frost (in) :	0
Wander Width (in) :	33.35
% Load Transfer :	0
Effective K (pci) :	279
Reduced Sub Effective K (pci) :	0
Joint Spacing :	15 to 20 ft
Dowel Spacing :	12.00 in
Dowel Length :	16.00 in
Dowel Diameter:	1.00 in

Layer Information

Layer Type	Material Type	Frost Code	Flexural Strength (psi)	% Steel	Analysis	Non frost Design Thickness (in)	Reduced Subgrade Strength (in)	Limited Subgrade Penetration (in)	K Strength (pci)
PCC	N/A	NFS	650	0	Compute	9.01	0	0	0
Base	bound Crushed Stc	NFS	0	0	Manual	8	0	0	0
Natural Subgrade	Cohesive Cut	NFS	0	0	Manual	0	0	0	200

Traffic Information

Pattern Name : CONDITION4

Vehicles	Weight (lb)	Passes per Life Span	Equivalent Passes
AXLE, 18 KIP	18000	1000000	7
M1A1, MAIN TANK TRACKED	120000	250000	38
RT240 KALMAR RTCH FORKLFT UNLOADED	65000	250000	250000
Equivalent Single Axle Loads			3.713E+10

APPENDIX D

LABORATORY DATA

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COMPACTION TEST REPORT

Curve No.: Bulk-1

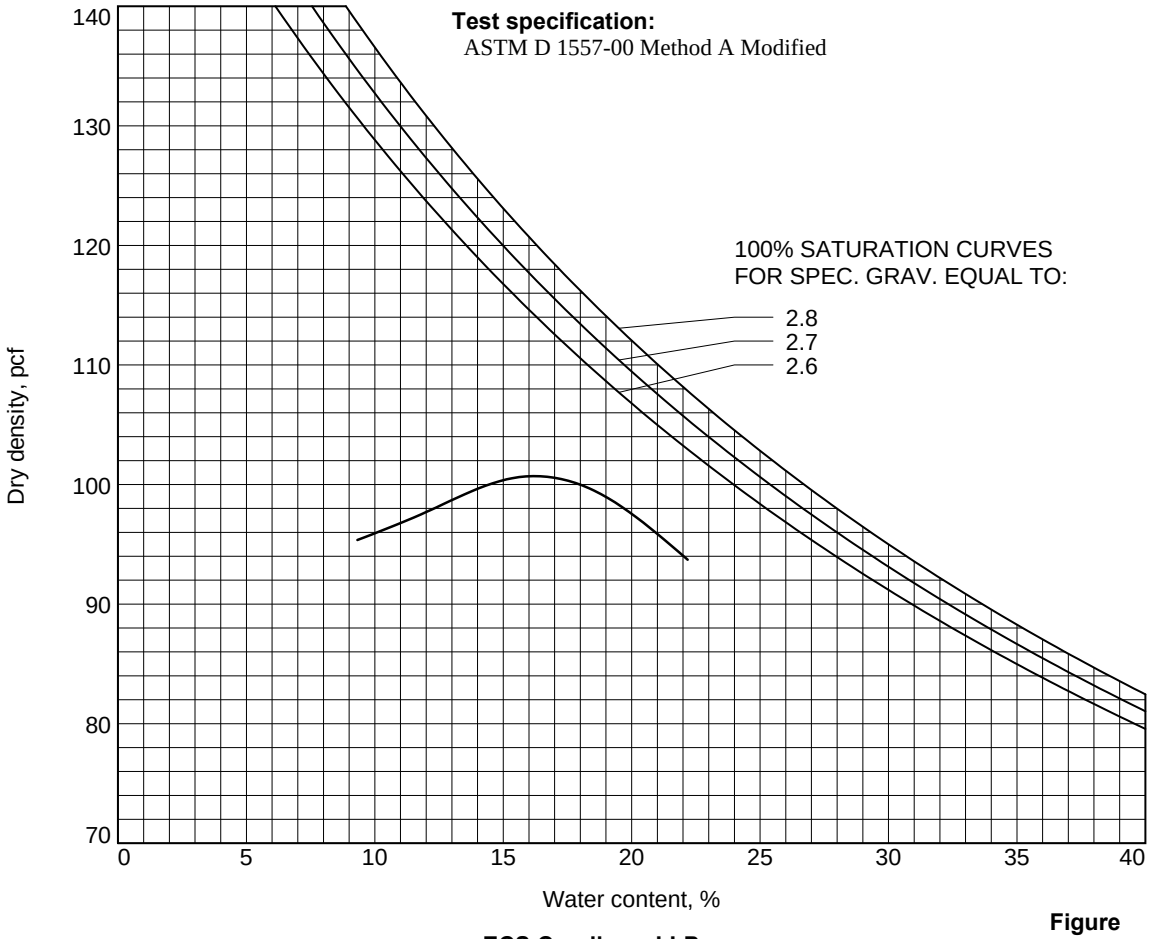
Project No.: 18460 **Date:** 6/5/13
Project: Camp Lejeune Landfill Phase IV - Hydro report
Client: C. Allan Bamforth, PE, LS
Source of Sample: SAMPLE A - CBR **Depth:** 0.00-0.00
Sample Number: Bulk-1
Remarks:

MATERIAL DESCRIPTION

Description: Dark Gray, Silty Fine Sand

Classifications - **USCS:** **AASHTO:**
Nat. Moist. = **Sp.G. =** 2.60
Liquid Limit = **Plasticity Index =**
% < No.200 =

TEST RESULTS
Maximum dry density = 100.7 pcf
Optimum moisture = 16.2 %

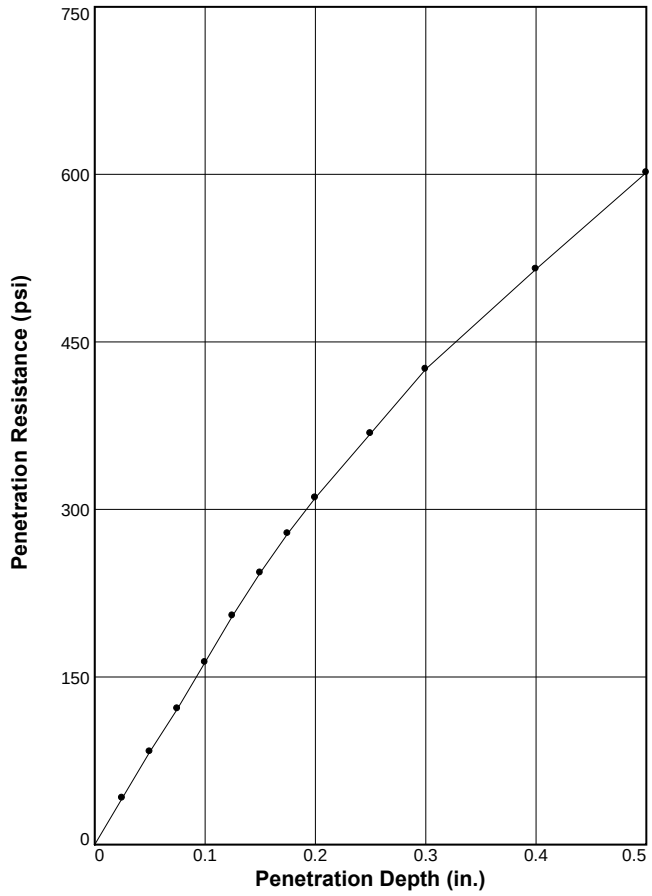


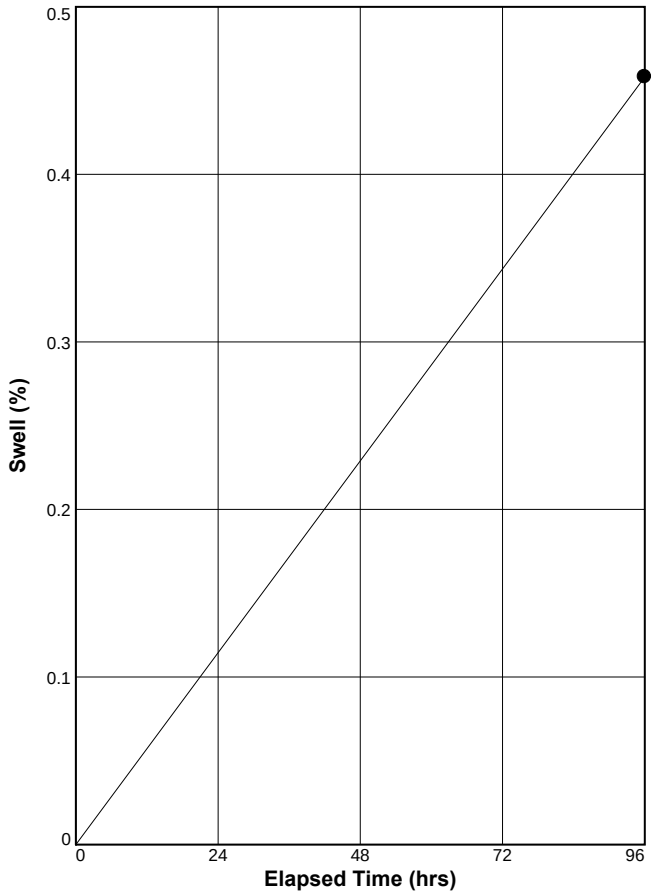
Figure

ECS Carolinas, LLP

Tested By: EG **Checked By:** KEL

BEARING RATIO TEST REPORT
ASTM D 1883-07





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	97.9	97.2	16.5	97.5	96.8	23.1	16.3	20.7	0.000	10.0	0.5
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Dark Gray, Silty Fine Sand		100.7	16.2		

Project No: 18460

Project: Camp Lejeune Landfill Phase IV - Hydro report

Source of Sample: SAMPLE A - CBR **Depth:** 0.00-0.00

Sample Number: Bulk-1

Date: 6/5/13

ECS Carolinas, LLP
7211 Ogden Business Park, Suite 201
Wilmington, NC 28411
Phone: (910) 686-9114 Fax: (910) 401-1185

Test Description/Remarks:

Mod. Proctor Comp. (ASTM D1557)

Figure _____

Tested By: KEL

COMPACTION TEST REPORT

Curve No.: Bulk-2

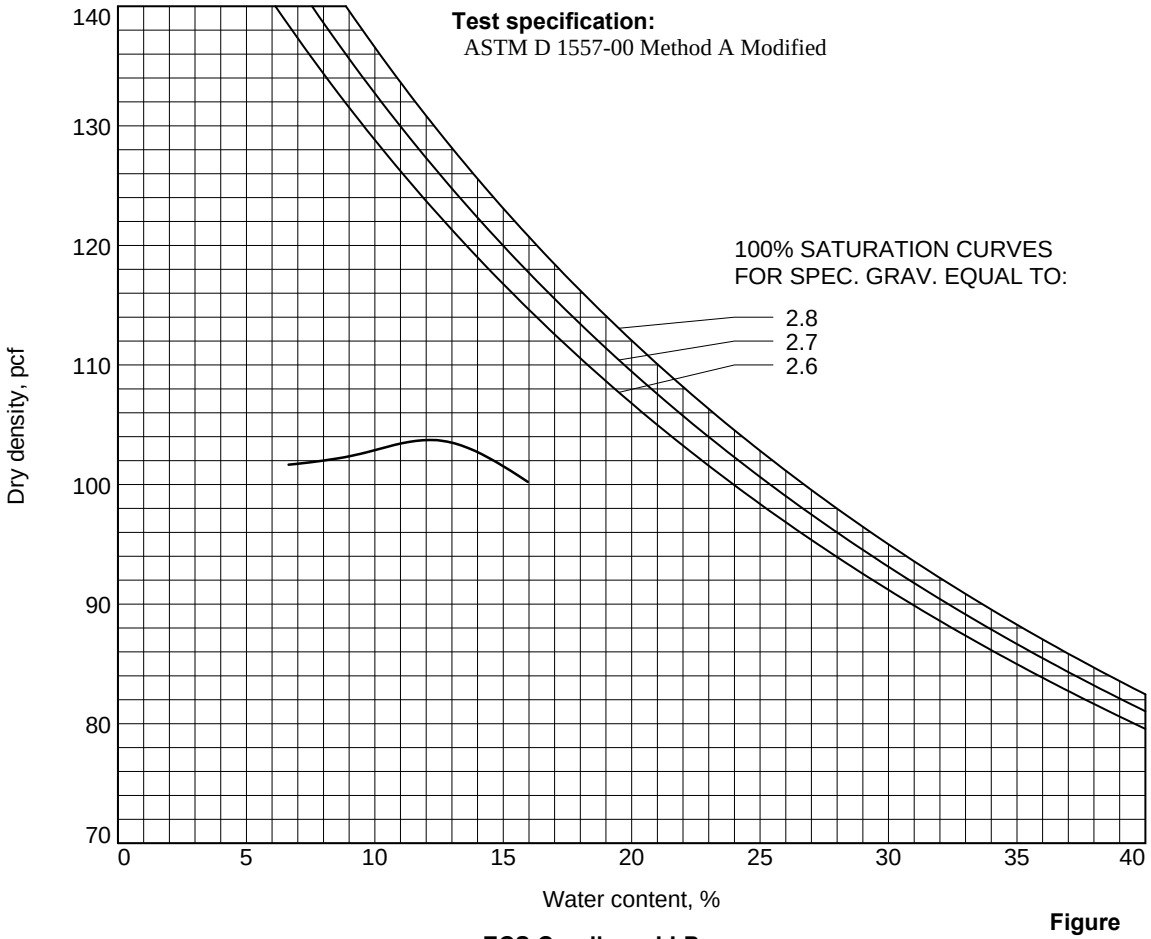
Project No.: 18460 **Date:** 6/5/13
Project: Camp Lejeune Landfill Phase IV - Hydro report
Client: C. Allan Bamforth, PE, LS
Source of Sample: SAMPLE B - CBR **Depth:** 0.00-0.00
Sample Number: Bulk-2
Remarks:

MATERIAL DESCRIPTION

Description: Dark Gray, Silty Fine to Medium Sand

Classifications - **USCS:** **AASHTO:**
Nat. Moist. = **Sp.G. =** 2.60
Liquid Limit = **Plasticity Index =**
% < No.200 =

TEST RESULTS
Maximum dry density = 103.7 pcf
Optimum moisture = 12.1 %

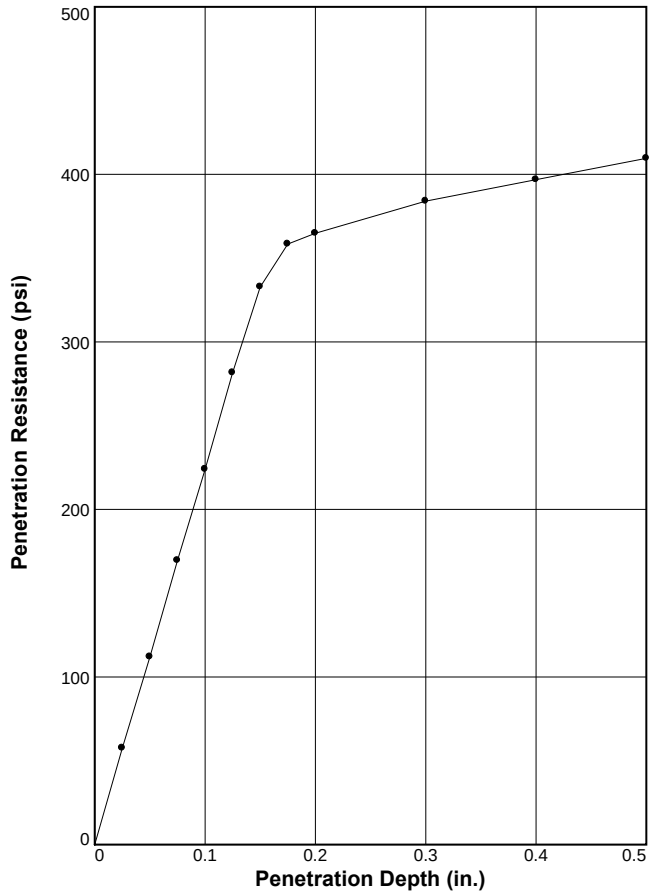


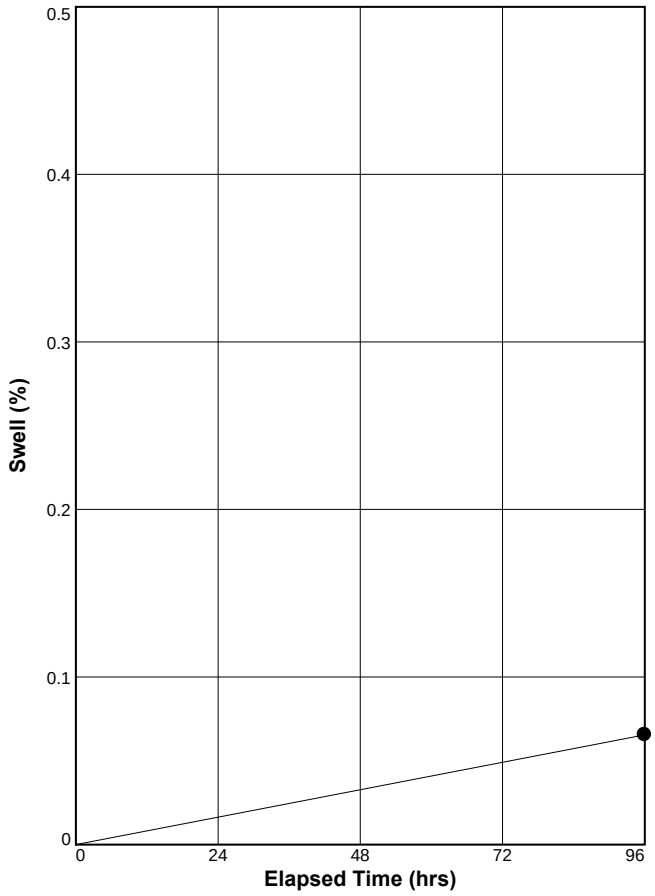
Figure

ECS Carolinas, LLP

Tested By: EG **Checked By:** KEL

BEARING RATIO TEST REPORT
VTM-008 (2007)





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	103.5	99.8	12.8	103.5	99.8	16.7	22.4	24.3	0.000	10.0	0.1
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Dark Gray, Silty Fine to Medium Sand		103.7	12.1		

Project No: 18460

Project: Camp Lejeune Landfill Phase IV - Hydro report

Source of Sample: SAMPLE B - CBR **Depth:** 0.00-0.00

Sample Number: Bulk-2

Date: 6/5/13

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Wilmington, NC 28411
Phone: (910) 686-9114 Fax: (910) 401-1185

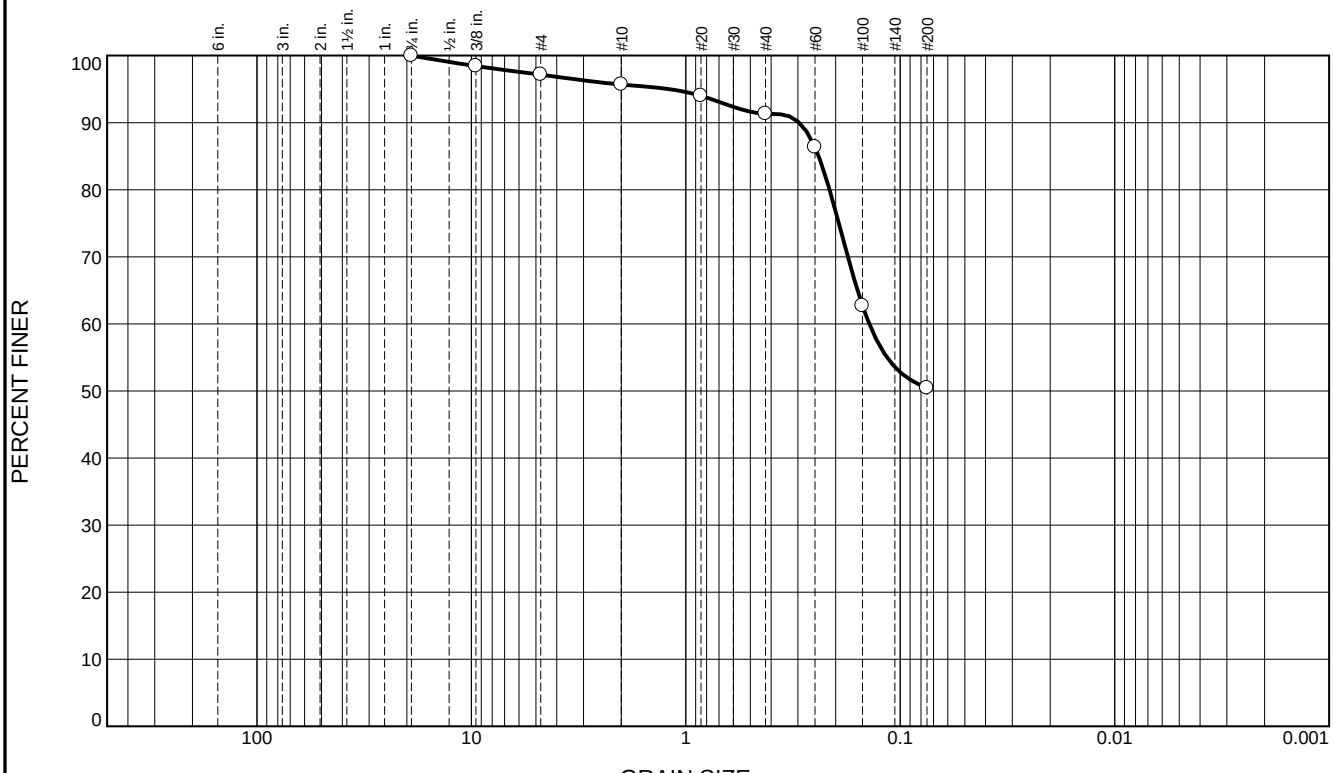
Test Description/Remarks:

Mod. Proctor Comp. (ASTM D1557)

Figure _____

Tested By: KEL

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.8	1.5	4.4	40.9	50.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
3/8	98.4		
#4	97.2		
#10	95.7		
#20	94.0		
#40	91.3		
#60	86.3		
#100	62.7		
#200	50.4		

* (no specification provided)

Soil Description

Orangish Brown, Sandy Lean CLAY

Atterberg Limits

PL= 15 LL= 24 PI= 9

Coefficients

D_{90}= 0.2960 D_{85}= 0.2404 D_{60}= 0.1395
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(1)

Remarks

Location: Test Pits
Sample Number: S-1 **Date:** 10/4/13

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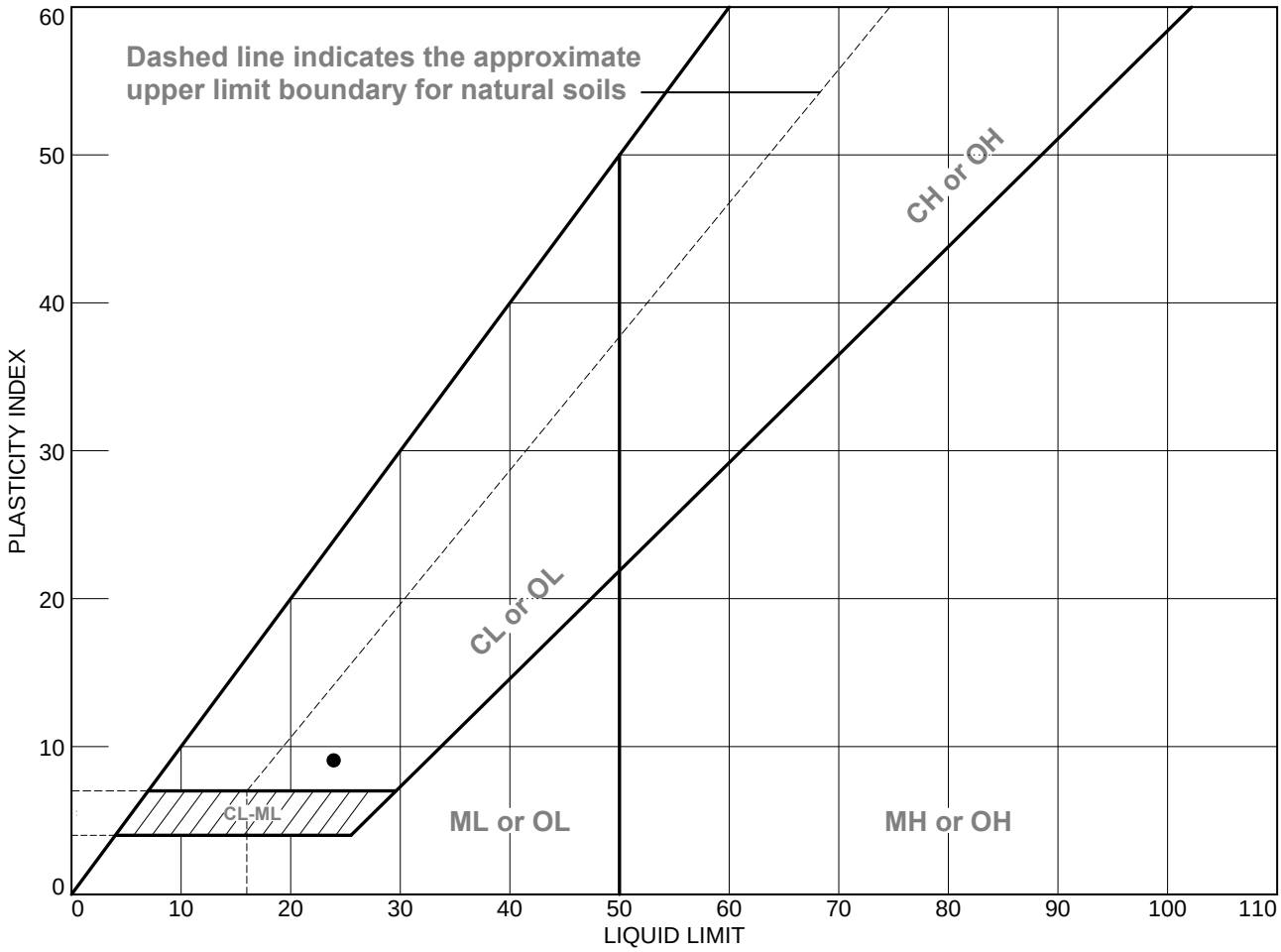
Ph: (910) 686-9114
Fax: (910) 686-9666

Client: C. Allan Bamforth, PE, LS
Project: Phase IV - Municipal Solid Waste Landfill Expansion
Project No: 22.18473 **Figure**

Tested By: KEL

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●		S-1			15	24	9	CL

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Ph: (910) 686-9114
Fax: (910) 686-9666

Client: C. Allan Bamforth, PE, LS
Project: Phase IV - Municipal Solid Waste Landfill Expansion
Project No.: 22.18473 **Figure**

Tested By: KEL

COMPACTION TEST REPORT

Curve No.: S-1

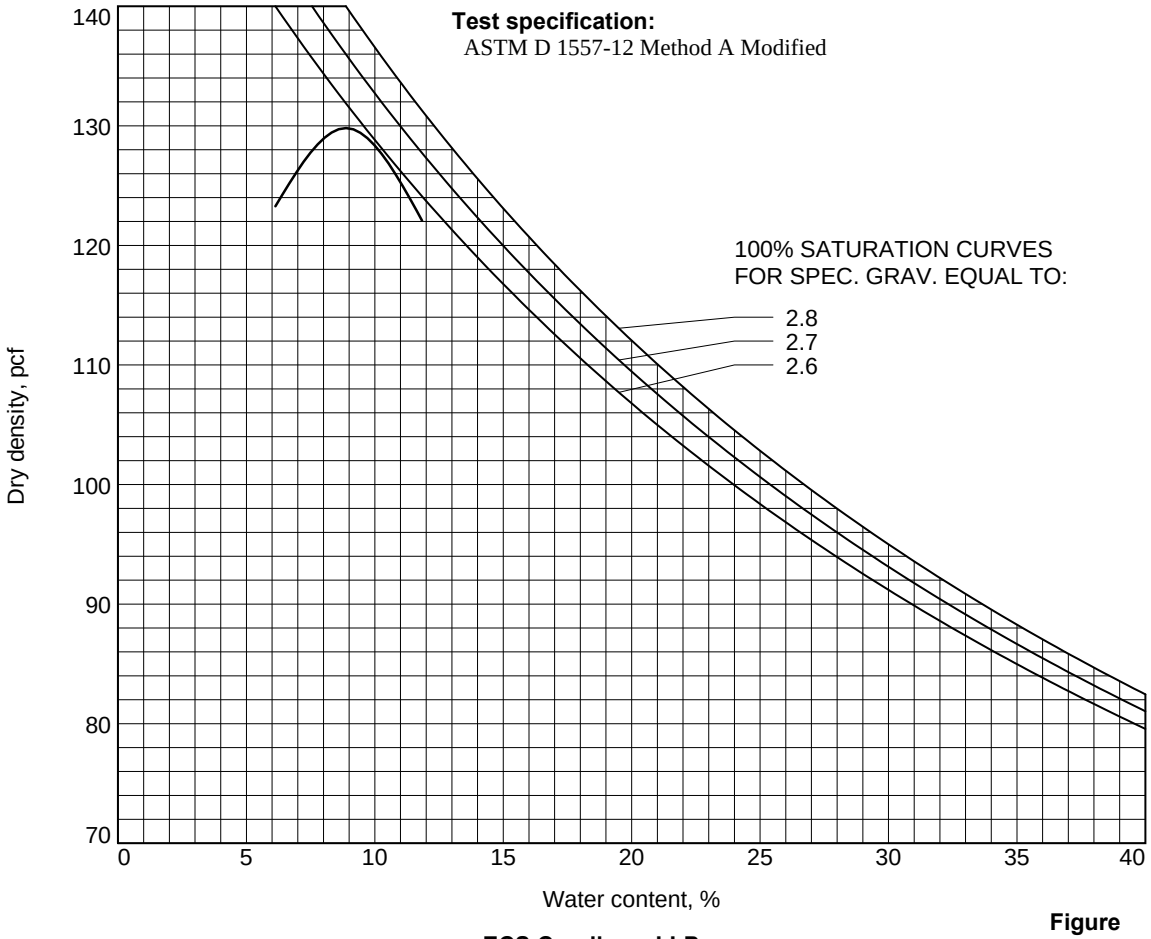
Project No.: 22.18473 **Date:** 9/27/13
Project: Phase IV - Municipal Solid Waste Landfill Expansion
Client: C. Allan Bamforth, PE, LS
Location: Test Pits
Sample Number: S-1
Remarks:

MATERIAL DESCRIPTION

Description: Orangish Brown, Sandy Lean CLAY

Classifications - **USCS:** CL **AASHTO:** A-4(1)
Nat. Moist. = **Sp.G. =** 2.60
Liquid Limit = 24 **Plasticity Index =** 9
% < No.200 = 50.4 %

TEST RESULTS
Maximum dry density = 129.8 pcf
Optimum moisture = 8.9 %

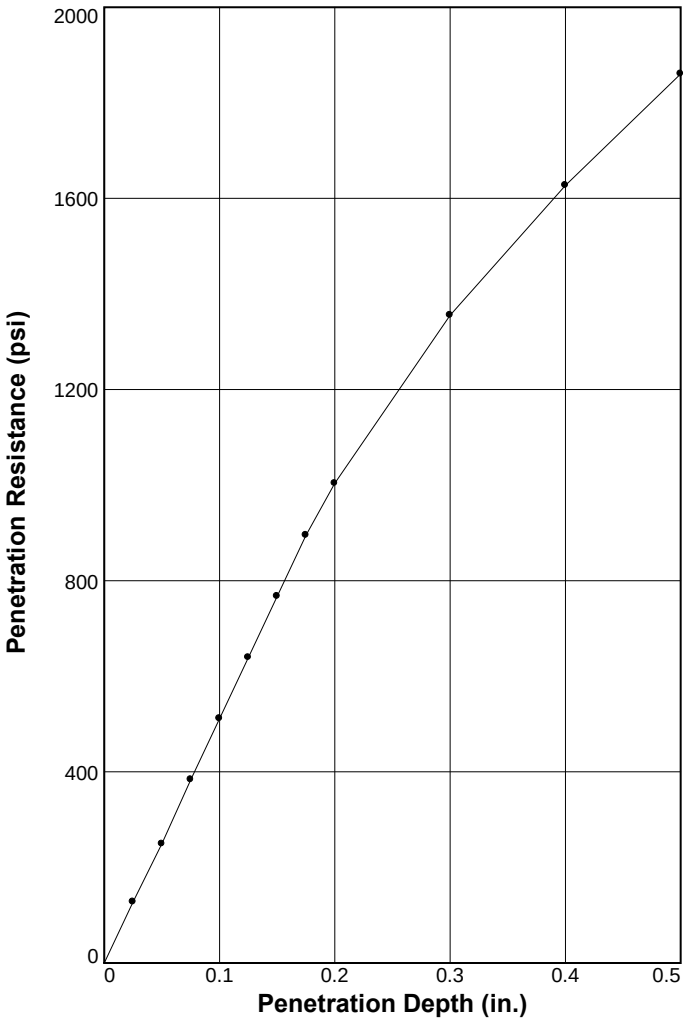


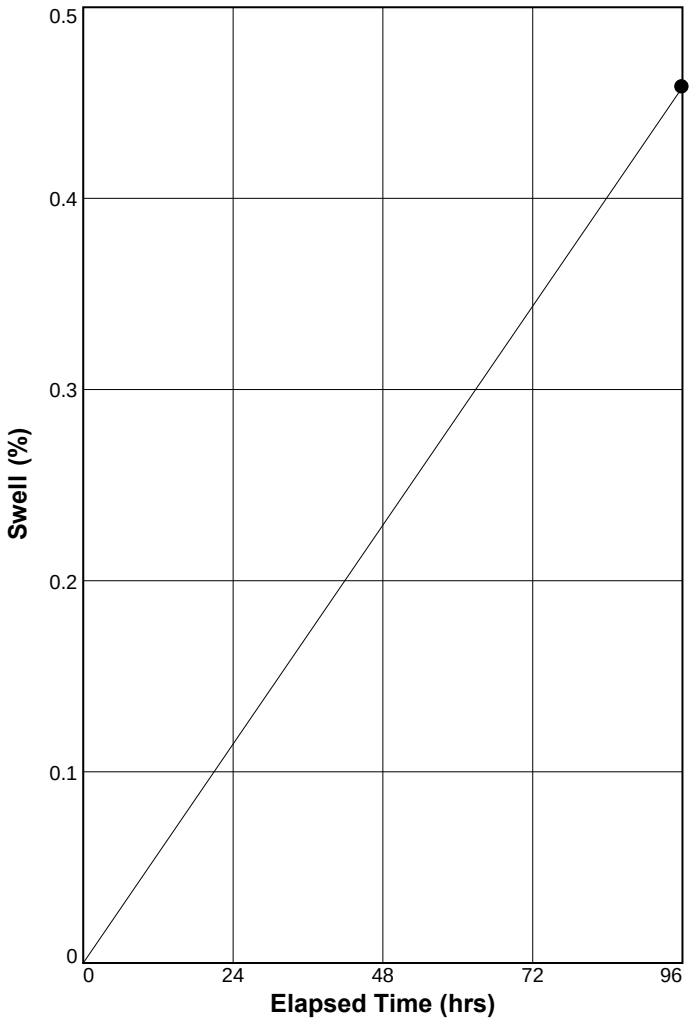
Figure

ECS Carolinas, LLP

Tested By: EG **Checked By:** KEL

BEARING RATIO TEST REPORT
ASTM D 1883-07





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	129.8	100	8.7	129.2	99.5	10.6	51.1	66.9	0.000	10.0	0.5
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Orangish Brown, Sandy Lean CLAY	CL	129.8	8.9	24	9

Project No: 22.18473

Project: Phase IV - Municipal Solid Waste Landfill Expansion

Location: Test Pits

Sample Number: S-1

Date: 10/4/13

Test Description/Remarks:

Mod. Proctor Comp. (ASTM D1557)

ECS CAROLINAS, LLP
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Ph: (910) 686-9114 Fax: (910) 686-9666

Figure _____

COMPACTION TEST REPORT

Curve No.: S-2

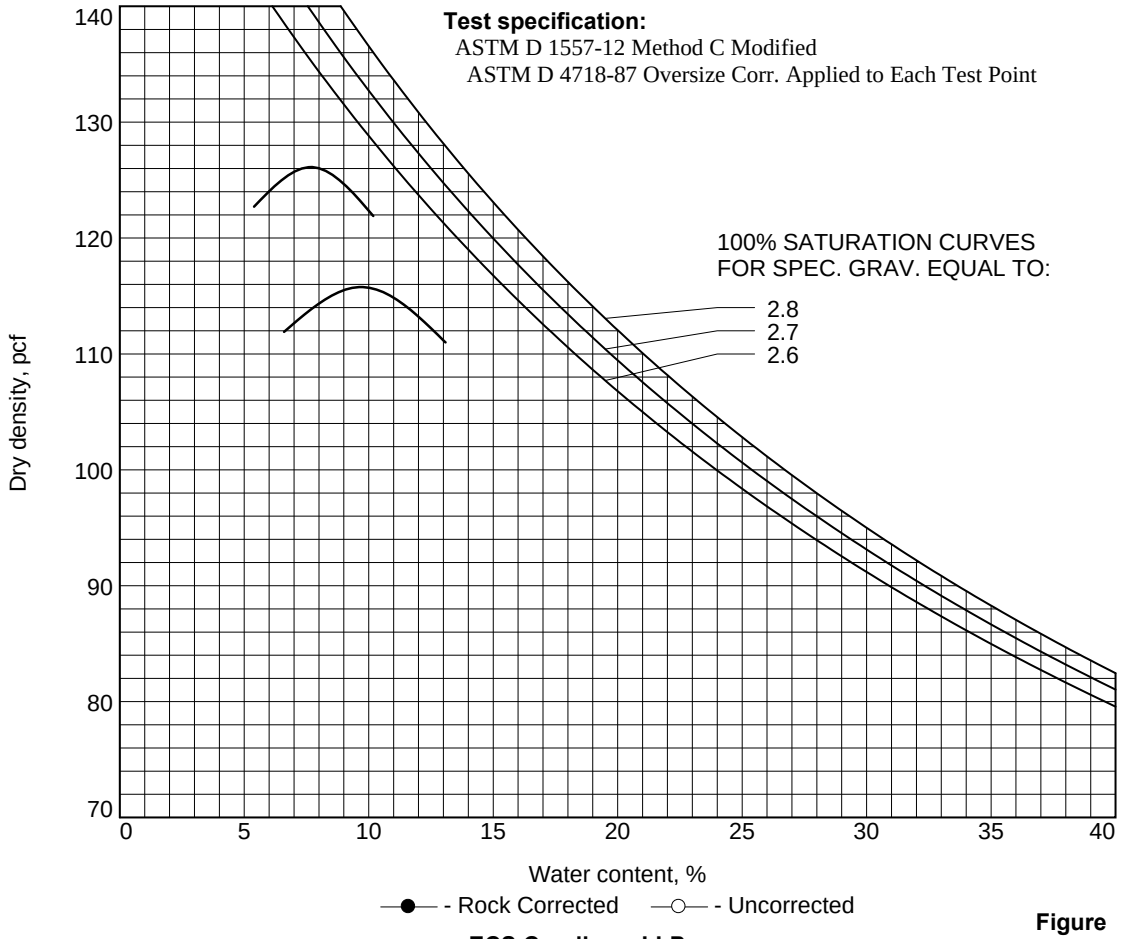
Project No.: 22.18473 **Date:** 9/27/13
Project: Phase IV - Municipal Solid Waste Landfill Expansion
Client: C. Allan Bamforth, PE, LS
Location: Test Pits
Sample Number: S-2
Remarks:

MATERIAL DESCRIPTION

Description: Light Gray, Sandy GRAVEL

Classifications - **USCS:** **AASHTO:**
Nat. Moist. = **Sp.G. =** 2.60
Liquid Limit = **Plasticity Index =**
% < No.200 =

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 126.1 pcf	115.8 pcf
Optimum moisture = 7.7 %	9.7 %

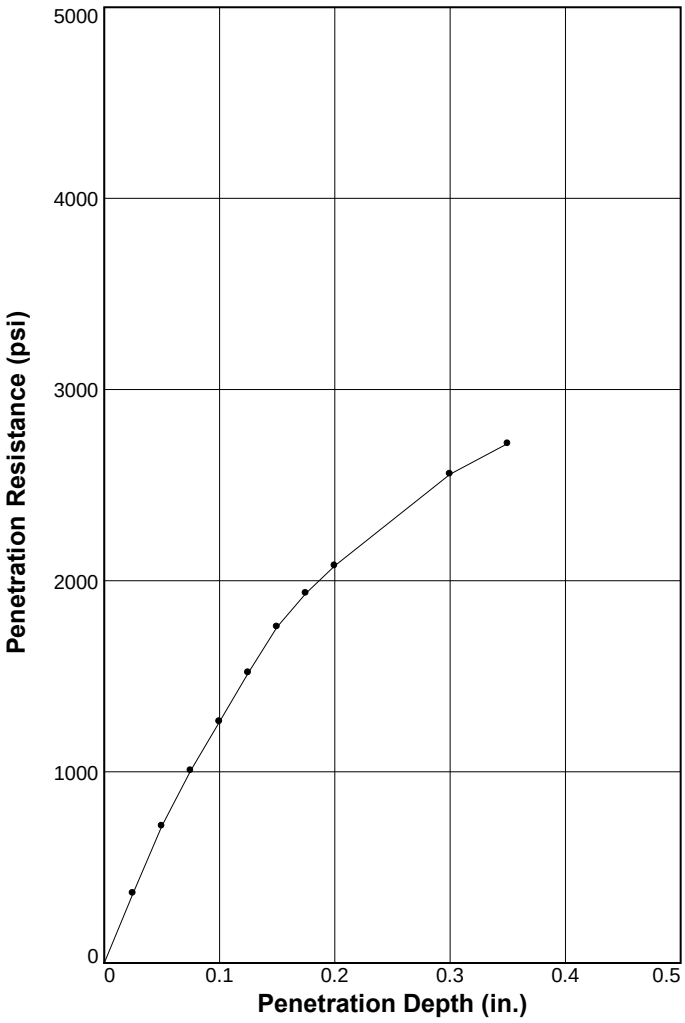


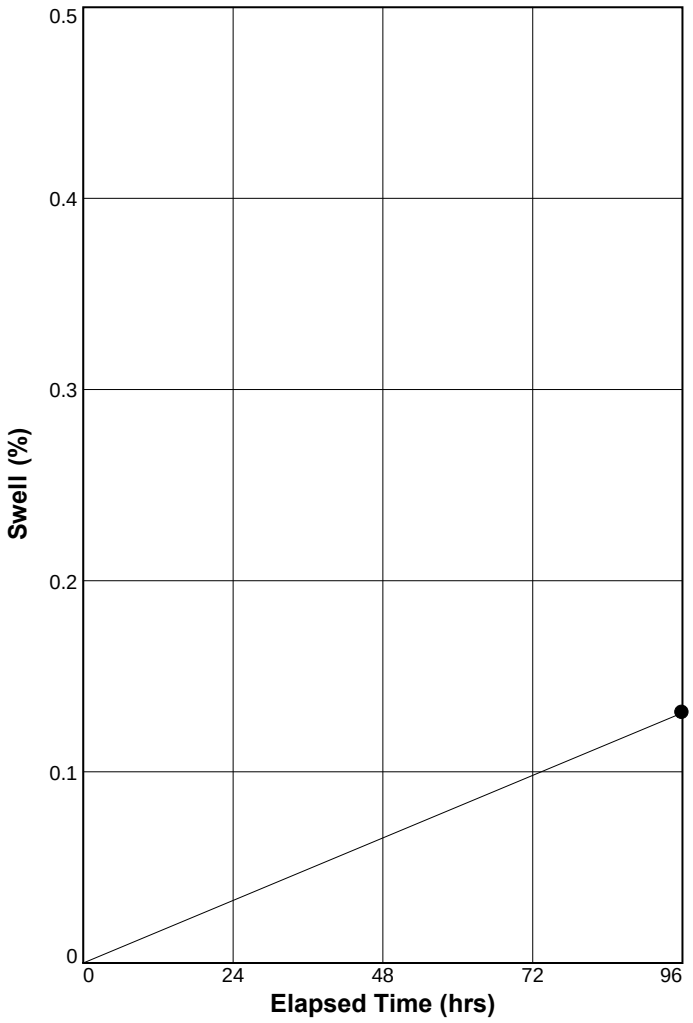
Figure

ECS Carolinas, LLP

Tested By: EG **Checked By:** KEL

BEARING RATIO TEST REPORT
ASTM D 1883-07





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	124.0	98.3	8.7	123.8	98.2	11.8	126.3	138.5	0.000	10.0	0.1
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Light Gray, Sandy GRAVEL		126.1	7.7		

Project No: 22.18473

Project: Phase IV - Municipal Solid Waste Landfill Expansion

Location: Test Pits

Sample Number: S-2

Date:

ECS CAROLINAS, LLP
7211 Ogden Business Park, Suite 201, Wilmington NC, 28411
Ph: (910) 686-9114 Fax: (910) 686-9666

Test Description/Remarks:

Mod. Proctor Comp. (ASTM D1557)

Sample stopped at 0.350 in - approaching limit of proving ring

Figure _____

APPENDIX E

GENERAL CONDITIONS

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General Conditions

The analysis, conclusions, and recommendations submitted in this report are based on the investigation previously outlined and the data collected at the points shown on the attached location plan. This report does not reflect specific variations that may occur between test locations. The test pits were located where site conditions permitted and where it is believed representative conditions occur, but the full nature and extent of variations between test pits and of subsurface conditions not encountered by any test pit may not become evident until the course of construction. If variations become evident at any time before or during the course of construction, it will be necessary to make a re-evaluation of the conclusions and recommendations of this report and further exploration, observation, and/or testing may be required.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and makes no other warranties, either expressed or implied, as to the professional advice under the terms of our agreement and included in this report. The recommendations contained herein are made with the understanding that the contract documents between the owner and foundation or earthwork contractor or between the owner and the general contractor and the caisson, foundation, excavating and earthwork subcontractors, if any, shall require that the contractor certify that all work in connection with foundations, piles, caissons, compacted fills and other elements of the foundation or other support components are in place at the locations, with proper dimensions and plumb, as shown on the plans and specifications for the project.

Further, it is understood the contract documents will specify that the contractor will, upon becoming aware of apparent or latent subsurface conditions differing from those disclosed by the original soil investigation work, promptly notify the owner, both verbally to permit immediate verification of the change, and in writing, as to the nature and extent of the differing conditions and that no claim by the contractor for any conditions differing from those anticipated in the plans and specifications and disclosed by the soil studies will be allowed under the contract unless the contractor has so notified the owner both verbally and in writing, as required above, of such changed conditions. The owner will, in turn, promptly notify this firm of the existence of such unanticipated conditions and will authorize such further investigation as may be required to properly evaluate these conditions.

Further, it is understood that any specific recommendations made in this report as to on-site construction review by this firm will be authorized and funds and facilities for such review will be provided at the times recommended if we are to be held responsible for the design recommendations.

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from alight industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ-sometimes significantly from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in-this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer For Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

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