AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
J	1 2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0002	30-Oct-2003	W22W9K-3210-9025	

6. ISSUED BY CODE W912QR

U. S. ARMY ENGINEER DISTRICT, LOUISVILLE
600 DR. MARTIN LUTHER KING, JR. PLACE
ROOM 821
LOUISVILLE KY 40202-2230

7. ADMINISTERED BY (If other than item 6) CODE DACA27

CONTRACT ADMINSTRATION BRANCH
ATTN: DEBRAUH M. LARDNER
P. O. BOX 59
LOUISVILLE KY 40201-0059

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)

X	9A. AMENDMENT OF SOLICITATION NO. DACA27-03-R-0020
X	9B. DATED (SEE ITEM 11) 14-Aug-2003
	10A. MOD. OF CONTRACT/ORDER NO.
	10B. DATED (SEE ITEM 13)

CODE FACILITY CODE

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

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

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

12. ACCOUNTING AND APPROPRIATION DATA (If required)

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

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

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

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

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

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

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

Subject Solicitation No. DACA27-03-R-0020 for Whole Neighborhood Renewal, Ft. Knox, KY, is amended as follows:

a. The Phase II Requiest for Proposal is hereby attached and made a part hereof.
b. The bid schedule is added to Section 00010 for completion. Only the original is to be submitted with your package.
c. Technical proposals shall be submitted in original and 7 seven copies. Price (bid schedule) shall be submitted in original only along with the Subcontracting Narrative and Subcontracting Plan and placed in a separate envelope.
d. The due date for Phase II proposals is 06 January 2004 at 4:30 PM Louisville Local Time. No late proposals will be accepted.
3. Pre-proposal conference is set for 14 November 2003 at 9:30 AM at Ft. Knox. Location to be determined.

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

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)
	TEL: EMAIL:

15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
(Signature of person authorized to sign)		BY (Signature of Contracting Officer)	30-Oct-2003

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

SECTION 00010 - SOLICITATION CONTRACT FORM

The Issued By organization has changed from

USA ENGINEER DISTRICT, LOUISVILLE
ATTN: CELRL-CT
600 DR. MARTIN LUTHER KING PLACE
ROOM 821
LOUISVILLE KY 40202

to

U. S. ARMY ENGINEER DISTRICT, LOUISVILLE
600 DR. MARTIN LUTHER KING, JR. PLACE
ROOM 821
LOUISVILLE KY 40202-2230

(End of Summary of Changes)

BIDDING SCHEDULE

PROJECT : Design Completion and Construction of the Whole Neighborhood Renewal

LOCATION : Fort Knox, Kentucky

BIDDER'S NAME: _____

BASE BID

ITEM NO.	DESCRIPTION	UNIT	AMOUNT
0001	Primary Facilities - Construction of the housing units	lump sum	$ _____
0002	Sitework	lump sum	$ _____
0003	Project design fees	lump sum	$ _____
0004	Water service permit	lump sum	$ 150
0005	Sanitary sewer permit	lump sum	$ 800
0006	New telephone service to Guest House	lump sum	$ 11,200

TOTAL BASE BID **$ _____**

0007	Option A – Walking path	lump sum	$_____
0008	Option B – Rapidly renewable flooring	lump sum	$_____
0009	Option C – Grass volleyball court	lump sum	$_____
0010	Option D – 180 additional trees	lump sum	$_____
0011	Option E – Trees of 2 ½" caliper	lump sum	$_____
0012	Option F – Raised panel interior doors	lump sum	$_____
0013	Option G – Additional phone outlets	lump sum	$_____
0014	Option H – Additional CATV outlets	lump sum	$_____

0015	Option I – Recessed soap/shampoo shelves	lump sum	$_____
0016	Option J – Extend unit roof over patio	lump sum	$_____
0017	Option K – Brick façade 25% of units	lump sum	$_____
0018	Option L – Cultured stone façade 25% of units	lump sum	$_____
0019	Option M – Chair rail	lump sum	$_____
0020	Option N – Full height brick for all one-story units	lump sum	$_____
0021	Option O – Street to MacDonald School	lump sum	$_____

TOTAL OPTION BID **$ _____**

TOTAL BASE BID PLUS OPTION BID **$ _____**

NOTES FOR BIDDING SCHEDULE

1. To better facilitate the receipt and proposal process, all modifications to proposals are to be submitted on copies of the latest bid schedules as published in the solicitation or the latest amendment thereto. In lieu of indicating additions/deductions to bid items, all bidders should state their revised prices for each item. The company name should be indicated on the face of the bidding schedule to preclude being misplaced.

2. Bidders must insert a price on all numbered items of the Bidding Schedule. The price may be zero dollars or a deduct amount. Failure to do so will disqualify the bid.

3. Attach a separate sheet describing each Option and Betterment, with the Option Items keyed to the Bid Item Number, and providing sufficient information for the Government to evaluate the quality and quantity of the Option or Betterment being offered.

4. If a modification to a bid is submitted which provides for a lump-sum adjustment to the total estimated cost, the application of the lump-sum adjustment to each unit price and/or lump-sum price in the bid schedule must be stated or, if it is not stated, the bidder agrees

that the lump-sum adjustment shall be applied on a prorata basis to every bid item in the bid schedule.

5. CONDITIONS GOVERNING EVALUATION OF BIDS AND AWARD OF CONTRACT.
One contract only will be awarded on this project and evaluation will be made on the Total Base Bid Plus Option Bid, in accordance with the paragraph entitled "Evaluation Of Options (JUL 1990)" in the Instructions to Offerors.

The Government may require the delivery of the numbered line items, identified in the schedule as option items, in the quantity and at the price stated in the schedule. The Contracting Officer may exercise the option by written notice to the Contractor within 180 days of Notice to Proceed.

6. Description of Bid Items - The general outline of the principal features of each item as listed below does not in any way limit the responsibility of the bidder for making a thorough investigation of the drawings and the specifications to determine the scope of work including each item of the bidding form. Further descriptions of the Options may be found in paragraph 1-1.3 of the Statement of Work.

Description of Base Bid Items

(a) Item No. 0001 "Primary Facilities - Construction of the housing units" includes all construction work required within a line five feet outside of the housing units, except that work covered by Items No. 0003.

(b) Item No. 0002 "Sitework" includes all demolition and construction work required within a line five feet outside the housing units, except that work covered by Items No. 0003 and 0008.

(c) Item No. 0003 "Project design fees" includes the fees for the Offerors' design professionals to complete the design and construction documents for the project, except for the design work included in Item No. 0002.

(d) Item No. 0004 "Water service permit" includes the costs of obtaining a permit for water service from the Directorate of Base Operations Support (DBOS).

(e) Item No. 0005 "Sanitary sewer permit" includes the costs of obtaining a permit for sanitary service from DBOS.

(f) Item No. 0006 "New telephone service to Guest House" includes the estimated cost for Bell South to install a new telephone service to the Wickam Guest House.

(g) Item No. 0007 "Option A – Walking path" includes all costs associated with the design and construction of a walking path to the swimming pool complex. See Notes 3 and 6 above.

(h) Item No. 0008 "Option B – Rapidly renewable flooring" includes the cost difference associated with the design and construction of rapidly renewable

hardwood flooring in lieu of the base bid hardwood flooring. See Notes 3 and 6 above.

(i) Item No. 0009 "Option C – Grass volleyball court" includes all costs associated with the design and construction of a grass volleyball court. See Notes 3 and 6 above.

(j) Item No. 0010 "Option D – 180 additional trees" includes all costs associated with design and provision of 180 additional trees for the project. See Notes 3 and 6 above.

(k) Item No. 0011 "Option E – Trees of 2 ½" caliper" includes the cost difference associated with the design and provision of trees of 2 ½" minimum caliper throughout the project, in lieu of the base bid tree size. See Notes 3 and 6 above.

(l) Item No. 0012 "Option F – Raised panel interior doors" includes the cost difference associated with the design and construction of raised panel interior doors in lieu of the base bid interior doors. See Notes 3 and 6 above.

(m) Item No. 0013 "Option G – Additional phone outlets" includes all costs associated with design and construction of additional telephone outlets throughout the units. See Notes 3 and 6 above.

(n) Item No. 0014 "Option H – Additional CATV outlets" includes all costs associated with design and construction of additional CATV outlets throughout the units. See Notes 3 and 6 above.

(o) Item No. 0015 "Option I – Recessed soap/shampoo shelves" includes all costs associated with design and construction of such shelves in bathrooms. See Notes 3 and 6 above.

(p) Item No. 0016 "Option J – Extend unit roof over patio" includes all costs associated with design and construction of roofing extensions to cover unit patios. See Notes 3 and 6 above.

(q) Item No. 0017 "Option K - Brick façade 25% of units" includes the cost difference associated with the design and construction of full brick facades on 25% of the units in lieu of the base bid finish of brick wainscot and siding. See Notes 3 and 6 above.

(r) Item No. 0018 "Option L - Cultured stone façade 25% of units" includes the cost difference associated with the design and construction of cultured stone facades on 25% of the units in lieu of the base bid finish of brick wainscot and siding. See Notes 3 and 6 above.

(s) Item No. 0019 "Option M – Chair rail" includes all costs associated with the design and construction of a chair rail living room, dining room and family room. See Notes 3 and 6 above.

(t) Item No. 0020 "Option N - Full height brick for all one-story units" includes the cost difference associated with the design and construction of full height brick exterior finish on all single-story units. See Notes 3 and 6 above.

(u) Item No. 0021 "Option O - Street to MacDonald School" includes all costs associated with the design and construction of a street, with street lighting, connecting the housing development with MacDonald School to the west. See Notes 3 and 6 above.

GENERAL DECISION KY030011 06/13/03 KY11
 General Decision Number KY030011

 Superseded General Decision No. KY020011

 State: Kentucky

 Construction Type:
 RESIDENTIAL

 County(ies):
 ANDERSON HARDIN NELSON
 BRECKINRIDGE LARUE SPENCER
 BULLITT MARION WASHINGTON
 GRAYSON MEADE

 RESIDENTIAL CONSTRUCTION PROJECTS (consisting of single family
 homes and apartments up to and including 4 stories)

 Modification Number Publication Date
  0 06/13/2003

COUNTY(ies):
ANDERSON HARDIN NELSON
BRECKINRIDGE LARUE SPENCER
BULLITT MARION WASHINGTON
GRAYSON MEADE

 SUKY4003A 05/01/1984

	Rates	Fringes
AIR CONDITIONING & HEATING MECHANICS	6.35	
BRICKLAYERS	6.77	
CARPENTERS	6.63	
CEMENT MASONS	6.70	
DRYWALL HANGERS & FINISHERS	6.64	
ELECTRICIANS	6.67	
INSULATION INSTALLERS	5.15	
LABORERS:		
General	5.15	
Mason Tenders	5.15	
Asphalt Rakers & Lutemen	6.37	
PAINTERS	7.00	
PLASTERERS	7.00	
PLUMBERS & PIPEFITTERS	7.67	
POWER EQUIPMENT OPERATORS:		
Backhoe	7.00	
Bulldozer	7.57	
Distributor	8.10	
Front End Loader	7.36	
Grader	8.00	
Roller	7.41	
Paver	8.52	
ROOFERS	6.36	
SHEET METAL WORKERS	6.30	
SOFT FLOOR LAYERS/CARPET LAYERS	9.00	
TRUCK DRIVERS	5.15	

WELDERS - Receive rate prescribed for craft performing operation
to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(ii)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review

Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.

Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.
END OF GENERAL DECISION

GENERAL DECISION KY030027 06/13/03 KY27
 General Decision Number KY030027

 Superseded General Decision No. KY020027

 State: Kentucky

 Construction Type:
 HEAVY
 HIGHWAY

 County(ies):

ANDERSON	GALLATIN	MERCER
BATH	GRANT	MONTGOMERY
BOURBON	GRAYSON	NELSON
BOYD	GREENUP	NICHOLAS
BOYLE	HARDIN	OLDHAM
BRACKEN	HARRISON	OWEN
BRECKINRIDGE	HENRY	ROBERTSON
BULLITT	JEFFERSON	ROWAN
CARROLL	JESSAMINE	SCOTT
CARTER	LARUE	SHELBY
CLARK	LEWIS	SPENCER
ELLIOTT	MADISON	TRIMBLE
FAYETTE	MARION	WASHINGTON
FLEMING	MASON	WOODFORD
FRANKLIN	MEADE	

 Heavy and Highway Construction Projects

 Modification Number Publication Date
 0 06/13/2003

COUNTY(ies):

ANDERSON	GALLATIN	MERCER
BATH	GRANT	MONTGOMERY
BOURBON	GRAYSON	NELSON
BOYD	GREENUP	NICHOLAS
BOYLE	HARDIN	OLDHAM
BRACKEN	HARRISON	OWEN
BRECKINRIDGE	HENRY	ROBERTSON
BULLITT	JEFFERSON	ROWAN
CARROLL	JESSAMINE	SCOTT
CARTER	LARUE	SHELBY
CLARK	LEWIS	SPENCER
ELLIOTT	MADISON	TRIMBLE
FAYETTE	MARION	WASHINGTON
FLEMING	MASON	WOODFORD
FRANKLIN	MEADE	

 BRIN0004D 04/01/2002

	Rates	Fringes
BRECKINRIDGE COUNTY:		
BRICKLAYERS	24.15	6.55

 BRKY0001G 06/01/2001

	Rates	Fringes
BULLITT, CARROLL, GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE,		

MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER & TRIMBLE
COUNTIES:

BRICKLAYERS	20.00	5.43

BRKY0002F 06/01/2002

	Rates	Fringes
BRACKEN, GALLATIN, GRANT, MASON & ROBERTSON COUNTIES:		
BRICKLAYERS	22.96	7.39

BRKY0007D 06/01/2001

	Rates	Fringes
BOYD, CARTER, ELLIOTT, FLEMING, GREENUP, LEWIS & ROWAN COUNTIES:		
BRICKLAYERS	23.04	8.32

BRKY0017D 06/01/2002

	Rates	Fringes
ANDERSON, BATH, BOURBON, BOYLE, CLARK, FAYETTE, FRANKLIN, HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS, OWEN, SCOTT, WASHINGTON & WOODFORD COUNTIES:		
BRICKLAYERS	19.40	6.20
LAYOUT MEN	19.65	6.20
REFRACTORY/ACID BRICK/GLASS	19.90	6.20

CARP0064A 07/01/2002

	Rates	Fringes
CARPENTERS	21.45	6.13
PILEDRIVERMEN	21.70	6.13
DIVERS	32.55	6.13

CARP1031P 06/01/2002

	Rates	Fringes
ANDERSON, BATH, BOURBON, BOYLE, CLARK, FAYETTE, FRANKLIN, HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS, OWEN, SCOTT & WOODFORD COUNTIES:		
MILLWRIGHTS	19.50	9.53

CARP1031Q 06/01/2002

	Rates	Fringes
BOYD, CARTER, ELLIOTT, FLEMING, GREENUP, LEWIS, MASON, ROBERTSON & ROWAN COUNTIES:		
MILLWRIGHTS	20.79	14.04

CARP1031R 06/01/2002

	Rates	Fringes
BRECKINRIDGE, BULLITT, CARROLL, GALLATIN, GRAYSON, HARDIN, HENRY,		

JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY,
SPENCER, TRIMBLE & WASHINGTON COUNTIES:

MILLWRIGHTS	22.25	10.30

CARP1066D 09/01/1999

	Rates	Fringes
BRACKEN & GRANT COUNTIES:		
MILLWRIGHTS	21.90	7.92

ELEC0212H 06/03/2002

	Rates	Fringes
BRACKEN, GALLATIN & GRANT COUNTIES:		
ELECTRICIANS	23.95	7.38

ELEC0212Q 11/01/2000

	Rates	Fringes
BRACKEN, GALLATIN & GRANT COUNTIES:		
SOUND COMMUNICATIONS:		
Installer	18.00	3.475
Cable Puller	9.00	2.64

ELEC0317L 05/30/2001

	Rates	Fringes
BOYD, CARTER, ELLIOTT & ROWAN COUNTIES:		
ELECTRICIANS:		
Electricians	23.11	11.04
Cable Splicers	24.27	11.08

ELEC0369J 06/05/2002

	Rates	Fringes
ANDERSON, BATH, BOURBON, BOYLE, BRECKINRIDGE, BULLITT, CARROLL, CLARK, FAYETTE, FRANKLIN, GRAYSON, HARDIN, HARRISON, HENRY, JEFFERSON, JESSAMINE, LARUE, MADISON, MARION, MEADE, MERCER, MONTGOMERY, NELSON, NICHOLAS, OLDHAM, OWEN, ROBERTSON, SCOTT, SHELBY, SPENCER, TRIMBLE, WASHINGTON & WOODFORD COUNTIES:		
ELECTRICIANS	24.25	8.24

ELEC0575B 01/01/2003

	Rates	Fringes
FLEMING, GREENUP, LEWIS & MASON COUNTIES:		
ELECTRICIANS	26.30	7.92

ENGI0181Y 01/01/2003

	Rates	Fringes

POWER EQUIPMENT OPERATORS:

GROUP 1	21.10	9.15
GROUP 2	18.68	9.15
GROUP 3	19.06	9.15
GROUP 4	18.42	9.15

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1 - A-Frame Winch Truck; Auto Patrol; Backfiller; Batcher Plant; Bituminous Paver; Bituminous Transfer Machine; Boom Cat; Bulldozer; Mechanic; Cableway; Carry-All Scoop; Carry Deck Crane; Central Compressor Plant; Clamshell; Concrete Mixer (21 cu. ft. or Over); Concrete Paver; Truck-Mounted Concrete Pump; Core Drill; Crane; Crusher Plant; Derrick; Derrick Boat; Ditching & Trenching Machine; Dragline; Dredge Operator; Dredge Engineer; Elevating Grader & Loaders; Grade-All; Gurries; Heavy Equipment Robotics Operator/Mechanic; High Lift; Hoe-Type Machine; Hoist (Two or More Drums); Hoisting Engine (Two or More Drums); Horizontal Directional Drill Operator; Hydrocrane;

Hyster; KeCal Loader; LeTourneau; Locomotive; Mechanic; Mechanically Operated Laser Screed; Mechanic Welder; Mucking Machine; Motor Scraper; Orangepeel Bucket; Piledriver; Power Blade; Pumpcrete; Push Dozer; Rock Spreader, attached to equipment; Rotary Drill; Roller (Bituminous); Scarifier; Scoopmobile; Shovel; Side Boom; Subgrader; Tailboom; Telescoping Type Forklift; Tow or Push Boat; Tower Crane (French, German & other types); Tractor Shovel; Truck Crane; Tunnel Mining Machines, including Moles, Shields or similar types of Tunnel Mining Equipment

GROUP 2 - Air Compressor (Over 900 cu. ft. per min.); Bituminous Mixer; Boom Type Tamping Machine; Bull Float; Concrete Mixer (Under 21 cu. ft.); Dredge Engineer; Electric Vibrator; Compactor/Self-Propelled Compactor; Elevator (One Drum or Buck Hoist); Elevator (When used to Hoist Building Material); Finish Machine; Firemen & Hoist (One Drum); Flexplane; Forklift (Regardless of Lift Height); Form Grader; Joint Sealing Machine; Outboard Motor Boat; Power Sweeper (Riding Type); Roller (Rock); Ross Carrier; Skid Mounted or Trailer Mounted Conrete Pump; Switchman or Brakeman; Throttle Valve Person; Tractair & Road Widening Trencher; Tractor (50 H.P. or Over); Truck Crane Oiler; Tugger; Welding Machine; Well Points; & Whirley Oiler

GROUP 3 - Greaser on Grease Facilities servicing Heavy Equipment

GROUP 4 - Bituminous Distributor; Burlap & Curing Machine; Cement Gun; Concrete Saw; Conveyor; Deckhand Oiler; Grout Pump; Hydraulic Post Driver; Hydro Seeder; Mud Jack; Oiler; Paving Joint Machine; Power Form Handling Equipment; Pump; Roller (Earth); Steerman; Tamping Machine; Tractor (Under 50 H.P.); & Vibrator

CRANES WITH BOOMS 150 ft. & Over (Including JIB) $.50 Premium

EMPLOYEES ASSIGNED TO WORK BELOW GROUND LEVEL ARE TO BE PAID 10% ABOVE BASIC WAGE RATE. THIS DOES NOT APPLY TO OPEN CUT WORK.

IRON0044I 06/01/2002

	Rates	Fringes
BOURBON (Northern third, including Townships of Jackson, Millersburg, Ruddel Mills & Shawhan);		
CARROLL (Eastern third, including the Township of Ghent);		
FLEMING (Western part, excluding Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksridge, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford);		
MASON (Western two-thirds, including Townships of Dover, Lewisburg, Mays Lick, Maysville, Minerva, Moranburg, Murphysville, Ripley, Sardis, Shannon, South Ripley & Washington);		
NICHOLAS (Townships of Barefoot, Barterville, Carlisle, Ellisville, Headquarters, Henryville, Morningglory, Myers & Oakland Mills);		
OWEN (Townships of Beechwood, Bromley, Fairbanks, Holbrook, Jonesville, Long Ridge, Lusby's Mill, New, New Columbus, New Liberty, Owenton, Poplar Grove, Rockdale, Sanders, Teresita & Wheatley);		
SCOTT (Northern two-thirds, including Townships of Biddle, Davis, Delaplain, Elmville, Longlick, Muddy Ford, Oxford, Rogers Gap, Sadieville, Skinnersburg & Stonewall) & BRACKEN, GALLATIN, GRANT, HARRISON & ROBERTSON COUNTIES:		
IRONWORKERS:		
Structural	23.45	10.88
Fence Erector	21.11	10.88

IRON0070J 06/01/2002

	Rates	Fringes
BOURBON (Southern two-thirds, including Townships of Austerlity, Centerville, Clintonville, Elizabeth, Hutchison, Littlerock, North Middletown & Paris);		
CARROLL (Western two-thirds, including Townships of Carrollton, Easterday, English, Locust, Louis, Prestonville & Worthville);		
CLARK (Western two-thirds, including Townships of Becknerville, Flanagan, Ford, Pine Grove, Winchester & Wyandotte);		
OWEN (Eastern eighth, including Townships of Glenmary, Gratz, Monterey, Perry Park & Tacketts Mill);		
SCOTT (Southern third, including Townships of Georgetown, Great Crossing, Newtown, Stampling Ground & Woodlake);		
ANDERSON, BOYLE, BRECKINRIDGE, BULLITT, FAYETTE, FRANKLIN, GRAYSON, HARDIN, HENRY, JEFFERSON, JESSAMINE, LARUE, MADISON,		

MARION, MEADE, MERCER, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE, WASHINGTON & WOODFORD COUNTIES:

IRONWORKERS	23.25	10.87

IRON0372F 06/01/2002

	Rates	Fringes
BOURBON (Northern third, including Townships of Jackson, Millersburg, Ruddel Mills & Shawhan);		
CARROLL (Eastern third, including the Township of Ghent);		
FLEMING (Western part, Excluding Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksridge, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford);		
MASON (Western two-thirds, including Townships of Dover, Lewisburg, Mays Lick, Maysville, Minerva, Moranburg, Murphysville, Ripley, Sardis, Shannon, South Ripley & Washington);		
NICHOLAS (Townships of Barefoot, Barterville, Carlisle, Ellisville, Headquarters, Henryville, Morningglory, Myers & Oakland Mills);		
OWEN (Townships of Beechwood, Bromley, Fairbanks, Holbrook, Jonesville, Long Ridge, Lusby's Mill, New, New Columbus, New Liberty, Owenton, Poplar Grove, Rockdale, Sanders, Teresita & Wheatley);		
SCOTT (Northern two-thirds, including Townships of Biddle, Davis, Delaplain, Elmville, Longlick, Muddy Ford, Oxford, Rogers Gap, Sadieville, Skinnersburg & Stonewall);		
BRACKEN, GALLATIN, GRANT, HARRISON & ROBERTSON COUNTIES:		
IRONWORKERS, Reinforcing:		
Up to & including 30-mile radius of Hamilton County, Ohio Courthouse	22.71	10.47
Beyond 30-mile radius of Hamilton County, Ohio Courthouse	22.96	10.47

IRON0769G 06/01/2002

	Rates	Fringes
CLARK (Eastern third, including Townships of Bloomingdale, Hunt, Indian Fields, Kiddville, Loglick, Rightangele & Thomson);		
FLEMING (Townships of Beechburg, Colfax, Elizaville, Flemingsburg, Flemingsburg Junction, Foxport, Grange City, Hillsboro, Hilltop, Mount Carmel, Muses Mills, Nepton, Pecksridge, Plummers Landing, Plummers Mill, Poplar Plains, Ringos Mills, Tilton & Wallingford);		
MASON (Eastern third, including Townships of Helena, Marshall, Orangeburg, Plumville & Springdale);		

NICHOLAS (Eastern eighth, including the Township of Moorefield
Sprout);

BATH, BOYD, CARTER, ELLIOTT, GREENUP, LEWIS, MONTGOMERY & ROWAN
COUNTIES:

IRONWORKERS:

ZONE 1	24.92	11.14
ZONE 2	25.32	11.14
ZONE 3	27.32	11.14

ZONE 1 - Up to 10 mi. radius of union hall, Ashland, Ky., 1643
Greenup Avenue
ZONE 2 - 10 to 50 mi. radius of union hall;
ZONE 3 - 50 mi. radius and beyond

LABO0189C 07/01/2002

	Rates	Fringes
LABORERS:		
GROUP 1	16.34	7.38
GROUP 2	16.59	7.38
GROUP 3	16.64	7.38
GROUP 4	17.24	7.38

LABORERS CLASSIFICATIONS

GROUP 1 - Aging & Curing of Concrete; Asbestos Abatement Worker; Asphalt Plant; Asphalt; Batch Truck Dump; Carpenter Tender; Cement Mason Tender; Cleaning of Machines; Concrete; Demolition; Dredging; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Level D; Flagperson; Grade Checker; Hand Digging & Hand Back Filling; Highway Marker Placer; Landscaping, Mesh Handler & Placer; Puddler; Railroad; Rip-rap & Grouter; Right-of-Way; Sign, Guard Rail & Fence Installer; Signal Person; Sound Barrier Installer; Storm & Sanitary Sewer; Swamper; Truck Spotter & Dumper; & Wrecking of Concrete Form

GROUP 2 - Batter Board Man (Sanitary & Storm Sewer); Brickmason Tender; Mortar Mixer Operator; Burner & Welder; Bushammer; Chain Saw Operator; Concrete Saw Operator; Deckhand Scow Man; Dry Cement Handler; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Level C; Forklift Operator for Masonary; Form Setter; Green Concrete Cutting; Hand Operated Grouter & Grinder Machine Operator; Jackhammer; Pavement Breaker; Paving Joint Machine; Pipelayer; Plastic Pipe Fusion; Power Driven Georgia Buggy & Wheel Barrow; Power Post Hole Digger; Precast Manhole Setter; Walk-Behind Tamper; Walk-Behind Trencher; Sand Blaster; Concrete Chipper; Surface Grinder; Vibrator Operator; & Wagon Driller

GROUP 3 - Air Track Driller; Asphalt Luteman & Raker; Gunnite Nozzleman; Gunnite Operator & Mixer; Grout Pump Operator; Powderman & Blaster; Side Rail Setter; Rail Paved Ditch; Screw Operator; Tunnel (Free Air); & Water Blaster

GROUP 4 - Caisson Worker (Free Air); Cement Finisher;

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  Environmental - Nuclear, Radiation, Toxic & Hazardous Waste -
  Levels A & B; Miner & Driller (Free Air); Tunnel Blaster; &
  Tunnel Mucker (Free Air)
----------------------------------------------------------------

 PAIN0012F  06/01/2001

                                     Rates           Fringes
BATH, BOURBON, BOYLE, CLARK, FAYETTE, FLEMING, FRANKLIN,
 HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS,
 ROBERTSON, SCOTT & WOODFORD COUNTIES:

PAINTERS:
 Brush; Roll; Spray; Sandblasting;
  Steam Cleaning; Steeplejack Work;
  Lead Abatement; & Coal Tar          16.81           2.60

 Bridge/Equipment Tender and/or
  Containment Builder                 17.96           2.60

 Swing & Scaffold Bridges; Structural
  Steel; Open Acid Tanks; High
  Tension Electrical Equipment; &
  Hot Pipes                           21.00           2.60
----------------------------------------------------------------

 PAIN0012T  06/15/2002
                                     Rates           Fringes
BRACKEN, GALLATIN, GRANT, MASON & OWEN COUNTIES:

PAINTERS:
 Elevated Tanks                      22.30           5.10

(HEAVY & HIGHWAY BRIDGES - GUARDRAILS-LIGHTPOLES-
 STRIPING):
  Bridge/Equipment Tender and/or
Containment Builder                18.95           5.10
  Brush & Roller                      21.30           5.10
  Spray                               21.80           5.10
  Sandblasting & Hopper Tender;
Water Blasting                     22.05           5.10
  Bridges when highest point of
clearance is 60 feet or more; &
Lead Abatement Projects            22.30           5.10
  Sandblasting, Hopper Tender,
Waterblasting (Bridges when
highest point of clearance is
60 feet or more)                   23.05           5.10
----------------------------------------------------------------

 PAIN0118D  05/01/2003
                                     Rates           Fringes
ANDERSON, BRECKINRIDGE, BULLITT, CARROLL, GRAYSON, HARDIN, HENRY,
 JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY,
 SPENCER, TRIMBLE & WASHINGTON COUNTIES:

PAINTERS:
 Brush                               17.37           6.47
 Abrasive Blaster; Fireproofing;
  Lead Abatement; Spray; &
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Waterblasting 4000 PSI and Above	17.87	6.47

PAIN1072D 06/01/2002

	Rates	Fringes
BOYD, CARTER, ELLIOTT, GREENUP, LEWIS & ROWAN COUNTIES:		
PAINTERS:		
Bridges	23.28	9.07
All Other Work	19.42	9.07

PLUM0107F 08/01/2002

	Rates	Fringes
BRECKINRIDGE, BULLITT, CARROLL (Western Half), FRANKLIN (Western three-fourths), GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE & WASHINGTON COUNTIES:		
PLUMBERS; GAS FITTERS:		
Plumbing contracts less than $150,000.00	19.92	6.42
All Other Plumbing contracts	24.90	6.42

PLUM0248C 06/01/2002

	Rates	Fringes
BOYD, CARTER, ELLIOTT, GREENUP, LEWIS & ROWAN COUNTIES:		
PLUMBERS & STEAMFITTERS	22.97	12.40

PLUM0392H 06/01/2002

	Rates	Fringes
BRACKEN, CARROLL (Eastern Half), GALLATIN, GRANT, MASON, OWEN & ROBERTSON COUNTIES:		
PIPEFITTERS & PLUMBERS	26.00	8.09

PLUM0452C 11/01/2002

	Rates	Fringes
ANDERSON, BATH, BOURBON, BOYLE, CLARK, FAYETTE, FLEMING, FRANKLIN (Eastern one-fourth), HARRISON, JESSAMINE, MADISON, MERCER, MONTGOMERY, NICHOLAS, SCOTT & WOODFORD COUNTIES:		
PIPEFITTERS & PLUMBERS:		
Projects over 1 1/2 million dollars in piping contracts:		
ZONE 1	22.30	7.72
ZONE 2	23.30	7.72
Projects under 1 1/2 million dollars in piping contracts:		
ZONE 1	18.92	7.72
ZONE 2	19.92	7.72

ZONE 1 - Within 25 mile radius of Fayette County Courthouse
ZONE 2 - Beyond 25 mile radius of Fayette County Courthouse

PLUM0522D 08/01/2002

	Rates	Fringes
BRECKINRIDGE, BULLITT, CARROLL (Western Half), FRANKLIN (Western three-fourths), GRAYSON, HARDIN, HENRY, JEFFERSON, LARUE, MARION, MEADE, NELSON, OLDHAM, SHELBY, SPENCER, TRIMBLE & WASHINGTON COUNTIES:		
PIPEFITTERS & STEAMFITTERS	25.90	8.98

SUKY2003A 10/08/2001

	Rates	Fringes
TRUCK DRIVERS:		
GROUP 1	16.57	7.34
GROUP 2	16.68	7.34
GROUP 3	16.86	7.34
GROUP 4	16.96	7.34

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - Mobile Batch Truck Tender

GROUP 2 - Greaser; Tire Changer; & Mechanic Tender

GROUP 3 - Single Axle Dump; Flatbed; Semi-trailer or Pole Trailer when used to pull building materials and equipment; Tandem Axle Dump; Distributor; Mixer; & Truck Mechanic

GROUP 4 - Euclid & Other Heavy Earthmoving Equipment & Lowboy; Articulator Cat; 5-Axle Vehicle; Winch & A-Frame when used in transporting materials; Ross Carrier; Forklift when used to transport building materials; & Pavement Breaker

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(ii)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

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SECTION 00800

SPECIAL CLAUSES

10/02

PART 1 GENERAL

1.1 REFERENCES - NOT USED

1.2 SUBMITTALS

Government approval/acceptance is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Pollution Prevention Plan;

Drug Free Workplace; G

SD-05 Design Data

Equipment-in-Place List; G

The Contractor shall make a list of all installed equipment furnished under this contract

Maintenance and Parts Data;

The Contractor shall furnish brochures, catalog cuts, parts lists, manufacturer's data sheets or other publicatios which show detailed parts data.

SF1413;

Within 7 days after award of any subcontract, the Contractor shall deliver to the Contracting Officer a completed SF 1413

Local Agency Check;

The Contractor is required to provide a Local Agency Check for each

individual that will be working on this contract.

Notice of Soil Treatment;

The Contractor shall provide seven days written notice to the Contracting Officer before required soil treatment agents are applied.

Progress Photographs;

SD-07 Certificates

Warranties;

Insurance;

SD-11 Closeout Submittals

As-Built Drawings; G

Drawings showing final as-built conditions of the project. The CADD drawings submittals shall consist of two separate types of media. One set of media shall consist of the electronic CADD drawing (AutoCad) files - four separate copies on CD-ROM. The second set of media shall consist of two sets of mylars, two sets of blue line prints of the mylars, and the approved marked working as-built prints.

Mechanical Room Layout; G

1.3 COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK (APR 1984) FAR 52.211-10.
2 Jan 96

The Contractor shall be required to commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, prosecute said work diligently, and complete the entire work ready for use not later than 920 calendar days after date of receipt of notice to proceed. The time stated for completion shall include as-built drawings, O&M manuals, operational tests/reports/training/instructions, equipment lists, and final cleanup of the premises.

a. The proposed project is within the range of the Federally endangered Indiana Bat (myotis sodalis) and Gray Bat (myotis grisescems). These bats roost in trees in riparian, bottomland and upland forests. Because of the extent of bat habitat and the project's proximity to a known population of bats, the Contractor shall avoid cutting of trees during the bat reproductive cycle (April 1 through October 15).

b. The Government anticipates that the Whole Neighborhood Renewal housing development will be constructed and turned over for occupancy in

three or four phases, with approximately one-quarter to one-third of the units being turned over in each phase. Contractor shall plan such phases so that units and infrastructure turned over in each phase is complete and fully ready for occupancy, including streets, utilities, associated recreation facilities, etc. Phasing shall also be arranged so that occupants of completed areas are not required to travel through areas where construction work is continuing, and so that completed areas can be fenced off for safety and security purposes from areas of continuing construction. Contractor shall provide six-foot high chain link fencing for the purpose, with gates as required, and shall relocate as necessary as each phase is completed and ready for occupancy.

c. The Government desires that some housing units be completed and turned over at the earliest date practical, preferably in January of 2005. The Government will accept approximately 20 units or more in the first phase to be turned over.

1.4 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000) FAR 52.211-12.
Oct 00

a. If the Contractor fails to complete the work within the time specified in his approved project schedule, including phase turnover dates, the Contractor shall pay liquidated damages to the Government in the amount of $1156.00 for each calendar day of delay until the work is completed or accepted.

b. If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

c. Refer to the paragraph PROTECTION OF TREES in Section 01410 for penalties associated with Contractor failing to protect significant trees identified in that section and designated in successful offeror's accepted proposal for protection and incorporation in the project site design.

1.5 TIME EXTENSIONS (SEPT 2000) FAR 52.211-13 - NOT USED

1.6 EXCLUSION OF PERIODS IN COMPUTING COMPLETION SCHEDULES - NOT USED

1.7 CONTRACT DRAWINGS AND SPECIFICATIONS (AUG 2000) DFARS 252.236-7001

(May 2002)

a. At award, the Government will furnish the Contractor a compact disk containing all technical contract documents. This disk will include a complete set of drawing files and technical specification files which have all amendments incorporated. The disk will contain drawing files in CALS Type 4 format and technical specifications in PDF format.

The CALS files and the PDF files are being provided for the Contractor's

use in printing hard copies of contract documents.

In addition, native CADD files and Word files are provided in accordance with "AS-BUILT DOCUMENTS" paragraph for the Contractor's use in developing as-built plans and specifications.

b. The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies;

(4) Be responsible for any errors which might have been avoided by complying with paragraph (b); and

(5) Reproduce and print contract drawings and specifications as needed.

c. Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

d. The work shall conform to the RFP, including specifications and the Offeror's proposal:

TABLE OF DRAWINGS

Drawing No.	Title (followed by drawing code if different from that shown above)	Latest Rev. No. & Date
G0.1	Cover Sheet	22 August 2003
C1.1	Existing Conditions	22 August 2003
C1.2	Existing Utilities	22 August 2003
C2.1	Site Demolition	22 August 2003
C3.1	Site Survey - For Information Only	22 August 2003
L1.1	Site Constraint Plan - For Information Only	22 August 2003
G-100	Fort Knox, General And Demoloition Notes	22 August 2003
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	Exist. Elevations For Demolition	22 August 2003
A-201	Fort Knox, Binter Court Existing Photos	22 August 2003
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REF-100	Family Housing, Bldg. E Plans And Details, For Reference Only	22 August 2003
REF-101	Family Housing, Bldg. F Plans And Details, For Reference Only	22 August 2003
REF-102	Bldgs D, E, F Elevations And Details For Reference Only	22 August 2003

1.8 AS-BUILT DOCUMENTS - NOT USED

1.9 AS-BUILT DOCUMENTS FOR DESIGN BUILD PROJECTS
4 February 1999 (Version 2)

1.9.1 General

It is the scope of this section to provide guidance to the Contractor on preparing as-built drawings and as-built specifications. An as-built drawing is a construction drawing revised to reflect the final as-built conditions of the project as a result of modifications and corrections to the project design required during construction. The final as-built drawings shall not have the appearance of marked up drawings, but that of professionally prepared drawings as if they were the "as designed" drawings.

As-built specifications are the construction specifications as modified by changes (contract mods, ACO approved variations from the construction specifications which did not result in contract mods, and any additional details which were not fully developed at the time of completion of construction documents).

1.9.2 Maintenance of As-Built Drawings

The Contractor shall keep a careful record set of blue line prints at the job site, marked in red, of all changes and corrections from the contract drawings. The Contractor shall enter changes and corrections on drawings promptly to reflect "Current Construction". This update shall be done no less frequently than on a weekly basis for the blue line prints and update no less frequently than a quarterly basis for the CADD files, which were prepared previously in accordance with Section 01021. A confirmation shall be included that the as-builts are up to date with the submission of the monthly project schedule. If the Contractor fails to maintain the as-built drawings as required herein, the Contracting Officer will deduct from the monthly progress payment, an amount representing the estimated monthly cost of maintaining the as-built drawings. Final payment with respect to separately priced facilities or the contract as a whole, will be withheld until proper as-built drawings have been furnished to, and accepted by the Contracting Officer. The marked-up set of plans shall reflect any changes, alterations, adjustments or modifications. Changes must be reflected on all sheets affected by the change. Changes shall include marking the

drawings to reflect structural details, foundation layouts, equipment sized, and other extensions of design.

1.9.3 Maintenance of As-Built Specifications

As-built specifications shall be marked up no less frequently than on a weekly basis. Revised electronic files shall be done no less frequently than monthly.

1.9.4 Underground Utilities

The drawings shall indicate, in addition to all changes and corrections, 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, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average elevation of the top of each run or underground structure shall also be recorded.

1.9.5 Borrow Areas - NOT USED

1.9.6 Partial Occupancy

For projects where portions of construction are to be occupied or activated before overall project completion, including portions of utility systems, as-built drawings for those portions of the facility being occupied or activated shall be supplied at the time the facility is occupied or activated. This same as-built information previously furnished must also be shown on the final set of as-built drawings.

1.9.7 Phased Occupancy

As each phase of the project is occupied, as-built drawings for that phase shall be supplied at the time the phase is turned over to the Government. At the end of the project, all as-built drawings shall be provided in a single package.

1.9.8 As-Built Conditions That are Different From the Contract Drawings

All as-built conditions that are different from the contract drawings shall be accurately reflected on each drawing. If the as-built condition is accurately reflected on a shop drawing, then furnish that shop drawing in CADD format. The final as-built drawing shall refer to the shop drawing file that includes the as-built information.

1.9.9 Additional As-Built Information that Exceeds the Detail Shown on the Contract Drawings:

These as-built conditions include those that reflect structural details, foundation layouts, equipment, sizes, mechanical room layouts and other

extensions of design, that were not shown in the project design documents because the exact details were not known until after the time of approved shop drawings. It is recognized that these shop drawing submittals (revised showing as-built conditions) will serve as the as-built record without actual incorporation into the contract drawings. Furnish all such shop drawings in CADD format.

1.9.10 Final As-Built Drawings

At the time of Beneficial Occupancy of the project or at a designated phase of the project, final as-built CADD files shall be provided to the Contracting Officer in the following formats:

(1) On CD-ROM in the format as specified in Section 01021 - four copies
(2) Full size original on photographic Mylars - two sets
(3) Full size blue-line prints from the Mylar - two sets
(4) The record set of blue line mark-ups

In the event the Contractor accomplishes additional work after this submittal, which changes the as-built conditions, the Contractor shall furnish a new CD-ROM, new full size original on photographic Mylars of affected sheets, and new blue line copy which depicts all the additional changes.

1.9.11 Title Blocks

Title Blocks shall be clearly marked to indicate final as-built drawings.

1.9.12 Final As-Built Specifications

Final as-built specifications shall be prepared in Microsoft Word and the electronic files shall be placed on the same CD-ROM that contains the as-built CADD files. The front sheet of the specifications shall contain an identification which clearly labels the specifications as representing as-built conditions and shall be dated with the date of the submittal.

1.9.13 Other As-Built Documents

All other documents such as design analysis, catalog cuts, certification documents that are not available in native electronic format shall be scanned and provided in an organized manner in Adobe.pdf format.

1.9.14 Final Payment

No separate or direct payment will be made for the work specified herein. All costs associated with this work shall be included in the applicable contract prices for the items requiring as-built drawings listed in the bidding schedule.

1.10 EQUIPMENT DATA
15 June 1990

Real Property Equipment.

Contractor shall be required to make an Equipment-in-Place list of all installed equipment furnished under this contract. This list shall include all information usually listed on manufacturer's name plate. The form is part of SPECIAL CLAUSES and is included following the SPECIAL CLAUSES, so to positively identify the piece of property. The list shall also include the cost of each piece of installed property F.O.B. construction site. For each of the items which is specified herein to be guaranteed for a specified period from the date of acceptance thereof, the following information shall be given: The name, serial and model number address of equipment supplier, or manufacturer originating the guaranteed item. The Contractor's guarantee to the Government of these items will not be limited by the terms of any manufacturer's guarantee to the Contractor. Furnish the list as one (1) reproducible and three (3) copies to the Contracting Officer thirty (30) calendar days before completion of any segment of the contract work which has an incremental completion date.

Maintenance and Parts Data.

The Contractor will be required to furnish a brochure, catalog cut, parts list, manufacturer's data sheet or other publication which will show detailed parts data on all other equipment subject to repair and maintenance procedures not otherwise required in Operations and Maintenance Manuals specified elsewhere in this contract. Distribution of directives shall follow the same requirements as listed in paragraph above.

1.11 PHYSICAL DATA (APR 1984) FAR 52.236-4.
2 January 1996

Data and information furnished or referred to below is furnished for the Contractor's information. The Government will not be responsible for any interpretation or conclusion drawn from the data or information by the Contractor.

Weather Conditions. The Contractor shall make his own investigations as to weather conditions at the site. Data may be obtained from various National Weather Service offices located generally at airports of principal cities, the nearest to this project being:

Louisville International Airport
Regional Airport Authority
Louisville, KY 502-368-6524

Historical data for all areas may be obtained from:

U. S. Department of Commerce
National Climatic Center
Federal Building
Asheville, N. C. 28801

Transportation Facilities. Roads in the general area are shown on the drawings. Access ways shall be investigated by the Contractor to satisfy himself as to their existence and allowable use.

1.12 UTILITIES (APR 1984) FAR 52.236-14 (Para. 1.12.a.(1) & 1.12.a.(2) only).
15 June 1990

a. Availability and Use of Utility Services - See Section 01500, Paragraph 1.2.

b. Alterations to Utilities

Where changes and relocations of utility lines are noted to be performed by others, the Contractor shall give the Contracting Officer at least thirty (30) days written notice in advance of the time that the change or relocation is required. In the event that, after the expiration of thirty (30) days after the receipt of such notice by the Contracting Officer, such utility lines have not been changed or relocated and delay is occasioned to the completion of the work under contract, the Contractor will be entitled to a time extension equal to the period of time lost by the Contractor after the expiration of said thirty (30) day period. Any modification to existing or relocated lines required as a result of the Contractor's method of operation shall be made wholly at the Contractor's expense and no additional time will be allowed for delays incurred by such modifications.

c. Interruptions of Utilities

(1) No utility services shall be interrupted by the Contractor to make connections, to relocate, or for any purpose without approval of the Contracting Officer.

(2) Request for Permission to shut down services shall be submitted in writing to the Contracting Officer not less than fourteen (14) days before date of proposed interruption. The request shall give the following information:

(a) Nature of Utility (Gas, L.P. or H.P., Water, etc.)

(b) Size of line and location of shutoff;

(c) Buildings and services affected.

(d) Hours and date of shutoff.

(e) Estimated length of time services will be interrupted.

(3) Services shall not be shutoff until receipt of approval of the proposed hours and date from the Contracting Officer.

(4) Shutoffs which will cause interruption of Government or others' work operations as determined by the Contracting Officer shall be accomplished during regular non-work hours or on non-work days of the affected parties without any additional cost to the Government. Buildings 7956 through 7963 include a swimming pool, restaurant/Lounge, and Guest House - hours allowed for utility interuptions are very limited.

(5) Operation of valves on water mains will be by Government personnel. Where shutoff of water lines interrupts service to fire hydrants or fire sprinkler systems, the Contractor shall arrange his operations and have sufficient material and personnel available to complete the work without undue delay or to restore service without delay in event of emergency.

(6) Flow in gas mains which have been shut off shall not be restored until the Government inspector has determined that all items serviced by the gas line have been shut off.

1.13 QUANTITY SURVEYS (APR 1984) FAR 52.236-16 - NOT USED

1.14 LAYOUT OF WORK (APR 1984) FAR 52.236-17
15 June 1990 **(Version 1)**

The Contractor shall lay out its work, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at his own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

1.15 LINES, GRADES AND LIMITS - NOT USED
20 Feb 2002

1.16 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984) FAR 52.236-1
15 June 1990

Version 1

The Contractor shall perform on the site, and with its own organization, work equivalent to at least 20 percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

a. For purposes of this paragraph "WORK BY THE CONTRACTOR" is defined as prime Contractor direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, equipment, or subcontractors. The "TOTAL AMOUNT OF WORK" is defined as total direct contract labor (including testing and layout personnel), exclusive of other general condition or field overhead personnel, material, or equipment.

b. Within 7 days after the award of any subcontract, either by himself or a subcontractor, the Contractor shall deliver to the Contracting

Officer a completed SF 1413, "Statement and Acknowledgment." The form shall include the subcontractor's acknowledgement of the inclusion in his subcontract of the clauses of this contract entitled "Davis-Bacon Act," "Contract Work Hours and Safety Standards Act-Overtime Compensation," "Apprentices and Trainees," "Compliance with Copeland Regulations," "Withholding of Funds," "Subcontracts," "Contract Termination-Debarment," and "Payrolls and Basic Records." Nothing contained in this contract shall create any contractual relation between the subcontractor and the Government.

1.17 SUPERINTENDENCE OF SUBCONTRACTORS
24 February 1992

a. The Contractor shall be required to furnish the following, in addition to the superintendence required by CONTRACT CLAUSE: SUPERINTENDENCE BY THE CONTRACTOR.

(1) If more than 50 percent and less than 70 percent of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(2) If 70 percent or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

b. If the Contracting Officer, at any time after 50 percent of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirements for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

1.18 IDENTIFICATION OF EMPLOYEES.
15 June 1990

a. The Contractor shall be responsible for furnishing an identification badge/card to each employee prior to the employees work on-site, and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of the employee. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

b. The Contractor is required to provide a Local Agency Check for each individual that will be working on this contract. See Paragraph "COMPLIANCE WITH POST/BASE REGULATIONS" for instructions.

1.19 CONTRACTOR-PREPARED NETWORK ANALYSIS SYSTEM - NOT USED
See Section 01320 PROJECT SCHEDULE

1.20 WARRANTY OF CONSTRUCTION (MAR 1994) ALTERNATE 1 (APR 1984) FAR 52.246-21I.
15 January 1998

a. General Requirements

(1) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph 1.20.a.(10) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

(a) Warranty Payment: Warranty work is a subsidiary portion of the contract work, and has a value to the Government approximating 1% of the contract award amount. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: Payments Under Fixed-Price Construction Contracts. If the Contractor fails to respond to warranty items as provided in paragraph 1.20.e(5), the Government may elect to acquire warranty repairs through other sources and, if so, shall backcharge the Contractor for the cost of such repairs. Such backcharges shall be accomplished under the Changes Clauses of the contract through a credit modification(s).

(2) This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession. This Warranty shall be transferable from the Government to a private housing management entity, should the Government elect to privatize this housing project prior to expiration of the Warranty.

(3) The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

(a) The Contractor's failure to conform to contract requirements; or

(b) Any defect of equipment, material, workmanship, or design furnished.

(4) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

(5) The Contracting Officer shall notify the Contractor, in writing, (see para. 1.20.b.(3) and 1.20.e) within a reasonable time after the discovery of any failure, defect, or damage.

(6) If the Contractor fails to remedy any failure, defect, or damage within

a reasonable time after receipt of notice, (see para. 1.20.e) the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(7) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall--

(a) Obtain all warranties that would be given in normal commercial practice;

(b) Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer, and be transferrable to a private housing management entity; and

(c) Provide names, addresses, and telephone numbers of all subcontractors, equipment suppliers, or manufacturers with specific designation of their area of responsibilities if they are to be contacted directly on warranty corrections; and

(d) Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

(8) In the event the Contractor's warranty under paragraph of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

(9) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.

(10) This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

(11) Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government.

(12) If turf is not established as defined in the specifications at the time of turn-over to the Government, the Contractor is required to return until acceptable turf is established. Tree and shrub warranty period of one growing season (12 months minimum) shall commence upon turn-over to the Government. See Statement Of Work 3-8.2

b. Performance Bond

(1) The Contractor's Performance Bond will remain effective throughout the construction warranty period and warranty extensions, and shall be transferred to the benefit of a private housing management entity, should

the Government elect to privatize this housing project prior to the expiration of the warranty. The Bond shall be transferable from the Government to a private housing management entity, should the Government elect to privatize this housing project prior to expiration of warranties.

(2) In the event the Contractor or his designated representative(s) fails to commence and diligently pursue any work required under this clause, and in a manner pursuant to the requirements thereof, the Contracting Officer shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, may make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(3) Following oral or written notification of required warranty repair work, the Contractor will respond as dictated by para. 1.20.e. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor as outlined in the paragraph 1.20.b.(2) above.

c. Pre-Warranty Conference

Prior to contract completion and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this clause. Communication procedures for Contractor notification of 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 shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warrantied construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of his responsibilities in connection with other portions of this provision.

d. Equipment Warranty Identification Tags

(1) The Contractor shall provide warranty identification tags on all Contractor and Government furnished equipment which he has installed.

(a) The tags shall be similar in format and size to the exhibits provided by this specification, they shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Contractor furnished equipment that has differing warranties on its components will have each component

tagged.

(b) Sample tags shall be submitted for Government review and approval. These tags shall be filled out representative of how the Contractor will complete all other tags.

(c) Tags for Warrantied Equipment: The tag for this equipment shall be similar to the following. Exact format and size will be as approved.

EQUIPMENT WARRANTY
CONTRACTOR FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

CONTRACTOR NAME

CONTRACTOR WARRANTY EXPIRES

MFG WARRANTY(IES) EXPIRE

EQUIPMENT WARRANTY
GOVERNMENT FURNISHED EQUIPMENT

MFG MODEL NO.

SERIAL NO.

CONTRACT NO.

DATE EQUIP PLACED IN SERVICE

MFG WARRANTY(IES) EXPIRE

(d) If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag. The Contractor warranty expires (warranty expiration date) and the final manufacturer's warranty expiration date will be determined as specified by para. 1.20.1.

(2) Execution. The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment.

(3) Payment. The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign a value of that amount in the breakdown for progress payments mentioned in the Contract Clause: PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS.

(4) Equipment Warranty Tag Replacement. As stated in para. 1.20.1.4, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

e. Contractor's Response to Warranty Service Requirements. Following oral or written notification by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, the Contractor shall respond to warranty service requirements in accordance with the "Warranty Service Priority List" and the three categories of priorities listed below.

First Priority Code 1 Perform on site inspection to evaluate situation, determine course of action, initiate work within 24 hours unless noted otherwise,and work continuously to completion or relief.

Second Priority Code 2 Perform on site inspection to evaluate situation, determine course of action, initiate work within 48 hours and work continuously to completion or relief.

Third Priority Code 3 All other work to be initiated within 5 work days and work continuously to completion or relief.

The "Warranty Service Priority List" is as follows:

Code 1 Air Conditioning Systems

a. Air conditioning leak in part of building, if causing damage.
b. Not cooling housing unit.

Code 2 Doors

a. Overhead doors not operational.
b. Interior or exterior personnel doors not functioning properly

Code 1 Electrical

a. Power failure (entire area or any building).
b. Smoke detectors.

Code 2 Electrical

a. Power failure (no power to a room or part of building).
b. Receptacle and lights (in a room or part of a building).
c. Fire alarm systems.

Code 3 Electrical
a. Street lights/recreation area lights

Code 1 Heat
a. Heating in unit not working.

Code 1 Water Heating Failure

Code 1 Kitchen Appliances
a. Refrigerator/stove not working

Code 2 Kitchen Appliances
Any other appliance not working.

Code 1 Plumbing
a. Stopped up drain - repair within 4 hours.

Code 2 Plumbing
a. Flush valves.
b. Fixture drain, supply line commode, or water pipe leaking.
c. Commode leaking at base.

Code 3 Plumbing
a. Leaking faucets

Code 1 Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2 Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 1 Water (Exterior)
No water to building.

Code 1 Water, Hot
No hot water.

Code 3 All other work not listed above

(1) Should parts be required to complete the work and the parts are not immediately available, the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractors proposals shall include a firm date and time that the required parts shall

be available on site to complete the permanent warranty repair. The Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer, will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Contracting Officer or an authorized representative of the installation designated in writing by the Contracting Officer will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

1.21 PAYMENT FOR MOBILIZATION AND PREPARATORY WORK (JAN 1997) DFARS 252.236-7003 - NOT USED

1.22 PAYMENT FOR MOBILIZATION AND DEMOBILIZATION (DEC 1991) DFARS 252.236-7004. - NOT USED

1.23 SALVAGE MATERIALS AND EQUIPMENT. - NOT USED

1.24 IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY (APR 1984) FAR 52.245-3..
2 January 1991

a. The Government will furnish to the Contractor the property identified in the Schedule to be incorporated or installed into the work or used in performing the contract. The listed property will be furnished at the place specified below. When the property is picked up, the Contractor shall verify its quantity and condition and acknowledge receipt in writing to the Contracting Officer. The Contractor shall also report in writing to the Contracting Officer within 24 hours of pick up any damage to or shortage of the property as received. All such property shall be installed or incorporated into the work at the expense of the Contractor, unless otherwise indicated in this contract.

Location of GFP:

At a building at Fort Knox to be identified

b. The Contractor is required to unload and transport the property to the jobsite at his own expense.

c. Each item of property to be furnished under this clause shall be identified in the Schedule by quantity, item, and description.

Quantity	Item	Description
178	Range	750 mm (30 inches) electric
178	Refrigerator	900 mm (36 inches) electric

1.25 AGGREGATE SOURCES - NOT USED

1.26 PROJECT SIGN
1 August 1996

Version 2 General. The Contractor shall furnish and erect at the location directed one project sign.

Exact placement location will be designated by the Contracting Officer. The panel sizes and graphic formats have been standardized for visual consistency throughout all Corps operations.

Panels are fabricated using HDO plywood with dimensional lumber uprights and bracing.

All legends are to be painted in the sizes and styles as specified by the graphic formats shown at the end of this section. The signs (including back and edges), posts and braces shall be given two coats of Benjamin Moore No. 120-60 poly-silicone enamel or approved equal before lettering. The 4' x 4' right section of the project sign shall be white with black lettering. The 2' x 4' left section shall be Communication Red (CR) with white lettering. Paint colors shall be as follow:

Black - Federal Standard 595a Color Number 27038
White - Federal Standard 595a Color Number 27875
Red - PANTONE 032

An example of the sign including mounting and fabrication details are also provided at the end of this section.

Name of the project shall be as follows:

Whole Neighborhood Renewal
Fort Knox, KY

Name of the designer shall be as follows:

The Design/Build Contractor awarded the project

Erection and Maintenance.

a. The sign shall be erected at the designated location. Sign shall be plumb and backfill of post holes shall be well tamped to properly support the signs in position throughout the life of the contract. The sign

shall be maintained in good condition until completion of the contract, shall remain the property of the Contractor, and shall be removed from the site upon completion of work under the contract.

b. The Corps of Engineers logo will be provided by the Contracting Officer.

Payment. No separate payment will be made for furnishing and erecting the project sign as specified and costs thereof shall be considered a subsidiary obligation of the Contractor.

1.27 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. ER 415-1-15 (31 OCT 89)
2 January 1991

This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the contract clause entitled "Default: Fixed Price Construction". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
6	6	6	8	6	6	7	5	3	5	5	5

Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated listed above, the Contracting Officer will convert any qualifying delays to

calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "Default (Fixed Price Construction)".

1.28 WAGE RATES
1 February 1995

The decision of the Secretary of Labor, covering rates of wages, including fringe benefits to be paid laborers and mechanics performing work under this contract, is attached hereto. The payment for all classes of laborers and mechanics actually employed to perform work under the contract will be specified in the following contract clauses: DAVIS-BACON ACT, CONTRACT WORK HOURS AND SAFETY STANDARDS ACT, and THE COPELAND ACT.

Wage decisions included are: ***[_____]***

The building decision applies to construction of ***[_____]***. The Heavy/Highway decision applies to any work located outside the exterior wall of the building(s).

1.29 PURCHASE ORDERS - NOT USED

1.30 INTERFERENCE WITH TRAFFIC AND PUBLIC AND PRIVATE PROPERTY.
15 June 1990

a. The Contractor at all times shall dispose his plant and conduct the work in such manner as to cause as little interference as possible with private and public travel. Damage (other than that resulting from normal wear and tear) to roads, shall be repaired to as good a condition as they were prior to the beginning of work and to the satisfaction of the Contracting Officer.

1.31 SEQUENCE OF WORK.
15 September 1995

Working Hours: The Contractor's operations on site shall be limited to the hours between 7:00 AM and 7:00 PM.

The cutting of trees is prohibited during the period from April 1 through October 15. See also Paragraph 1.3.a of this Section.

1.32 GOVERNMENT FIELD OFFICE FACILITIES AND SERVICES.
1 August 1996

No on-site Government field office is required

1.33 COMPLIANCE WITH POST/BASE REGULATIONS.
1 August 1996

a. The site of the work is on a military reservation and all rules and regulations issued by the Commanding Officer covering general safety, security, sanitary requirements, pollution control and traffic regulations, shall be observed by the Contractor. Information regarding these

requirements may be obtained by contacting the Contracting Officer, who will provide such information or assist in obtaining same from appropriate authorities. Such requirements may include, but are not limited to, personel ID badges and vehicle tags.

b. Contractor personnel shall park only in areas authorized by the Contracting Officer.

c. The Contractor shall provide a Seven Day Notice of Soil Treatment to the Contracting Officer, in writing, before required soil treatment agents are applied, to assure that DOD Certified Pest Control Personnel are present during soil treatment applications. All soil treatment applications must be in the presence of DOD Certified Pest Control personnel.

1.34 EQUIPMENT AND OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995)
EFAR 52.231-5000..
20 March 1997

a. This does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.

b. Allowable cost for construction plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region II. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time of negotiations shall apply.

c. Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

d. When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the Contracting Officer shall request the Contractor to submit either certified cost or

pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Cover Sheet.

e. Whenever a modification or equitable adjustment of contract price is required, the contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of SPECIAL CONTRACT REQUIREMENT: EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. A copy of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule" is available for review at the office of the District Engineer, Room 821, 600 Dr. Martin Luther King, Jr. Place, Louisville, Kentucky, or a copy may be ordered from the Government Printing Office at a cost of $11.00 by calling telephone no. (301) 953-7974.

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1.35 LABOR, EQUIPMENT, AND MATERIAL REPORTS
15 June 1990

Daily Equipment Report. The Contractor shall submit a daily report of all Contractor-owned or rented equipment at the jobsite. A similar report is required for all subcontractor equipment. The subcontractor's report may be separate or included with the Contractor's report provided the equipment is adequately identified as to ownership. The required equipment report shall include each item of equipment (hand-operated small tools or equipment excluded) on the job and shall specifically identify each item as to whether it is Contractor-owned or rented, shifts, hours of usage, down time for repairs, and standby time. Identification of the equipment shall include make, model and plant number of all items. Separate identification by a key sheet providing these data may be utilized with the daily report indicating the type of equipment and the equipment plant numbers. The format of the Daily Equipment Report will be as approved by the Government in the field.

Labor, Equipment & Material Reports for Extra Work/Cost. A Report shall also be submitted by the Contractor listing any labor, equipment and

materials expended on and/or impacted by any change order directed by the Government and for which total price/time agreement has not been reached. These requirements also apply to subcontractors at any tier. The same Report is required at any time the Contractor claims or intends to claim for extra costs whether or not there is Government recognition (constructive changes). This requirement is in addition to any Contractor "Notice" or "Reservation of Rights". Submittal of such a report will not be construed as satisfying the "Notice" required under the "Changes" clause or any other clause. But, absence of such Reports submitted to the Government contemporaneously with the alleged extra work/cost will be considered as evidence that no such extra work/cost occurred that are chargeable to the Government.

The Report shall be detailed to the degree required by the Government in the field and shall contain the following as a minimum:

a. The cause of the extra labor, equipment or materials costs.

b. For extra labor - Indicate crew, craft, hours, location and cost. Describe nature or type of extra costs, i.e, extra work, overtime, acceleration, interference, reassignment, mobilizations and demobilizations, supervision, overhead, type of inefficiency, etc.

c. For extra equipment - Indicate type and description, hours, location, cost; whether working, idle, standby, under repair, extra work involved, etc.

d. For extra materials - Indicate type and description, where used, whether consumed, installed or multi-use, quantity, cost, extra work involved, etc.

e. Affected activities - Relate to Contract Schedule (Network Analysis); demonstrate whether delay or suspension is involved.

f. Segregate all entries by prime and each subcontractor.

g. Summarize costs daily and by cumulative subtotal or with frequency required by the Government.

This report will not be considered as evidence that any of the alleged extra costs actually occurred. The report will be used to check against over obligation of funds for change orders directed prior to price/time agreement and to track alleged extra costs the Contractor considers otherwise chargeable against the Government. The Government may respond at any interval to either challenge, amend or confirm the report. Absence of a Government response is not to be considered acquiescence or denial. The Government may order work stoppage if deemed necessary to avoid overobligation of funds. The frequency of the report shall be daily or as otherwise approved by the Government representative in writing.

1.36 ILLINOIS RETAILER'S OCCUPATIONAL TAX AND USE TAX. - NOT USED

1.37 INDIANA SALES AND USE TAX - NOT USED

1.38 OHIO SALES AND USE TAX - NOT USED

1.39 PROGRESS PHOTOGRAPHS
18 Nov 1999)

Version 1 The Contractor shall, during the progress of the work, furnish the Contracting Officer photographs, slides, digital photos (furnished on CD-ROM) and negatives depicting construction progress. The photographic work furnished shall be commercial quality as determined by the Contracting Officer. The photography shall be performed between the first and fifth of each month and the photographs, slides and negatives delivered to the Contracting Officer not later than the 15th of each month taken. A minimum of six views from different positions shall be taken as directed to show, inasmuch as possible, work accomplished during the previous month. At least, one set of photographs, slides and negatives will be made at completion of the contract, after final inspection by the Contracting Officer. The photographs shall be 8"x10" color prints and a digital file. Each photograph and slide shall be identified on the face of the picture or the border of the slide giving date made, contract title and number, location of work, as well as a brief description of work depicted. Each negative will be identified with the same information on a sheet of paper by cross-referencing to the number on the negative. Two copies of photographs and slides, along with the original negatives of each view taken, shall be furnished to the Contracting Officer by the time stipulated above. No separate payment will be made for these services and all costs in connection thereto shall be considered a subsidiary obligation of the Contractor.

1.40 PAYMENT FOR MATERIALS DELIVERED OFFSITE. (MAR 1995) EFARS 52.232-5000 - NOT USED.

1.41 INSURANCE--WORK ON A GOVERNMENT INSTALLATION (SEP 1989) FAR 52.228-5.
17 July 1992

The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract at least the kinds and minimum amounts of insurance required in the Schedule or elsewhere in the contract.

(1) Coverage complying with State laws governing insurance requirements, such as those requirements pertaining to Workman's Compensation and Occupational Disease Insurance. Employer's Liability Insurance shall be furnished in limits of not less than $100,000.00 except in states with exclusive or monopolistic funds.

(2) Comprehensive General Liability Insurance for bodily injury coverage shall be furnished in limits of not less than $500,000 per occurrence.

(3) Comprehensive Automobile Liability Insurance for both bodily

injury and property damage, shall be furnished in limits of not less than $200,000.00 per person, $500,000.00 per accident for bodily injury, and $20,000.00 per accident for property damage. When the Financial Responsibility or Compulsory Insurance Law of the State, requires higher limits, the policy shall provide for coverage of at least those higher limits.

Before commencing work under this contract, the Contractor shall submit to the Contracting Officer in writing that the required insurance certification has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe, or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

The Contractor shall insert the substance of this clause, including this paragraph, in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

1.42 IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM
March 2002

RMS shall be maintained in accordance with Section 01312A QUALITY CONTROL SYSTEM (QCS). The following sample construction-phase forms are included at the end of this Section 00800:

Contractor Quality Control Report
Contractor Planning Information
Subcontractor Information
Definable Features of Work
Pay Activities and Activity Information
Submittal Information
Quality Control Testing Information
User Schooling Information

1.43 SCAFFOLDING
July 2003

The following requirements supplement EM 385-1-1. In the event of a conflict between these requirements and EM 385-1-1, the more strict requirement shall take precedence.

All scaffold systems shall be erected, inspected and disassembled under the direction of a competent person. The competent person must be present and on site during these operations. The qualifications and training of the competent person and the crew performing the work shall be submitted to the Contracting Officer and accepted prior to commencement of the work. All

scaffold systems must be inspected daily and certified as usable prior to use each days use by the competent person. Scaffolds shall also be inspected and certified by the competent person upon completion of any changes to the scaffolding system i.e. adding or removing a level or etc. The competent person must be present and on site during these changes to the scaffold system. The contractor shall develop a system that notifies all parties of the certification status. The use a red/green tag system denoting the serviceability is an acceptable certification system.

A scaffold erection plan shall be submitted for all scaffold systems regardless of type scaffold to be used. This plan shall include erection and dismantling operations and all manufacture's details of the system and shall demonstrate compliance with EM 385-1-1. The plan shall be accepted by the Contracting Officer prior to the erection of the scaffold. This plan shall be reviewed at the preparatory and initial meetings with all parties involved in the scaffolding operation and use thereof. In the event others crafts will be using the scaffolding system, they shall also be briefed on the proper use of the system.

Every level of conventional and masonry type scaffolding systems shall be fully planked and include handrails and toe boards. The contractor is advised that he must analyze the added weight of this requirement on the capacity of the scaffold system and adjust his operations accordingly. All personnel erecting and dismantling scaffolds must be protected by a personal fall protection system.

Access to any type scaffold system above 6 (six) feet shall be by stair tower.

1.44 USE OF INCLINOMETER FOR LONG BED DUMP TRUCKS - NOT USED>

1.45 AVAILABILITY OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1). 17 May 2000

As covered by CONTRACT CLAUSE "ACCIDENT PREVENTION", compliance with EM 385-1-1 is a requirement for this contract. Copies may be purchased for $31.00 each at the following address:

United States Government Bookstore
Room 118, Federal Building
1000 Liberty Avenue
Pittsburgh, PA 15222-4003
Telephone: (412) 395-5021 FAX: (412) 395-4547

Or downloaded from the following website:

http://www.usace.army.mil/inet/usace-docs/eng-manuals/em385-1-1/toc.htm

1.46 FIRE PROTECTION DURING CONSTRUCTION (MIL-HDBK-1008c Para. 1.6) 15 April 1991

The Contractor is alerted to the requirements of Contract Clause "CLEANING UP" and more specifically to the requirements for fire protection during

construction spelled out in EM 385-1-1 and NFPA No. 241 Building Construction and Demolition Operations. This item must be covered in the submittal required under Contract Clause "ACCIDENT PREVENTION".

1.47 HAUL ROADS - NOT USED - See 01500 TEMPORARY CONSTRUCTION FACILITIES
2 Jan 1996

1.48 RADIOACTIVE MATERIAL/EQUIPMENT - NOT USED

1.49 CONSTRUCTION/SITE MANAGEMENT STANDARDS FOR CONSTRUCTION ON AMC INSTALLATIONS - NOT USED

1.50 CONSTRUCTION HAZARD COMMUNICATION
1 November 1991

The Contractor is required to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1926.59). This standard is designed to inform workers of safe and appropriate methods of working with hazardous substances in the workplace. The standard has five requirements, and every hazardous or potentially hazardous substance used or stored in the work area is subject to all five. They are:

(1) Hazard Evaluation. Any company which produces or imports a chemical or compound must conduct a hazard evaluation of the substance to determine its potential health or physical hazard. The hazard evaluation consists of an investigation of all the available scientific evidence about the substance. The Contractor is required to assure that all producers (manufacturer/distributors) have performed these evaluations and transmit the required information with any hazardous materials being used or stored on the project site. From the hazard evaluation, a substance may be classified as a health hazard, or a physical hazard. These classifications are then further broken down according to type:

Health Hazards	Physical Hazards
Carcinogens	Combustible liquids
Irritants	Compressed gases
Sensitizers	Explosives
Corrosives	Flammables
Toxic substances	Organic peroxides
Highly toxic substances	Unstable substances
Substances harmful to specific organs or parts of the body	Water-reactive substances

(2) Warning Labels. If a chemical is hazardous or potentially hazardous, the producer or importer must affix a warning label to every container of that chemical before it leaves his facility. The Contractor must assure these labels are attached and legible. The label must identify the chemical, state the hazard, and give the name and address of the

producer or importer. If the hazardous substance is transferred to another container, that container must then be labeled, tagged, or marked with the name of the chemical and the appropriate hazard warning. Warning labels should be replaced immediately if they are defaced or removed.

(3) Material Safety Data Sheets. The producer or importer must also supply a material safety data sheet (MSDS). The Contractor must keep these available in the work area where the substance is used, so that the people using the substance can easily review important safety and health information, such as:

The hazard possible from misuse of the substance
Precautions necessary for use, handling, and storage
Emergency procedures for leaks, spills, fire and first aid
Useful facts about the substance's physical or chemical properties

(4) Work Area Specific Training. Because of hazardous substance may react differently depending on how it is used or the environment of the work area, the Contractor must conduct work area specific training; special training which takes the Contractor's operations, environment, and work policies into consideration. Work area training presents:

The hazardous substances which are present in the work place and the hazards they pose

Ways to protect against those hazards, such as protective equipment, emergency procedures, and safe handling

Where the MSDS's are kept, and an explanation of the labeling system
Where the Contractor's written Hazard Communication Program is located

(5) The Written Hazard Communication Program. In accordance with OSHA requirements, the Contractor must prepare a written Hazard Communication Program. This document will be included in the Contractor's Accident Prevention Plan. This document states how the Contractor plans to ensure that hazardous materials are appropriately labeled, how and where MSDS's will be maintained, and how employees will be provided with specific information and training.

1.51 ENVIRONMENTAL PROTECTION CLAUSE TANK CLEANING AND PAINTING - NOT USED

1.52 MECHANICAL ROOM LAYOUT (ORL).
24 February 1992

Detailed mechanical room layout drawings shall be submitted for approval in accordance with SD-04 Section 01331. Layout drawings shall show location and maintenance clearances, and utility, piping, and duct connections, for all mechanical room equipment. Drawings shall be submitted at the same time as the submittals for the equipment to be located within the mechanical room.

1.53 RIGHTS IN TECHNICAL DATA--NONCOMMERCIAL ITEMS - NOT USED.

1.54 LIMITATIONS ON THE USE OR DISCLOSURE OF GOVERNMENT-FURNISHED

INFORMATION MARKED WITH RESTRICTIVE LEGEND DFARS - NOT USED>

1.55 NOT USED

1.56 VARIATIONS IN ESTIMATED QUANTITIES - SUBDIVIDED ITEMS - NOT USED

1.57 PARTNERING
August 1996

In order to most effectively accomplish this contract, the Government proposes to form a partnership with the Contractor to develop a cohesive building team. It is anticipated that this partnership would involve the Corps of Engineers, Fort Knox Housing and Base Operations Support Staff, the Contractor, primary subcontractors and the designers. This partnership would strive to develop a cooperative management team drawing on the strengths of each team member in an effort to achieve a quality project within budget and on schedule. This partnership would be bilateral in membership and participation will be totally voluntary. All costs, excluding labor and travel expenses, shall be shared equally between the Government and the Contractor. The Contractor and Government shall be responsible for their own labor and travel costs.

1.58 ACTIVITY ENVIRONMENTAL ANALYSIS - NOT USED

1.59 CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT PLAN
16 July 1999

a. The Contractor is required to submit for government approval a detailed C&D Waste Management Plan within 30 days after contract award and prior to initiating any site clearance or C&D work.

b. Specific elements to be addressed in the plan are as follows: Designated individuals on the contractor's staff who are responsible for C&D waste prevention and management.

(1) Actions that will be taken to reduce solid waste generation (including use of more efficient facility design and construction processes, reduced packaging and packing materials, supplier take-back programs, etc.). Description of the specific approaches to be used in recycling/reuse of the various materials generated, including, as appropriate, the specification of areas and equipment to be used for processing, sorting, and temporary storage of C&D wastes.

(2) Characterization of the waste to be generated during the C&D project, to include types and quantities of waste materials. The characterization should address site waste materials, building materials, packaging, packing, wastes generated by construction equipment, wastes generated by site offices, and wastes generated by the workforce on-site.

(3) Landfill and/or incinerator name, tipping fee amounts, projected cost of disposing of all trash and waste materials in the landfill/incinerator, as if there would be no salvage or recycling on the project.

(4) Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and public arts programs that accept used materials (e.g., Habitat For Humanity, national materials exchange networks).

(5) A list of specific waste materials that will be salvaged for resale, salvaged and reused, and recycled; the recycling facilities that will be utilized; and copies of their permits and/or registrations.

(6) Identification of materials that cannot be recycled/reused with a written justification. All disposed materials including anticipated hazardous wastes must include names of haulers and disposal sites, and copies of their permits and/or registrations.

(7) Anticipated net cost savings determined by subtracting contractor program management costs and the cost of salvage (deconstruction), separating, and recycling from the following:

(1)revenue from the sale of salvaged products and materials;
(2)revenue from the sale of recycled products and materials;
(3)revenue from the return of materials; and
(4)incineration and/or landfill tipping fees saved due to diversion of materials.

(8) The plan must cover the following materials if the material is applicable to the specific project.

Asphalt	Gypsum
Concrete	Plastic
Soil	Polystyrene
Metal	Porcelain
Wood	Corrugated cardboard
Brick	Carpet

c. Firms and facilities used by the contractor for recycling, reuse, and disposal shall be appropriately permitted for the contractor's intended use, to the extent required by federal, state, and local regulations. The contractor shall maintain records of disposition of the materials, including all copies of manifests, origin, and disposal forms, and bills of lading. All facility, landfill, and hauler permits showing USEPA and state registration numbers shall be maintained and shall be available to the contracting officer when requested.

d. The Contracting Officer shall review the C&D waste management plan in coordination with the environmental office within 7 calendar days of submittal. Where the contracting officer determines that the contractor has

diligently explored all feasible methods to reduce C&D waste, the plan shall be approved, or approved with comment. Where it is determined that the contractor has not diligently explored all feasible methods, the contracting officer shall request a resubmittal.

e. All revenues generated by reusing, returning, salvaging, or recycling materials, as well as costs avoided by reduced tipping and incineration fees as compared to conventional disposal shall accrue to the contractor's benefit and be reported to the Contracting Officer. Where an on-site Army C&D landfill is the only available disposal facility, the Contractor will be changed the prevailing commercial rate.

1.60 DAMAGE TO WORK (ORL) - NOT USED

1.61 CONTINUING CONTRACTS (MAR 1995) EFARS 52.232-5001. - NOT USED

1.62 OBSTRUCTION OF NAVIGABLE WATERWAYS (DEC 1991) DFARS 252.236-7002. - NOT USED

1.63 SIGNAL LIGHTS - NOT USED

1.64 LAKE OPERATION - NOT USED

1.65 PROPOSED BETTERMENTS - AUG 1997

a. The minimum requirements of the contract are identified in the Request for Proposal (RFP). Priced options are also identified in the proposal, and become requirements of the contract if awarded by the Government. See Statement of Work paragraph 1-1.3 for options.

b. "Betterment" is defined as any component or system which exceeds the minimum requirements stated in the RFP. This includes all proposed betterments listed in the proposal in accordance with Submittal Requirements of Section 00115 of the RFP, and all Government-identified betterments, noted in the RFP as items to which "design consideration should be given." See also Statement of Work paragraphs 1-1.3 and 1-1.4.

c. "Government identified betterments" include the betterments identified on the "List of Accepted Project Betterments" prepared by the Proposal Evaluation Board and made a part of the contract by alteration, and all other betterments identified in the accepted Proposal after award.

1.66 SEQUENCE OF DESIGN/CONSTRUCTION
November 2001 **(Version 1)**

(a) The Contractor must submit for Government Approval a design Quality Control Plan in accordance with Section 01453, Paragraph 1.3 before design may proceed.

(b) After receipt of the Contract Notice to Proceed (NTP), the Contractor shall initiate design, comply with all design submission requirements as covered under Division 01 General Requirements, and obtain government review of each submission. No construction may be start, with the exception of demolition and sitework, until the Govwernment reviews the Final Design submission and determines it is satisfactory for purposes of beginning construction. Demolition shall not begin prior to Government approval of Contractor's Waste Management, Pollution Prevention, Accident Prevention, and Quality Control Plans, and Contractor's SF1413, Agency Checks and Insurance. Sitework may not begin prior to approval of Contractor's 65% Design Submittal. The ACO or COR will notify the Contractor when the design is cleared for construction. The Government will not grant any time extension for any design resubmittal required when, in the opinion of the ACO or COR, the initial submission failed to meet the minimum quality requirements as set forth in the contract.

(c) If the Government allows the Contractor to proceed with limited construction based on pending minor revisions to the reviewed Final Design submission, no payment will be made for any in-place construction related to the pending revisions until they are completed, resubmitted and are satisfactory to the Government.

(d) No payment will be made for any in-place construction until all required submittals have been made, reviewed and are satisfactory to the Government.

1.67 SEQUENCE OF DESIGN/CONSTRUCTION (FAST TRACK) - NOT USED

1.68 KEY PERSONNEL, SUBCONTRACTORS AND OUTSIDE ASSOCIATES OR CONSULTANTS
17 August 1998

In connection with the services covered by this contract, any inhouse personnel, subcontractors, and outside associates or consultants will be limited to individuals or firms that were specifically identified and agreed to during negotiations. The Contractor shall obtain the Contracting Officer's written consent before making any substitution for these designated inhouse personnel, subcontractors, associates, or consultants.

1.69 REQUIREMENTS FOR REGISTRATION OF DESIGNERS (APR 1984) FAR 52.236-25
25 February 1999

The design of architectural, structural, mechanical, electrical, civil, fire protection or other engineering features of the work shall be accomplished or reviewed and approved by architects or engineers registered to practice in the particular professional field involved in a State or possession of the United States, in Puerto Rico, or in the District of Columbia. All final drawings shall be signed and sealed by the registered professional responsible for the design.

1.70 DESIGN/BUILD CONTRACT - ORDER OF PRECEDENCE
17 August 1998

(a) The contract includes the standard contract clauses and schedules

current at the time of contract award. It entails (1) the solicitation in its entirety, including all drawings, cuts, and illustrations, and any amendments, and (2) the successful offeror's accepted proposal. The contract constitutes and defines the entire agreement between the Contractor and the Government. No documentation shall be omitted which in any way bears upon the terms of that agreement.

(b) In the event of conflict or inconsistency between any of the provisions of this contract, precedence shall be given in the following order:

(1) Betterments: Any portions of the accepted proposal which both conform to and exceed the provisions of the solicitation.

(2) Options as described in the proposal and awarded by the Government

(3) The provisions of the solicitations. (See also contract Clause: SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION.)

(4) All other provisions of the accepted proposal.

(5) Any design products including, but not limited to, plans, specifications, engineering studies and analyses, shop drawings, equipment installation drawings, etc. These are "deliverables" under the contract and are not part of the contract itself. Design products must conform with all provisions of the contract, in the order of precedence herein.

1.71 DESIGN CONFERENCES
17 August 1998

a. Pre-Work: As part of the Pre-work conference conducted after contract award, key representatives of the Government and the Contractor will review the design submission and review procedures specified herein, discuss the preliminary design schedule and provisions for phase completion of the D/B documents with construction activities (fast tracking), as appropriate, meet with Corps of Engineers Design Review personnel and key Using Agency points of contact and any other appropriate pre-design discussion items.

b. Design Review Conferences: Review conferences will be held on base for each design for each submittal. The Contractor shall bring the personnel that developed the design submittal to the review conference. The conferences will take place the week after the review is complete.

1.72 RESPONSIBILITY OF THE CONTRACTOR FOR DESIGN (Rev. MAY 2002)

(a) The Contractor shall be responsible for the professional quality, technical accuracy, and the coordination of all designs, drawings, specifications, and other non-construction services furnished by the Contractor under this contract. The Contractor shall, without additional compensation, correct or revise any errors or deficiency in its designs, drawings, specifications, and other non-construction services and perform

any necessary rework or modifications, including any damage to real or personal property, resulting from the design error or omission.

(b) The standard of care for all design services performed under this agreement shall be the care and skill ordinarily used by members of the architectural or engineering professions practicing under similar conditions at the same time and locality. Notwithstanding the above, in the event that the contract specifies that portions of the Work be performed in accordance with a performance standard, the design services shall be performed so as to achieve such standards.

(c) Neither the Government's review, approval or acceptance of, nor payment for, the services required under this contact shall be construed to operate as a waiver of any rights under this contract or of any cause of action arising out of the performance of this contract. The Contractor shall be and remain liable to the Government in accordance with applicable law for all damages to the Government caused by the Contractor's negligent performance of any of these services furnished under this contract.

(d) The rights and remedies of the Government provided for under this contract are in addition to any other rights and remedies provided by law.

(e) If the Contractor is comprised of more than one legal entity, each entity shall be jointly and severally liable hereunder.

1.73 WARRANTY OF DESIGN (FIRM-FIXED PRICE DESIGN-BUILD CONTRACT) (MAY 2002)

(a) The Contractor warrants that the design shall be performed in accordance with the Contract requirements. Design and design related construction not conforming to the Contract requirements shall be corrected at no additional cost to the Government. The standard of care for design is defined in paragraph (b) of Special Contract Requirement "RESPONSIBILITY OF THE CONTRACTOR FOR DESIGN".

(b) The period of this warranty shall commence upon final completion and the Government's acceptance of the work, or in the case of the Government's beneficial occupancy of all or part of the work for its convenience, prior to final completion and acceptance, at the time of such occupancy.

(c) This design warranty shall be effective from the above event through the Statue of Limitations and Statute of Repose, as applicable to the state that the project is located in.

(d) The rights and remedies of the Government provided for under this clause are in addition to any other rights and remedies provided in this contract or by law.

(e) This Warranty shall be transferable from the Government to a private housing management entity, should the Government elect to privatize this housing project prior to expiration of the Warranty.

1.74 CONSTRUCTOR'S ROLE DURING DESIGN (JUN 1998)

The Contractor's construction management key personnel shall be actively involved during the design process to effectively integrate the design and construction requirements of this contract. In addition to the typical required construction activities, the constructor's involvement includes, but is not limited to actions such as: integrating the design schedule into the Master Schedule to maximize the effectiveness of fast-tracking design and construction (within the limits allowed in the contract), ensuring constructability and economy of the design, integrating the shop drawing and installation drawing process into the design, executing the material and equipment acquisition programs to meet critical schedules, effectively interfacing the construction QC program with the design QC program, and maintaining and providing the design team with accurate, up-to-date redline and as-built documentation. The Contractor shall require and manage the active involvement of key trade subcontractors in the above activities.

1.75 VALUE ENGINEERING AFTER AWARD (June 1999)

(a) In reference to Contract Clause 52.248-3, "Value Engineering - Construction", the Government may refuse to entertain a "Value Engineering Change Proposal" (VECP) for those "performance oriented" aspects of the Solicitation documents which were addressed in the Contractor's accepted contract proposal and which were evaluated in competition with other offerors for award of this contract.

(b) The Government may consider a VECP for those "prescriptive" aspects of the Solicitation documents, not addressed in the Contractor's accepted contract proposal or addressed but evaluated only for minimum conformance with the Solicitation requirements.

(c) For purposes of this clause, the term "performance oriented" refers to those aspects of the design criteria or other contract requirements which allow the Offeror or Contractor certain latitude, choice of and flexibility to propose in its accepted contract offer a choice of design, technical approach, design solution, construction approach or other approach to fulfill the contract requirements. Such requirements generally tend to be expressed in terms of functions to be performed, performance required or essential physical characteristics, without dictating a specific process or specific design solution for achieving the desired result.

(d) In contrast, for purposes of this clause, the term "prescriptive" refers to those aspects of the design criteria or other Solicitation requirements wherein the Government expressed the design solution or other requirements in terms of specific materials, approaches, systems and/or processes to be used. Prescriptive aspects typically allow the Offerors little or no freedom in the choice of design approach, materials, fabrication techniques, methods of installation or other approach to fulfill the contract requirements.

1.76 DEVIATING FROM THE ACCEPTED DESIGN (JUN 2002)

(a) The Contractor must obtain the approval of the Designer of Record and the Government's concurrence for any Contractor proposed revision to the professionally stamped and sealed and Government reviewed and concurred design, before proceeding with the revision.

(b) The Government reserves the right to non-concur with any revision to the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

(c) Any revision to the design, which deviates from the contract requirements (i.e., the RFP and the accepted proposal), will require a modification, pursuant to the Changes clause, in addition to Government concurrence. The Government reserves the right to disapprove such a revision.

(d) Unless the Government initiates a change to the contract requirements, or the Government determines that the Government furnished design criteria are incorrect and must be revised, any Contractor initiated proposed change to the contract requirements, which results in additional cost, shall strictly be at the Contractor's expense.

(e) The Contractor shall track all approved revisions to the reviewed and accepted design and shall incorporate them into the as-built design documentation, in accordance with agreed procedures. The Designer of Record shall document its professional concurrence on the as-builts for any revisions in the stamped and sealed drawings and specifications.

1.77 GOVERNMENT-FURNISHED RFP DRAWINGS, SURVEYS AND SPECIFICATIONS (JUL 2002)

This is to clarify that contract clause 252.236-7001, "Contract Drawings and Specifications", refers to any Government-furnished design or design criteria included in the Request for Proposal (RFP).

1.78 52.227-023 DRAWINGS AND OTHER DATA TO BECOME PROPERTY OF THE GOVERNMENT (DFARS, Mar 1979)

All designs, drawings, specifications, notes, and other works developed in the performance of this contract shall become the sole property of the Government and may be used on any other design without additional compensation to the Contractor. The Government shall be considered the "person for whom the work was prepared" for the purpose of authorship in a copyrightable work under 17 U.S.C. 201(b). With respect thereto, the Contractor agrees not to assert or authorize others to assert any rights or to establish any claim under the design patent or copyright laws. The Contractor for a period of three (3) years after completion of the project agrees to furnish all retained works at the request of the Contracting Officer. Unless otherwise provided in the contract, the Contractor shall have the right to retain copies of all works beyond such period.

1.79 POLLUTION PREVENTION PLAN - NOT USED

1.80 POLLUTION PREVENTION PLAN 27 August 2001 {version II} - NOT USED

1.81 POLLUTION PREVENTION PLAN 27 August 2001 {version I} - NOT USED

1.82 POLLUTION PREVENTION PLAN 27 August 2001 {version II} - NOT USED

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION NOT USED

-- End of Section --

STATEMENT AND ACKNOWLEDGMENT

FORM APPROVED OMB NO
9000-0014

Public reporting burden for this collection of information is estimated to average .15 hours per response, including the time for reviewing instructions. Searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the suggestions for reducing this burden, to the FAR Secretarial (VRS), Office of Federal Acquisition and Regulatory Policy, GSA Washington, D.C. 20405: and to the Office of Management and Budget, Paperwork Reduction Project (9000-0014), Washington, D.C. 20503

PART I - STATEMENT OF PRIME CONTRACTOR

1. PRIME CONTRACT NO.	2. DATE SUBCONTRACT AWARDED	3. SUBCONTRACT NUMBER
4. PRIME CONTRACTOR (Name, address and ZIP code)		5. SUBCONTRACTOR (Name, address and ZIP code)

6. The prime contractor states that under the contract shown in item 1, a subcontract was awarded on date shown in item 2 by (Name of Awarding Firm)

to the subcontractor identified in item 5, for the following work:

7. PROJECT	8. LOCATION	
9. NAME AND TITLE OF PERSON SIGNING	10. BY (Signature)	11. DATE SIGNED

PART II - ACKNOWLEDGMENT OF SUBCONTRACTOR

12. The subcontractor acknowledges that the following clauses of the contract shown in item 1 are included in this subcontract:

Contract Work Hours and Safety Standards Act - Overtime Compensation - Construction	David-Bacon Act
Payrolls and Basic Records	Apprentices and Trainees
Withholding of Funds	Compliance with Copeland Regulations
Disputes Concerning Labor Standards	Subcontracts
	Contract Termination-Debarment
	Certification of Eligibility

13. NAME(S) OF ANY INTERMEDIATE SUBCONTRACTORS, IF ANY

14. NAME AND TITTLE OF PERSON SIGNING	15. BY (Signature)	16 DATE SIGNED

24 October 1988

(Sample of Typical contractor Quality report)

CONTRACTOR'S NAME
(Address)

DAILY CONSTRUCTION QUALITY CONTROL REPORT

Contract No:_____ Date:_____ Report No._____
Project Name_____
Weather: (Clear) (P. Cloudy) (Cloudy); Temperature: ____Min. ____Max; ____Rainfall ____in.

Contractor/Subcontractors/Supplier	Area of Responsibility
a.	
b.	
c.	
d.	
e.	
f.	
g.	

1. Definable Features of Construction in Progress: (Give briefly only definable features of work in progress and location. Refer to work performed by prime and/or subcontractor and/or supplier by letter in table above).

2. Material and/or Equipment Delivered to site:

3. Results of Surveillance:

Preparatory Phase (Attach minutes):

Initial Phase (Attach minutes):

Follow-up Phase (Include satisfactory work completed and/or deficiencies with action to be taken):

4. Tests Required by Plans and/or Specification Performed and results of Test: (Attach results of test taken on previous dates).

5. Verbal Instructions Received: (List any instructions given by Government Personnel on construction deficiencies. Retesting required, etc., with action to be taken.

6. Safety Deficiencies Noted. (Describe corrective actions taken).

7. Remarks: (Cover any conflicts in plans, specifications, or instruction).

CONTRACTOR'S VERIFICATION: The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above.

Contractor's Authorized QC Representative

All Construction Project Identification signs and Safety Performance signs are to be fabricated and installed as described below. The signs are to be erected at a location designated by the contracting officer and shall conform to the size, format, and typographic standards shown

The sign panels are to be fabricated from .75" High Density Overlay Plywood.

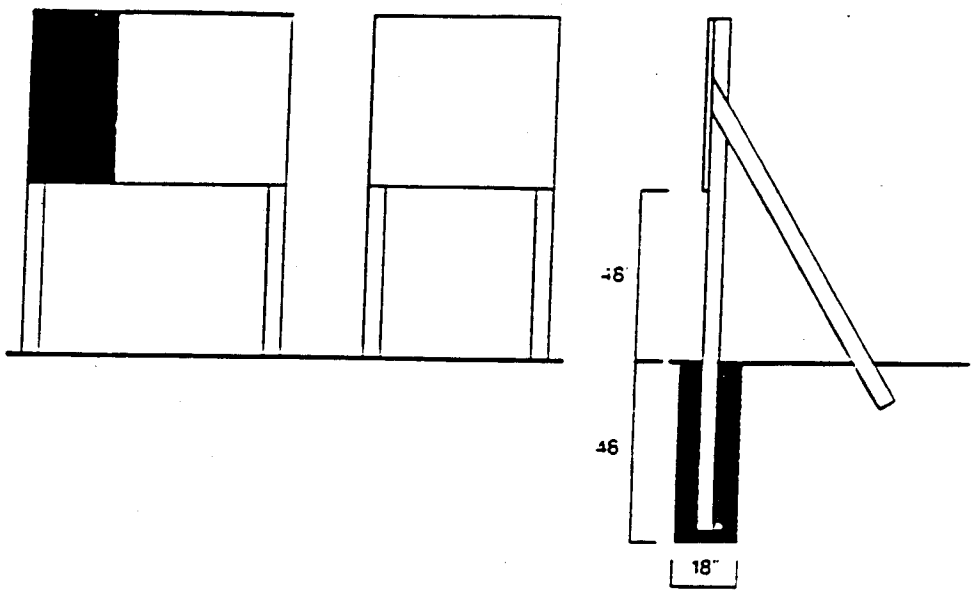
All graphics are to be applied to the background panel following the graphic formats as indicated.

Drill and insert six (6) .375" T-nuts from the front face of the HDO sign panel. Flange of T-nut to be flush with sign face.

Apply lettering and logo to prepared HDO plywood panel.

Sign uprights to be structural grade 4"x4" treated Douglas Fir or Southern Yellow Pine, No. 1 or better. Post to be 12' long. Drill six (6) .375" mounting holes in uprights to align with T-nuts in sign panel. Countersink (.5") back of hole to accept socket head cap screw (4"x.375").

Assemble sign panel and uprights. Imbed assembled sign panel and uprights in 4' hole. Bolt additional 2"x4" struts on inside face of uprights to reinforce installation as shown.



Construction Project Sign

Legend Group 1: Corps Relationship

1. _____
2. _____

Legend Group 2: Corps Signature

1. U.S. Army Corps
2. of Engineers

Legend Group 2A: District Name

1. _____
2. _____

Legend Group 3: Project Title

1. _____
2. _____
3. _____

Legend Group 4: Facility Name

1. _____
2. _____

Legend Group 5a: Designer

1. _____
2. _____
3. _____
4. _____
5. _____

Legend Group 5b: Contractor

1. _____
2. _____
3. _____
4. _____
5. _____

Introduction: Project Identification Sign

Below are two samples of the construction project identification sign showing how this panel is adaptable for use to identify either civil works projects with a local sponsor (top) or military (bottom). The graphic format for this 4' x 6' sign panel follows the legend guidelines and layout as specified below. The large 4' x 4' section of the panel on the right is to be white with black legend. For the top sign, the upper left 2' x 2' section of the sign with the full Corps signature is to be painted Communications Red with white lettering. The lower left 2' x 2' section of the sign shall match the local sponsor's colors with white lettering. For the bottom sign, the 2' x 4' left section of the sign with full Corps signature is to be painted Communications Red with white lettering. Mounting and fabrication details are provided.

Legend Group 1: One-to two-line description of Corps relationship to project.
Color: White
Typeface: 1.25" Helvetica Regular
Maximum line length: 19"

Legend Group 2: Two-line Corps Signature (US Army Corps of Engineers). Placed below Corps Castle
Color: White
Typeface: 1.5" Helvetica Bold

Legend Group 2a: District Name. Placed below Signature (6" Castle).
Color: White
Typeface: 1.25" Helvetica Regular

Legend Group 3: Words "Local Sponsor"
Color: White
Typeface: 1.25" Helvetica Regular
Maximum length: 19"

Legend Group 4: One-to-three lines for name of local sponsor
Color: White
Typeface: 1.5" Helvetica Regular

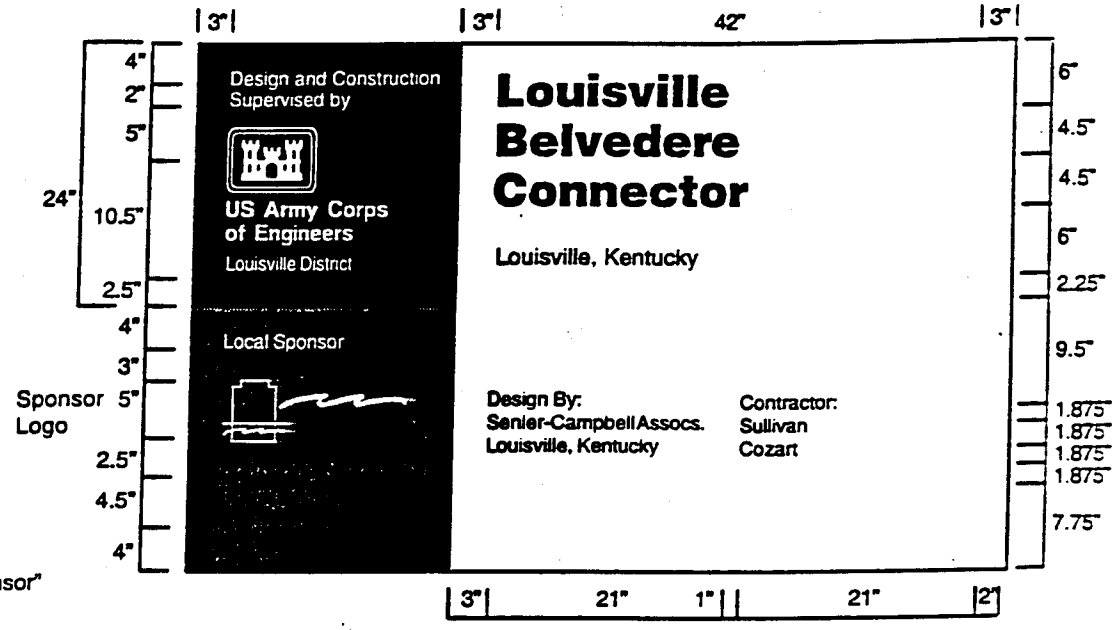
Legend Group 5: One- to three-line project title legend describes the work being done under this contract.
Color: Black
Typeface: 3" Helvetica Bold
Maximum line length: 42"

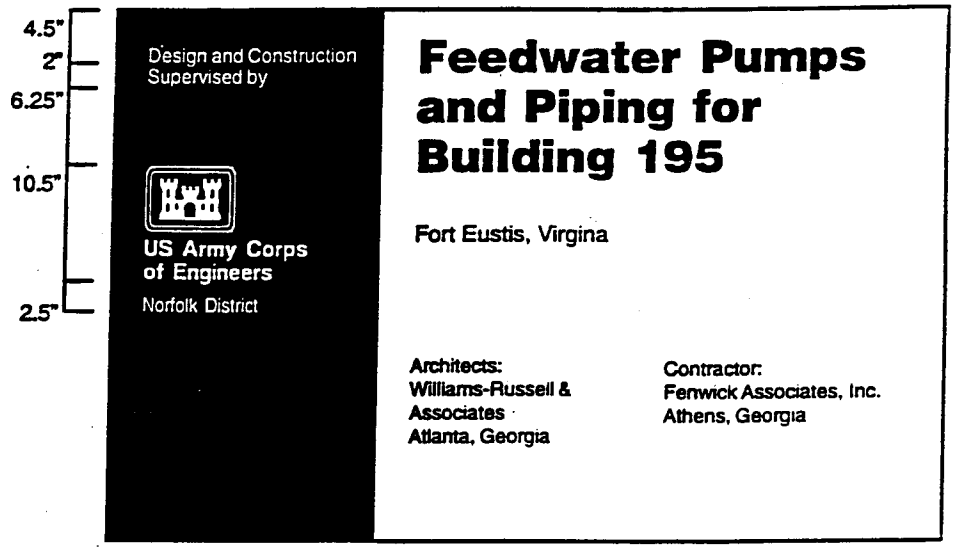
Legend Group 6: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Cross-align the first line of Legend Group 5 with the first line of the Corps Signature (US Army Corps) as shown.

Legend Groups 7a-b: One- to five-line identification of prime contractors including: type (general contractor, etc.) corporate or firm name, city, state.
Color: Black
Typeface: 1.25" Helvetica Regular
Maximum line length: 21"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown.





Legend Size	Panel Size	Post Size	Mounting Height	Color Bkg/Lgd
Various	4' x 6'	4" x 4"	48"	WH-RD/BK

SUBMITTAL REGISTER

(ER 415-1-10)

CONTRACT NO.:

TITLE AND LOCATION

CONTRACTOR:

SPECIFICATION SECTION:

ACTIVITY NO	TRANS-MITTAL NO.	ITEM NO	SPECIFICATION PARAGRAPH NUMBER	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL										CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
					DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	O&M MANUALS	INFORMATION ONLY	GOVERNMENT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE *(Read instructions on the reverse side prior to initiating this form)*	DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____
SPECIFICATION SEC. NO. *(Cover only one section with each transmittal)*	PROJECT TITLE AND LOCATION		CHECK ONE: THIS TRANSMITTAL IS FOR FIO ☐ GOV'T ☐ APPROVAL

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. (See Instruction no. 8) c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE g.	VARIATION (See instruction no. 6) h.	FOR CE USE CODE i.
				SPEC. PARA. NO. e.	DRAWING SHEET NO. f.			

REMARKS	I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated _____ NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED *(List by Item No.)*	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

Instructions

1. Section I will be initiated by the contractor in the required number of copies.

2. Each transmittal shall be numbered consecutively in the space provided for “Transmittal No.”. This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; in resubmittals, insert transmittal number of last submission as well as the new submittal number.

3. The “Item No.” will be the same “Item No.” as indicated on ENG FORM 4288-R for each entry on this form.

5. Separate transmittal form will be used for submittals under separate section of the specifications.

6. a check shall be placed in the “Variation” column when a submittal is not in accordance with the plans and specifications—also, a written statement to that effect shall be included in the space provided for “Remarks.

7. Form is self-transmittal, letter of transmittal is not required.

8. When a sample of material or Manufacturer’s Certificate of Compliance is transmitted, indicate “Sample” or “Certificate” in column c, Section I.

9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I columni to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g. to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A – Approved as submitted.

B – Approved, except as noted on drawings.

C – Approved, except as noted on drawings. Refer to attached sheet resubmission required.

D – Will be returned by separate correspondence.

E – Disapproved (See attached).

F – Receipt acknowledged.

FX – Receipt acknowledged, does not comply as noted with contract requirements.

G – Other *(Specify)*

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

(Reverse of ENG form 4025-R)

EQUIPMENT-IN-PLACE LIST

Contract No._____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

Description of Item:_____

Model No:_____

Serial No:_____

Capacity:_____

Name of Mfg:_____

Condition:_____

Checked by:_____Replacement Cost_____

(If Para. 10 is used, use this form)

DEFICIENCY LIST

CONTRACT NUMBER:_____ PROJECT: _____

		DEFICIENCY		CORRECTION		
DEFIC. NO.	DESCRIPTION	DATE OBSERVED	CQC REPORT NO.	DATE CORRECTED	CQC REPORT NO.	COMMENTS

CONTRACTOR QUALITY CONTROL REPORT

REPORT NO.

DATE

PROJECT/CONTRACT NUMBER

SUPERINTENDENT

CONTRACTOR

WEATHER

PRECIPITATION PAST 24 HOURS (IN INCHES)

TEMPERATURE ° F MINIMUM _ MAXIMUM

WERE THERE ANY DELAYS IN WORK PROGRESS TODAY? No ___ Yes___ If Yes, Explain:

VERBAL INSTRUCTIONS GIVEN BY THE GOVERNMENT:

HAS ANYTHING DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM? No___ Yes___ If Yes, Explain:

NOTE: Official notification of claim must be made to the Contracting Officer by seperate correspondence.

SAFETY INSPECTION/MEETINGS: Indicate inspections made, items inspected, deficiencies noted and corrective action taken.

WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? No___ Yes___ If Yes, attach accident report.

PRIME CONTRACTOR/SUBCONTRACTOR WORKFORCE
(If space provided below is inadequate, use additional sheets)

No.	TRADE	HOURS	EMPLOYER	No.	TRADE	HOURS	EMPLOYER

CUMULATIVE TOTAL HOURS OF WORK HOURS FROM PREVIOUS REPORT

TOTAL WORK HOURS ON JOB SITE THIS DATE

TOTAL WORK HOURS FROM START OF CONSTRUCTION

MAJOR ITEMS OF EQUIPMENT

TYPE/CAPACITY	No.	STANDBY HOURS	OPERATING HOURS

9. THREE PHASE INSPECTION

ADVANCE NOTICE OF PREPARATORY, INITIAL OR FINAL FOLLOW-UP INSPECTION: (minimum five working days notice required)

PREPARATORY INSPECTION HELD TODAY: Indicate Definable Features of Work. Attach Preparatory Checklist.

INITIAL INSPECTION HELD TODAY: Indicate Definable Features of Work. Attach Initial Checklist.

FINAL FOLLOW-UP INSPECTION HELD TODAY: Indicate NAS Activity Number. Attach Final Follow-up Checklist.

10. ACTIVITIES IN PROGRESS: Attach daily CQC follow-up inspection deficiencies/corrections noted.

ACTIVITY NUMBER	S=START C=CONTINUING F=FINISH	DESCRIPTION OF WORK ACTUALLY PERFORMED/MAJOR MATERIAL DELIVERIES TODAY

11. CQC TESTING

ACTIVITY NUMBER	DESCRIPTION OF TESTS PERFORMED	PASSED/FAILED

12. USER SCHOOLING CONDUCTED:

ACTIVITY NUMBER	DESCRIPTION OF SCHOOLING

13. INSTALLED PROPERTY PRICING DATA ATTACHED: YES___ NO___

14. TRANSFERRED PROPERTY, DD-1149 ATTACHED: YES___ NO___

15. QA COMMENTS CORRECTED TODAY: YES___ NO___

16. EQUIPMENT SAFETY CHECKLIST ATTACHED: YES___ NO___

GENERAL COMMENTS:

CONTRACTOR CERTIFICATION: On behalf of the contractor, I certify that this report is complete and correct and all equipment and material used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

Authorized Contractor Representative: _____

Report Date: _____ Date Submitted to Government Representative: _____

PROJECT NAME : _____ 21 Jul 92
LOCATION : _____
CONTRACT NO. : _____

CONTRACTOR PLANNING INFORMATION

PRIME CONTRACTOR

Prime Contractor : _____
Full Name & Address : _____
_____
_____
County : _____

PRIME CONTRACTOR STAFFING

Project Manager _____ Phone _____

Superintendent _____ Phone _____
Assist. Supt. _____

Quality Control Staff:

QC Name	Category Assignments	Category Codes
_____	, , , , , , , ,	A = ARCHITECTURAL
		E = ELECTRICAL
_____	, , , , , , , ,	P = PLUMBING
		M = MECHANICAL
_____	, , , , , , , ,	F = FIRE SPRINKLER
		S = STRUCTURAL
_____	, , , , , , , ,	R = ROOFING
		C = CIVIL
		T = SAFETY

CONTRACTOR LETTER CODES

LETTER from SITE OFFICE : _____
LETTER from HOME OFFICE : _____

MONTHLY PROGRESS SCHEDULE

Aug 1991 -	Aug 1992 -	Aug 1993 -
Sep 1991 -	Sep 1992 -	Sep 1993 -
Oct 1991 -	Oct 1992 -	Oct 1993 -
Nov 1991 -	Nov 1992 -	Nov 1993 -
Dec 1991 -	Dec 1992 -	Dec 1993 -
Jan 1992 -	Jan 1993 -	Jan 1994 -
Feb 1992 -	Feb 1993 -	Feb 1994 -
Mar 1992 -	Mar 1993 -	Mar 1994 -
Apr 1992 -	Apr 1993 -	Apr 1994 -
May 1992 -	May 1993 -	May 1994 -
Jun 1992 -	Jun 1993 -	Jun 1994 -
Jul 1992 -	Jul 1993 -	Jul 1994 -

USER SCHOOLING INFORMATION 21 Jul 92

SCHOOL	ACTIVITY NUMBER	SPECIFICATION SECTION	SPECIFICATION PARAGRAPH	REMARKS

SUBMITTAL INFORMATION 21 Jul 92

SECTION	ITEM NUMBER	DESCRIPTION	PARAGRAPH	TYPE	ACTIVITY NUMBER	PROCUREMENT PERIOD	REVIEWING OFFICE	REVIEWER	REVIEW PERIOD

CONTRACTOR PLANNING (15) GOVERNMENT PLANNING (13) PAGE 1 OF

SUBCONTRACTOR INFORMATION

21 Jul 92

ABBREVIATED NAME	TRADE	FULL NAME	STREET ADDRESS	CITY,STATE AND ZIPCODE	AUTO INS. EXPIRES	LIABILITY EXPIRES	WORKMENS EXPIRES	LABOR INTERVI

CONTRACTOR PLANNING (6)

GOVERNMENT PLANNING (5)

SUBCONTRACTOR INFORMATION 21 Jul 92

ABBREVIATED NAME	TRADE	FULL NAME	STREET ADDRESS	CITY,STATE AND ZIPCODE	AUTO INS. EXPIRES	LIABILITY EXPIRES	WORKMENS EXPIRES	LABOR INTERVI

CONTRACTOR PLANNING (6) GOVERNMENT PLANNING (5) PAGE 1 OF

DEFINEABLE FEATURES OF WORK

21 Jul 92

FEATURE OF WORK	ESTIMATED START	PREPARATORY TO INITIAL	FEATURE OF WORK	ESTIMATED START	PREPARATORY TO INITIAL

CONTRACTOR PLANNING (10)

PAY ACTIVITIES AND ACTIVITY INFORMATION 21 Jul 92

ACTIVITY NUMBER	ACTIVITY DESCRIPTION	BID ITEM #	$ AMOUNT OR QUANTITY	UNIT	FEATURE OF WORK	WORK CATEGORY	(SUB)CONTRACTOR	PROJECT AREA	CONTRACT PHASE	WORK TYPE 1	WORK TYPE 2	WORK TYPE 3

CONTRACTOR PLANNING (9 & 11) GOVERNMENT PLANNING (10) PAGE 1 OF

QUALITY CONTROL TESTING INFORMATION

21 Jul 92

TEST	ACTIVITY NUMBER	SPEC. SECTION	SPEC. PARAGRAPH	PERFORMED BY	TEST	ACTIVITY NUMBER	SPEC. SECTION	SPEC. PARAGRAPH	PERFORMED BY

CONTRACTOR PLANNING (13)

PAGE 1 OF

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATC
5211 Linbar Drive, Suite 513, Nashville, Tennessee 3721
Telephone: 615-831-9202
Fax: 615-831-951(

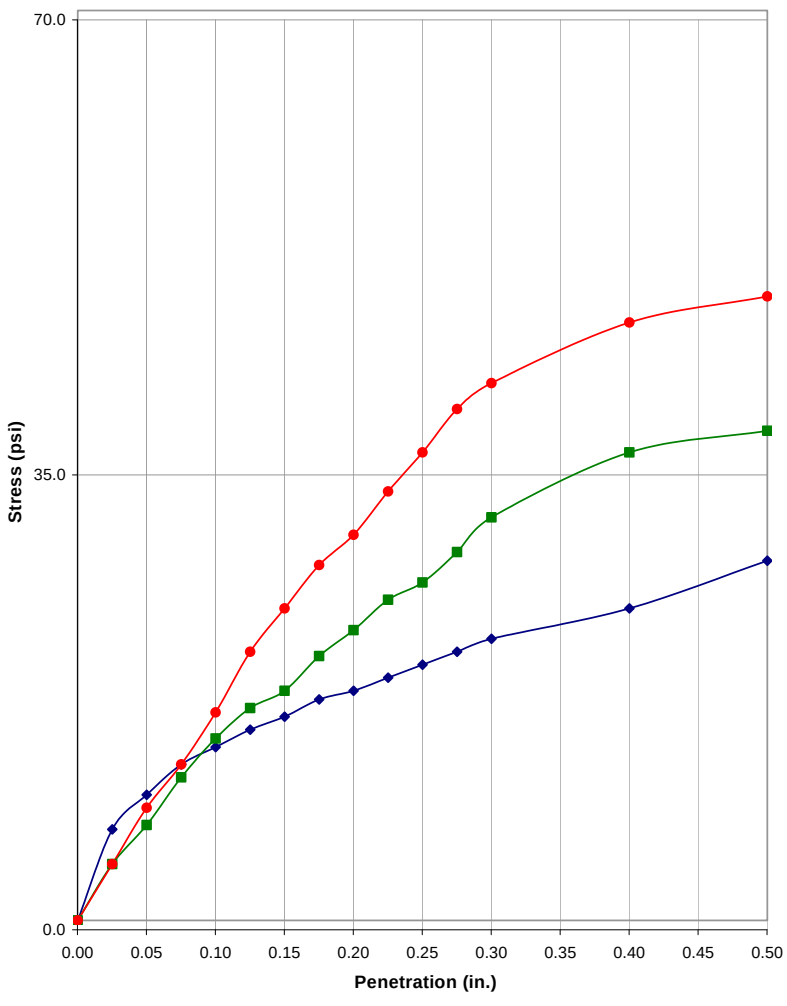
ASTM D1883 - STANDARD METHOD FOR CBR (CALIFORN BEARING RATIO) OF LABORATORY-COMPACTED SOI

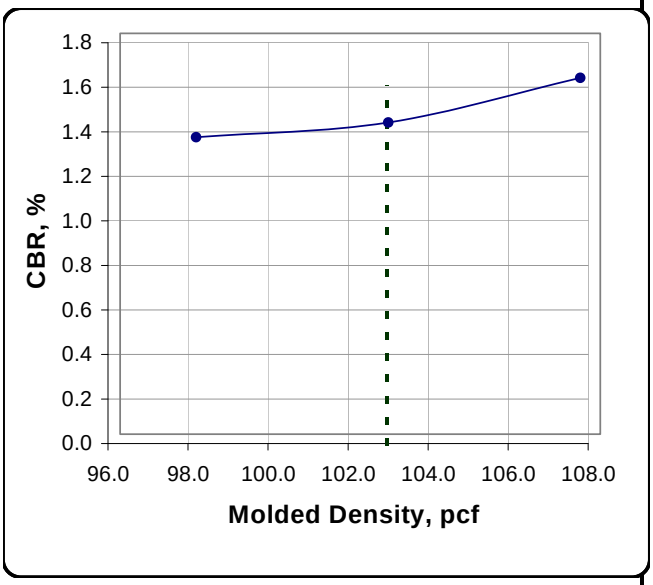
Project No: 3-7590-0000
Project: RSP \ FORT KNOX HOUSING \ GEO
Location: FORT KNOX, KENTUCKY
Date: June 12, 2003

Test Description/Remarks
SAMPLES COMPACTED TO APPROXIMATELY 90, 95 & 100% COMPACTION AND NEAR OPTIMUM MOISTURE CONTENT

Specimen / Mark	PRE-TEST			POST-TEST			CBR, (%)		Line corr.		Swell (%)
	Density	% max	Moist. (%)	Density	% max	Moist. (%)	0.1"	0.2"			
1 ◆	97.9	90.3	17.4	90.9	83.9	25.7%	1.3	1.2	0.000	15.0	0.55
2 ■	102.7	94.7	17.4	97.2	89.7	22.3%	1.4	1.5	0.000	15.0	1.40
3 ●	107.5	99.2	17.4	103.2	95.2	20.4%	1.6	2.0	0.000	15.0	1.64

MATERIAL DESCRIPTIOI	USCS	MAX.DENS.	OPT. M%	LL	PI
Brown silty clay	CH	108.4	18	69	43





CBR @ 95.0% = 1.4
for 0.1 in. penetratio

Fig. No. ***B-2,S-1***

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATC
5211 Linbar Drive, Suite 513, Nashville, Tennessee 3721
Telephone: 615-831-9202
Fax: 615-831-951(

ASTM D1883 - STANDARD METHOD FOR CBR (CALIFORN BEARING RATIO) OF LABORATORY-COMPACTED SOI

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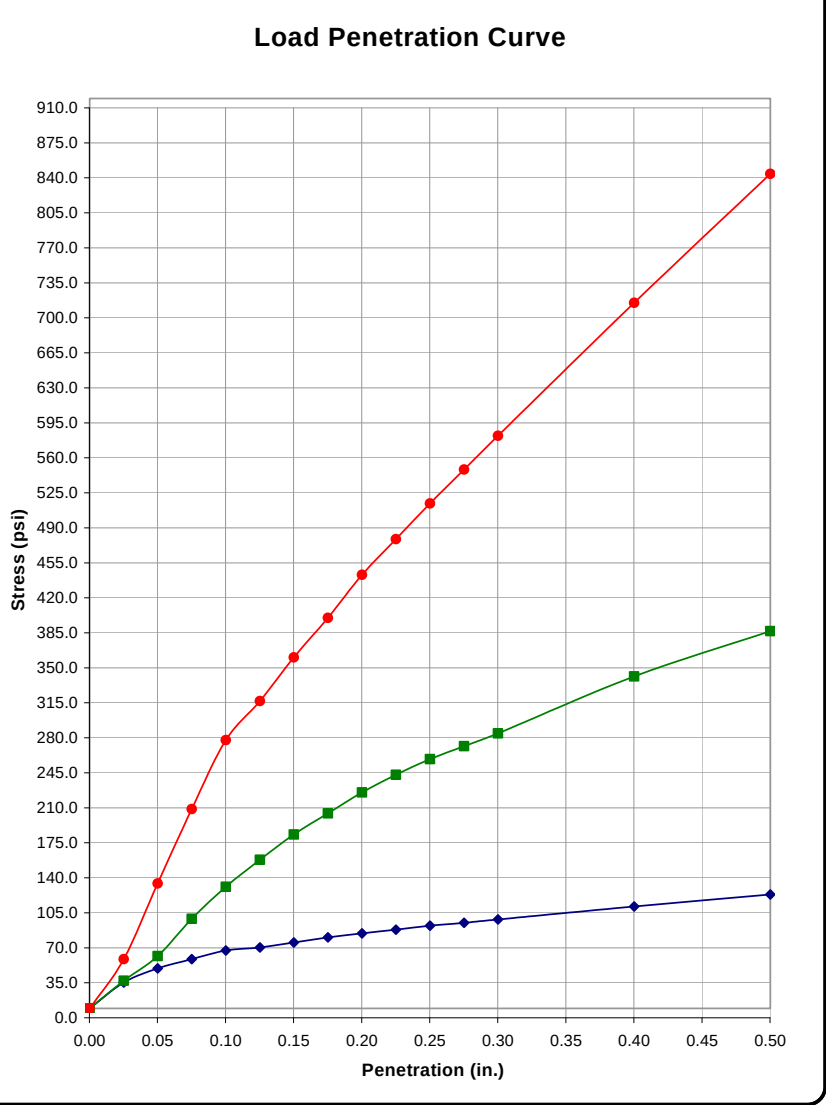
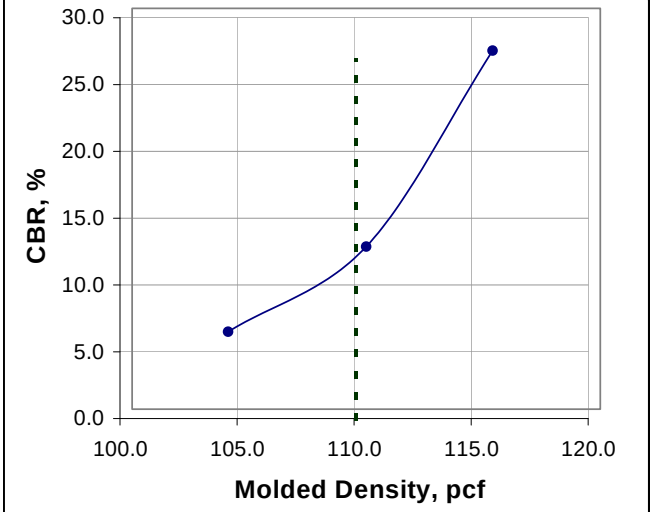
Specimen / Mark	PRE-TEST			POST-TEST			CBR, (%)		Line corr.		Swell (%)
	Density	% max	Moist. (%)	Density	% max	Moist. (%)	0.1"	0.2"			
1 ◆	104.1	89.8	13.2	97.3	84.0	20.4%	5.8	5.0	0.000	15.0	0.59
2 ■	110.0	94.9	13.2	104.8	90.4	17.7%	12.2	14.4	0.000	15.0	1.00
3 ●	115.4	99.6	13.2	111.6	96.3	16.1%	26.8	28.9	0.000	15.0	0.72

MATERIAL DESCRIPTIOI	USCS	MAX.DENS.	OPT. M%	LL	PI
Brown clay	CL	115.9	12.2	29	9





CBR @ 95.0% = 12.5
for 0.1 in. penetratio

Fig. No. ***B-6,S-1***

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATC
5211 Linbar Drive, Suite 513, Nashville, Tennessee 3721
Telephone: 615-831-9202
Fax: 615-831-951(

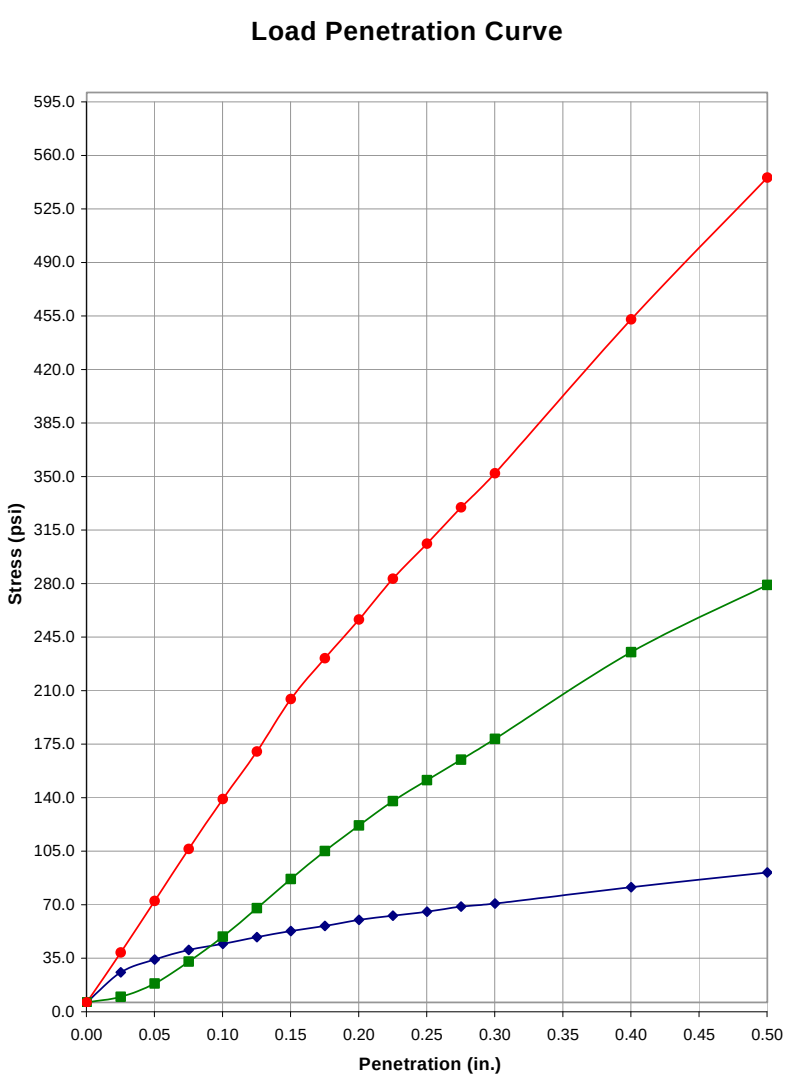
ASTM D1883 - STANDARD METHOD FOR CBR (CALIFORN BEARING RATIO) OF LABORATORY-COMPACTED SOI

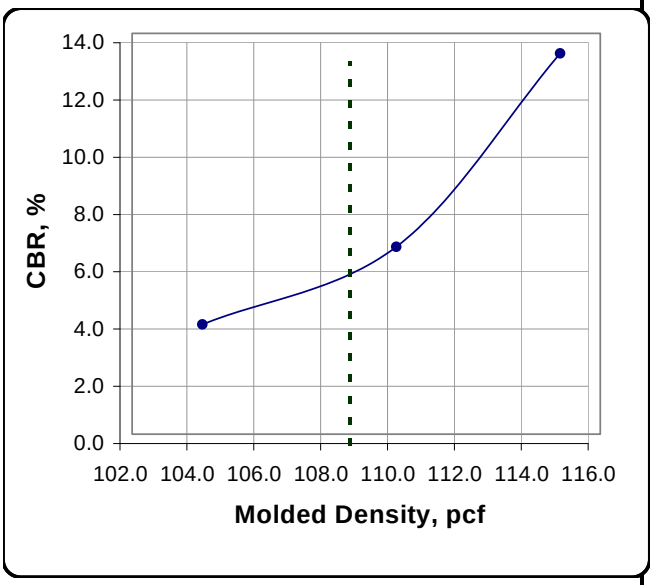
Project No: 3-7590-0000
Project: RSP \ FORT KNOX HOUSING \ GEO
Location: FORT KNOX, KENTUCKY
Date: June 12, 2003

Test Description/Remarks
SAMPLES COMPACTED TO APPROXIMATELY 90, 95 & 100% COMPACTION AND NEAR OPTIMUM MOISTURE CONTENT

Specimen / Mark	PRE-TEST			POST-TEST			CBR, (%)		Line corr.		Swell (%)
	Density	% max	Moist. (%)	Density	% max	Moist. (%)	0.1"	0.2"			
1 ◆	104.1	90.8	15.1	99.2	86.6	20.4%	3.8	3.6	0.000	15.0	0.31
2 ■	109.9	95.9	15.1	106.9	93.3	17.8%	6.5	9.0	0.030	15.0	0.50
3 ●	114.8	100.2	15.1	113.8	99.3	15.7%	13.3	16.7	0.000	15.0	0.31

MATERIAL DESCRIPTIOI	USCS	MAX.DENS.	OPT. M%	LL	PI
Brown silty clay	CL	114.6	14.2	35	15





CBR @ 95.0% = 6.0
for 0.1 in. penetratio

Fig. No. ***B-19,S-1***

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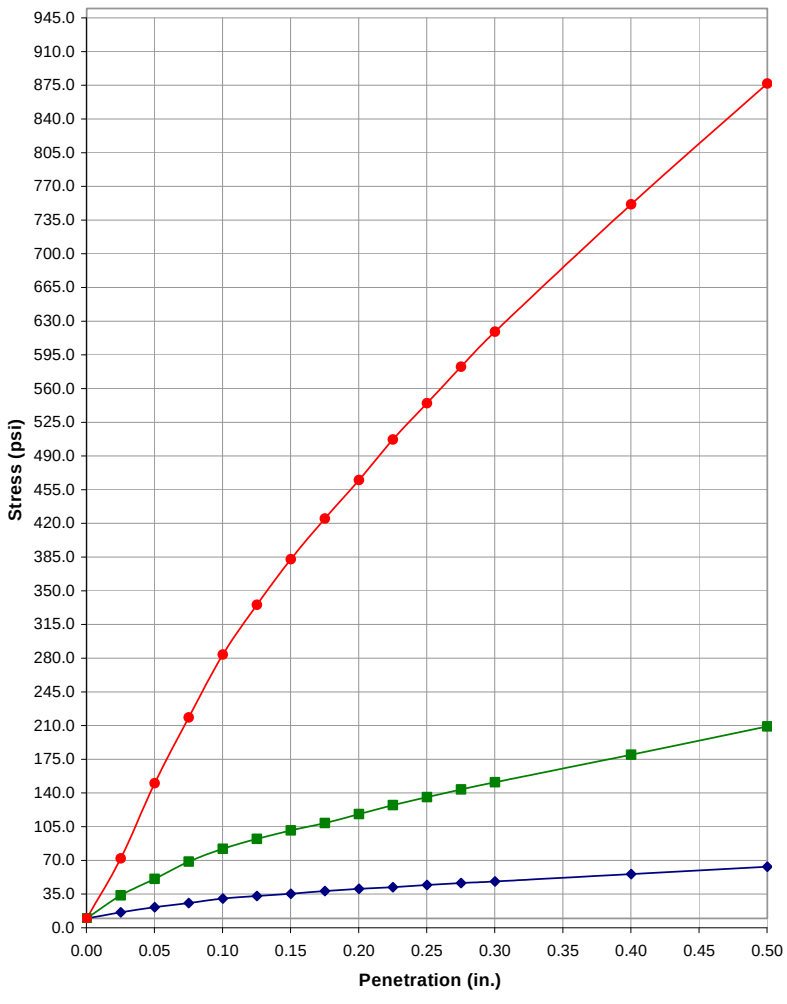
ASTM D1883 - STANDARD METHOD FOR CBR (CALIFORN BEARING RATIO) OF LABORATORY-COMPACTED SOI

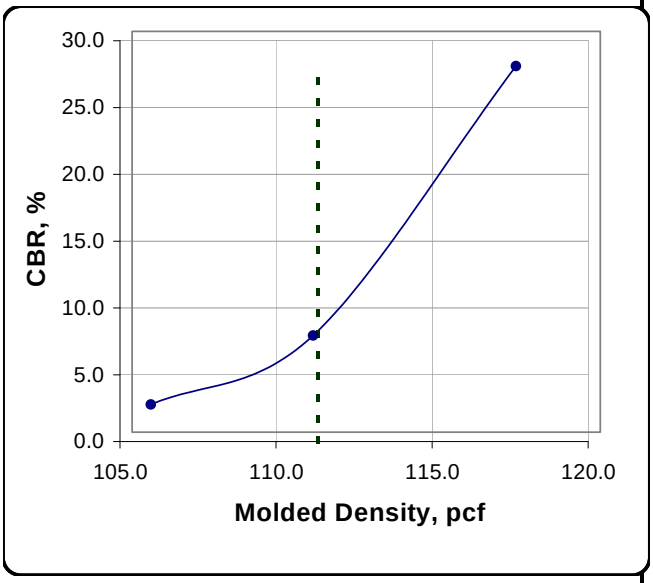
Project No: 3-7590-0000
Project: RSP \ FORT KNOX HOUSING \ GEO
Location: FORT KNOX, KENTUCKY
Date: June 12, 2003

Test Description/Remarks
SAMPLES COMPACTED TO APPROXIMATELY 90, 95 & 100% COMPACTION AND NEAR OPTIMUM MOISTURE CONTENT

Specimen / Mark	PRE-TEST			POST-TEST			CBR, (%)		Line corr.		Swell (%)
	Density	% max	Moist. (%)	Density	% max	Moist. (%)	0.1"	0.2"			
1 ◆	105.6	90.1	13.5	99.4	84.8	20.4%	2.1	2.0	0.000	15.0	0.15
2 ■	110.8	94.5	13.5	106.6	91.0	17.7%	7.2	7.2	0.000	15.0	0.20
3 ●	117.3	100.1	13.5	114.6	97.8	16.1%	27.4	30.4	0.000	15.0	0.11

MATERIAL DESCRIPTIOI	USCS	MAX.DENS.	OPT. M%	LL	PI
Brown silty clay	CL	117.2	13.9	35	16





CBR @ 95.0% = 8.9
for 0.1 in. penetratio

Fig. No. ***B-19,S-2***

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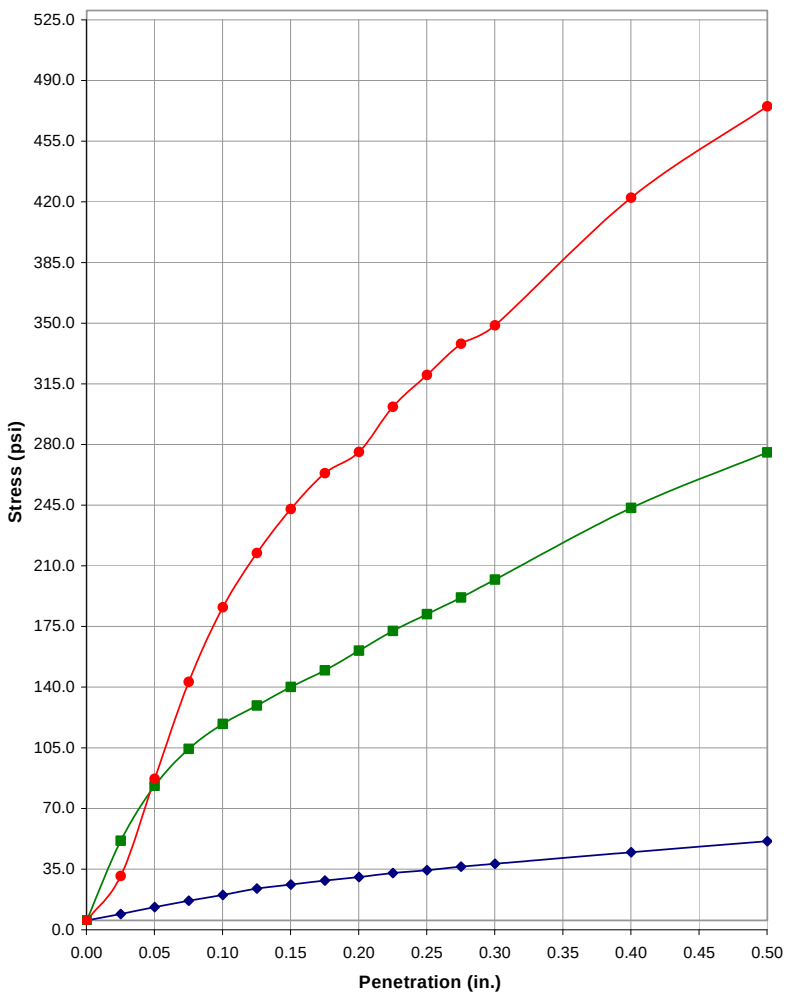
ASTM D1883 - STANDARD METHOD FOR CBR (CALIFORN BEARING RATIO) OF LABORATORY-COMPACTED SOI

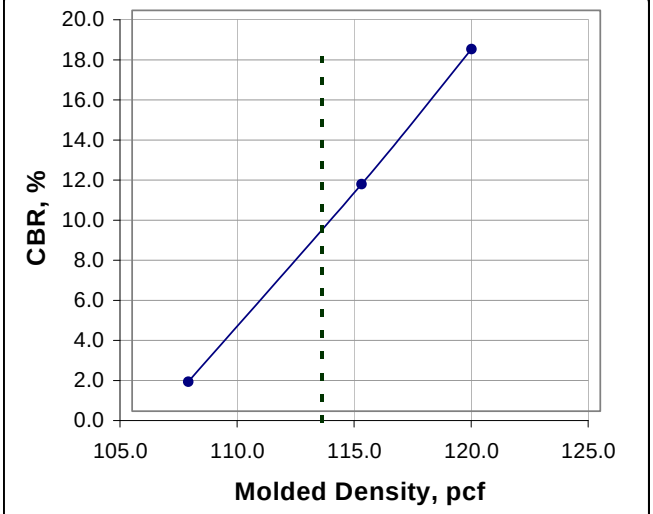
Project No: 3-7590-0000
Project: RSP \ FORT KNOX HOUSING \ GEO
Location: FORT KNOX, KENTUCKY
Date: June 12, 2003

Test Description/Remarks
SAMPLES COMPACTED TO APPROXIMATELY 90, 95 & 100% COMPACTION AND NEAR OPTIMUM MOISTURE CONTENT

Specimen / Mark	PRE-TEST			POST-TEST			CBR, (%)		Line corr.		Swell (%)
	Density	% max	Moist. (%)	Density	% max	Moist. (%)	0.1"	0.2"			
1 ◆	107.4	89.8	12.3	100.5	84.0	19.5%	1.5	1.7	0.000	15.0	0.37
2 ■	114.8	96.0	12.3	108.3	90.6	18.4%	11.3	10.4	0.000	15.0	0.52
3 ●	119.5	99.9	12.3	116.3	97.2	15.0%	18.1	18.0	0.000	15.0	0.31

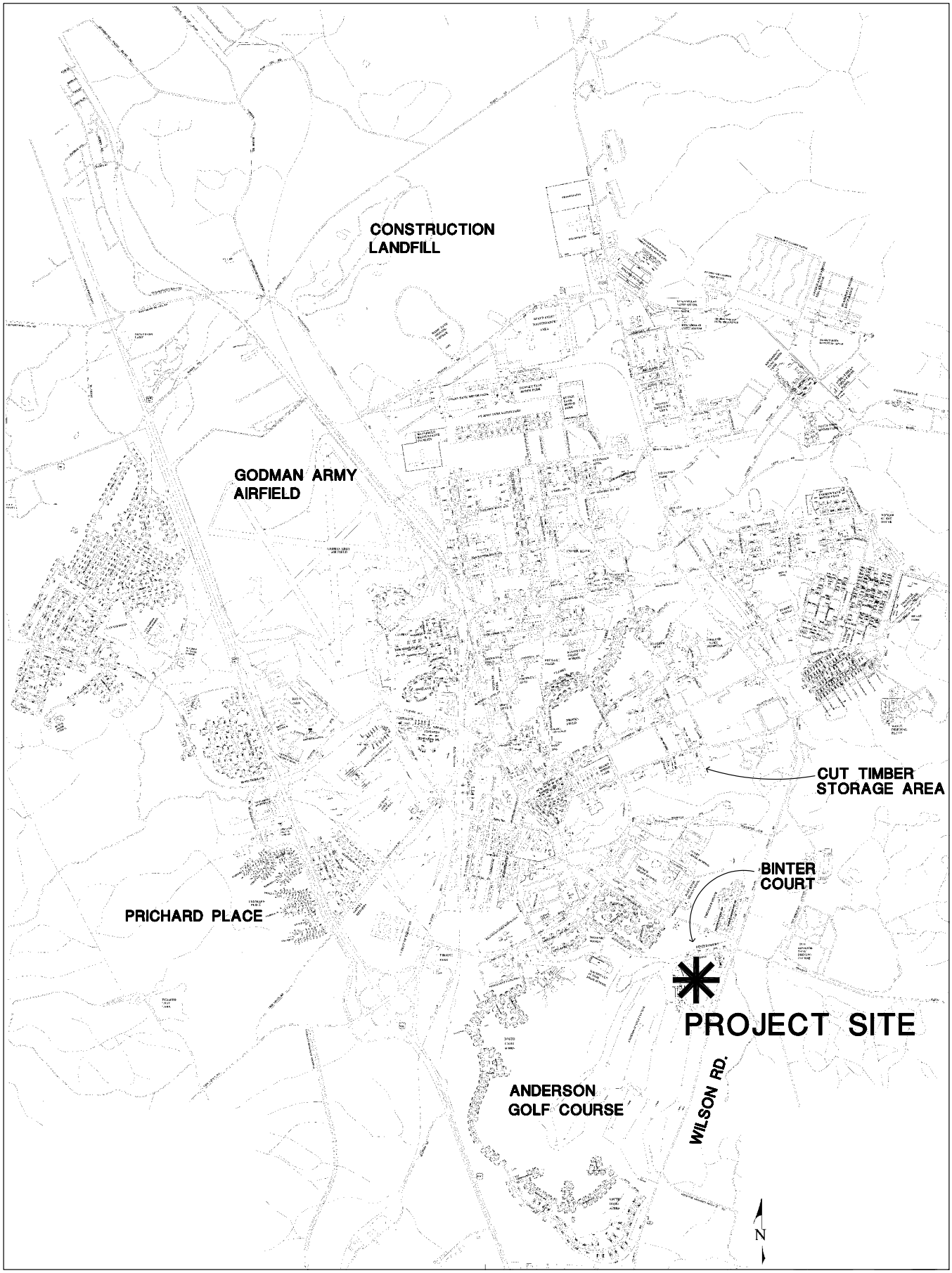
MATERIAL DESCRIPTIO	USCS	MAX.DENS.	OPT. M%	LL	PI
Reddish-Brown silty cla\	CL	119.6	13.1	35	18





CBR @ 95.0% = 9.7
for 0.1 in. penetratio

Fig. No. ***B-25***



RSP Architects, Ltd.
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SITE LOCATION MAP- FT. KNOX

US ARMY CORPS
OF ENGINEERS
LOUISVILLE DISTRICT

REPORT OF SUBSURFACE EXPLORATION AND PRELIMINARY GEOTECHNICAL SITE ASSESSMENT

Proposed Base Housing
Anderson Golf Course, Ft. Knox Military Reservation
Ft. Knox, Kentucky

AMEC Project No. 03-7590-0000

Prepared By:

AMEC Earth & Environmental, Inc.
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Prepared For:

RSP Architects
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June 2003

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16 June 2003

Mr. Jim Fitzhugh
RSP Architects
1220 Marshall St. NE
Minneapolis, MN 55413-1036

Re: Preliminary Geotechnical Site Assessment
Proposed Base Housing, Anderson Golf Course
Ft. Knox Military Reservation, Ft. Knox, Kentucky
AMEC Project No. 03-7590-0000

Dear Mr. Fitzhugh:

We have completed a series of borings, site reconnaissance and a laboratory testing program for the above referenced project. Presented on the following pages are summaries of the field and laboratory data developed for the proposed base housing development along with general information and/or recommendations regarding geotechnical site development issues and identified karst features. Important information regarding studies of the type performed has been prepared by the ASFE organization and this is presented in Appendix 1 for your review. This study has been completed in accordance with our proposal dated 17 April 2003 and your scope of work dated 23 April 2003. This study represents a preliminary geotechnical site assessment for approximately 90 acres. It is not intended for specific foundation design of any particular structure as subsurface conditions may vary significantly over relatively short distances. Site specific geotechnical subsurface exploration and site and structure specific recommendations should be prepared for any proposed buildings. Our professional services and findings obtained have been prepared in accordance with generally accepted engineering principles and practices. No other warranty, expressed or implied is made. Environmental services are beyond the scope of this study; accordingly, this report does not address the chronology of previous land use or any related, environmentally sensitive issues. Additionally, this report does not address regulatory issues associated with storm water runoff, the identification and modification of regulated wetlands or groundwater recharge areas.

EXPLORATION AND TESTING

A total of 49 boring locations were identified for drilling. Boring locations were determined in the field using the site topographic survey map of the property, readily accessible landmarks and a tape measure or pacing. Subsequent to the completion of our borings, Gresham Smith and Partners

surveyed each boring location. The final surveyed locations and elevations were provided to us by Gresham Smith and Partners in the form of an AutoCAD file that was used as the base map for Figure 3. Borings were advanced to a depth of 15 feet or auger refusal, whichever was encountered first. Bedrock was cored at a series of boring locations where bedrock was encountered at depths of approximately 10 feet or less. Table 1 provides a summary of the completed borings, corresponding ground surface elevation, their overall depth and thickness of overburden and bedrock cored. Corresponding boring logs are presented in Appendix 2.

The borings were auger-drilled and drive sampled in general accordance with the requirements of ASTM D 1586 (*Penetration Test and Split-Barrel Sampling of Soils*), commonly referred to as the Standard Penetration Test (SPT). Split-spoon soil samples were obtained at approximately 2.5-foot intervals throughout the overburden depth. In addition to the split-spoon samples, 26 relatively undisturbed samples were obtained by means of thin-wall (Shelby) tubes for the purpose of laboratory determinations of soil insitu unit weight and unconfined compressive strength. The locations of Shelby tubes are indicated on the boring logs. Large-volume, disturbed soil samples were also obtained to provide material used to develop moisture-density (Proctor) curves and California Bearing Ratio (CBR) values. A total of five bulk samples were obtained. Upon completion of auger drilling, rock cores were obtained from nine of the borings where auger refusal was encountered. Up to five-foot long cores were obtained using an NX-size core barrel. The Rock Quality Designation (RQD) and percent recovery values are listed on the corresponding boring logs presented in Appendix 2. Upon completion of drilling operations, each boring was monitored for the presence of water. Finally, the boreholes were backfilled with soils removed from the borings, an 18-inch thick plug of concrete placed in the borehole and the plug topped with about six inches of topsoil.

The soil samples were visually examined and logged in our laboratory by members of our professional staff. Laboratory testing was performed on selected soil samples to provide data from which to estimate engineering properties. Testing consisted of:

- 63 moisture content determinations,
- 5 grain size analyses including hydrometers,
- 15 Atterberg limits determinations,
- 25 unconfined compressive strength determinations,
- 25 unit weight determinations,
- 5 resistivity determinations,
- 5 sulphate content determinations,
- 5 modified Proctor moisture-density relationships, and
- 5 CBR determinations.

Our interpretation(s) of the soil and rock samples along with laboratory test results are included on the graphic logs presented in Appendix 2. A laboratory test summary table, grain size distribution curves, unconfined compression test reports, modified Proctor moisture-density curves and CBR test reports are presented in Appendix 3. The soil and rock samples not consumed by laboratory testing will be stored at our laboratory for a period of at least 60 days. Thereafter, they will be discarded unless otherwise directed by you.

In addition to the above soil borings and sample acquisition, AMEC also performed a site reconnaissance to catalog and describe known or readily evident closed depressions (karst features or sinkholes) located within the limits of the study area. This task was performed in conjunction with golf course superintendent Mr. Kenny Shively who was familiar with many of these features located within the limits of Anderson Golf Course. These features are numbered and identified on Figure 3. Closed depressions shown on the provided topographic site survey map or noted during our site reconnaissance were characterized and those observations are tabulated in Table 2. It should be noted that although we have endeavored to identify most existing depressed areas, our experience with similar sites indicates additional subsidence features not detected by our fieldwork may exist within areas currently forested or heavily vegetated. Mr. Shively pointed out that sinkholes which appear within the golf course are generally repaired and grassed fairly quickly; therefore, it was impossible to locate some repaired sinkholes.

SITE AND SUBSURFACE CONDITIONS

The proposed base housing project will be built over approximately 90 acres, located west of Wilson Road and south of Dixie Street on the Ft. Knox Military Reservation, Ft. Knox, Kentucky. A portion of the proposed study area is located on the existing northern portion of the Anderson Golf Course. Within the overall study limits, the area including the golf course clubhouse and base Guesthouse is excluded from the development area. The general site location is identified on the USGS topographic quadrangle maps for Vine Grove and Fort Knox, Kentucky, a copy of which is presented as Figure 1.

The Anderson Golf Course, generally in the area surrounding the existing clubhouse and Guesthouse, makes up approximately two-thirds of the study area. Remaining existing structures and infrastructure within the study area include Binter Court and eight associated buildings, electric, gas, water, sanitary and irrigation utility lines, and an unpaved road extending southwest from the end of Binter Court. The general terrain is rolling to relatively flat with typical slopes ranging from 3H:1V (Horizontal: Vertical) to about 30H:1V. Some locally steeper slopes (<2:1V) and flat areas

appear to be the result of grading or former development activities. Topographic contours on the site survey map provided to us exhibit topographic relief of approximately 22 meters (72 feet) and elevations are between 200 and 221 meters (656 to 725 feet, MSL). Approximately 25 acres on the western side of the subject study area are predominantly covered with woods or dense vegetation. Small pockets of trees and landscaping are found throughout the remainder of the site; however, with the exception of building or paved areas the remainder of the study area is open grass.

Drainage within the study area is provided by overland runoff as well as some improved drainage facilities including a series of roadside ditches and culverts along Wilson Road and Binter Court. Natural drainage features include one intermittent blueline stream that flows from west to east across the northern third of the site and a series of closed depressional landforms likely associated with underlying karst features (sinkholes) that detain surface water and either convey it underground or allow it to evapotranspirate. The stream directly captures runoff from approximately two-thirds of the site and may capture, through underground connections, essentially all precipitation that falls on the site and percolates into the subsurface. After leaving the northeast corner of the study site, the stream flows north parallel with Wilson Road, then east and discharges to Mill Creek. Mill Creek flows north discharging to the Salt River which subsequently discharges to the Ohio River.

Characterizations of karst features (in this case, closed topographic depressions commonly referred to as sinkholes) were made at 10 locations across the study area as shown on Figure 3. Depression identified as S-101 was determined to be related to former grading work and was not considered the result of karst activity. At several locations, multiple small karst features in close proximity or located within one larger depression were described together (such as S-100, S-102, S-104, S-105 and S-106). The majority of the features were very nearly round in shape and varied in diameter from several yards to tens of yards. Almost all of the features (or "dropouts") identified were located in the southwestern portion of the study area. Several features were noted along a broad swale (see S-103, S-106 and S-100) that ended in a closed depression (S-100). (We understand from conversations with the golf course maintenance personnel that other drainage features in other parts of the golf course (not within the study area) also have a number of "drop-outs" or sinks that follow the axis of the existing drainage features.) Due to the demands of operating a golf course, "dropouts", often only several feet in diameter and several feet in depth, are regularly filled and grassed to eliminate hazards to golfers. Depression S-108 was completely obscured by re-grading activities including the placement of a sidewalk over the area and was located for us by golf course maintenance personnel.

Isolated areas generally within existing larger depressions were noted to have experienced relatively recent subsidence and/or repair (such as S-109); however, the overall bottom of the larger features appeared to be relatively stable, were soil lined and often contained some fill material. Fill materials typically consisted of crushed rock and/or soil that had been placed to repair them. Large mature trees were generally not present in the features reviewed. Water was found in S-100 but was not found in any of the other features at the time of our field program. Based on conversations with maintenance personnel, we understand several features do temporarily contain water following heavy periods of precipitation.

General Soils Information

A review of published soil survey literature indicates a majority of the property has a soil description designation of Silt Loam – Crider Silt Loam (CrD, 2% to 6% slopes), Nolin Silt Loam (No, 0% to 2% slopes), Vertrees Silt Loam (VrD, 12% to 20% slopes) and Vertrees Silty Clay Loam (VtD3, 6% to 20% slopes, severely eroded). The Vertrees Silty Clay Loam soil series covers approximately one-half of the study area and dominates the southern half of the site. Located primarily in the northern half of the site the Nolin Silt Loam covers about 30 percent of the study area primarily within the area along the intermittent blueline stream and Binter Court. The remaining portions of the site consist of small area of Vertrees Silt Loam in the northwest portion of the site and Crider Silt Loam in a thin strip next to Wilson Road.

According to the USDA soil survey, the Vertrees Silty Clay Loam soil series is described as moderately steep, deep, well-drained soils on ridgetops and hillsides and in karst areas. This soil has lost most of its original surface layer through erosion. A representative profile of this soil includes from 0 to 6 inches of yellowish-brown to reddish-brown silty clay loam and from 6 to 66 inches of yellowish-red, firm, plastic clay with occasional chert and soft shale fragments. This soil is reported to have low to moderate shrink-swell potential.

According to the USDA soil survey, the Nolin Silt Loam soil series described as well-drained, nearly level soil in strips 175 to 2,000 feet wide on flood plains and in circular and oval areas in depressions. In the depressions, surface water drains through openings into underground streams. Without drainage improvements, this soil is subject to frequent flooding from November to May. In a representative profile this soil includes from 0 to 10 inches of dark grayish-brown silt loam and from 10 to 66 inches of brown silt loam. This soil is reported to have low shrink-swell potential.

According to the USDA soil survey, the Vertrees Silt Loam soil series is described as well-drained, deep, moderately steep soil is found on hillsides and in karst areas. Areas on hillsides are in bands 150 to 1,000 feet wide that wind around the points of ridges and the heads of ravines. In karst areas, depressions are common and slopes are irregular. A representative soil profile includes from 0 to 7 inches of brown silt loam with occasional chert fragments, from 7 to 24 inches and is yellowish-brown mottled red, firm, plastic clay. From 24 to 70 inches it is red, firm, plastic clay with occasional chert fragments.

According to the USDA soil survey, the Crider Silt Loam soil series is described as well-drained, deep, gently sloping soil in bands, blocks and ovals areas on ridgetops and in karst areas. In karst areas, drainageways are dismembered and lead through openings in depressions into underground streams. A representative soil profile includes from 0 to 8 inches of brown silt loam, from 8 to 26 inches it is brown silt loam and from 26 to 48 inches it is reddish-brown silty clay loam. Below this horizon is red, very firm, plastic silty clay.

General Bedrock Information

A review of published geologic literature indicates the site is underlain by the Mississippian Age St. Louis Limestone (map unit Msl) as shown on Figure 2. This formation, which is greater than 230 feet thick, consists of limestone, dolomite and shale. Limestone is yellowish-gray, light olive gray and dark gray to medium bluish-gray and weathers light gray to olive gray. It is very fine to medium grained with beds commonly less than 1 foot thick. Dolomite is medium dark gray to olive gray and weathers to yellowish-gray. It is very fine to fine grained with beds from 0.1 to 5 feet thick. The parent rock weathers to silty and cherty reddish-orange clay residuum generally 30 to 40 feet thick. This deep weathering and numerous sinks typify the unit. Bedrock dips gently to the east at a rate of approximately 20 feet per mile based on mapped information for the Salem Limestone which lies stratigraphically below the St. Louis Limestone about elevation 198.1 m, MSL (650 feet, MSL).

Site Exploration Results

A total of 49 borings were performed on a relatively even spacing across the study site at the locations shown on Figure 3. Soils encountered in the upper intervals or horizons generally match reasonably well with published soil survey information. Some areas of the golf course as well as the developed areas have been graded to achieve the current contours; however, soil types encountered in these areas generally reflected site soils in presumably undisturbed areas. At sixty percent of the boring locations bedrock was not encountered within the upper 15 feet. Six borings

encountered rock at depths of 10 feet or less(as shallow as six feet); however, rock was generally encountered at depths greater than 10 feet below existing ground surface.

Based on the exploratory data, the general soil profile consists of a surficial interval of topsoil. This interval generally consisted of organic silty clay and was predominantly six inches thick. At a few notable locations (Borings B-42 through B-44 and B-46) topsoil was found to be approximately 12 inches thick and at several other locations (Borings B-39 and B-45) topsoil was found to be only one to two inches thick. Below the surficial interval the borings encountered generally firm to stiff, brown to dark brown, reddish-brown and reddish-brown to mottled tan, moderate to high plastic, slightly silty to silty clay to low plastic, clayey silt. Variable amounts of black nodules, chert and rock fragments were found throughout. This interval varied in thickness from several feet thick to greater than 15 feet. Intervals of gray silt were noted in several borings and where the borings approached the highly weathered underlying bedrock, soils were significantly lighter in color, tended to be more silty to sandy and contained substantial amounts of shale and limestone rock fragments. It is noted that rock fragments contained within the soil matrix generally inflated SPT blow counts. Soils with a consistency of soft to very soft soils were encountered at several locations as listed below:

- Boring B-6 to a depth of 8.0 feet,
- Boring B-9 to a depth of 4.0 feet,
- Boring B-14 to a depth of 3.0 feet,
- Boring B-18 to a depth of 4.0 feet,
- Boring B-19 to a depth of 6.0 feet,
- Boring B-27 between 3.0 and 10.0 feet, and
- Boring B-28 between 3.0 and 8.0 feet.

The soils encountered during this exploration appear to be residual in nature, derived from the underlying limestone, dolomite and shale bedrock. Each boring was checked for water upon completion and was found to be dry. Despite the lack of water present in the borings, stabilized or temporary perched groundwater levels may potentially be found within the depths explored at other times of the year.

Bulk over burden soils from five locations were tested for a variety of soil characteristics and corrosion potential. All lab data is summarized in Appendix 3 and several aspects are discussed here. The table below presents the soil corrosivity parameters tested compared with reference critical values.

Test	Units	Reference Critical Values	Lab Results				
			B-6 1' - 5'	B-19 1' - 5'	B-23 1' - 5'	B-29 2' - 5'	B-35 10' - 15'
Resistivity	ohm - cm	<2,000	20,400	5,710	8,500	8,600	47,800
Sulphate Content	ppm	>500	18.4	ND	16.1	ND	ND

Notes: ND - Below detection level of test method.

Based on the above data the soil constituents tested for the selected soils appear to fall well below the level of concern for sulphate content and well above the minimum value for resistivity.

CBR values were determined for five bulk soil samples obtained from the site and test reports are included for these samples in Appendix 3. CBR values obtained at 95% of the modified proctor maximum dry density and optimum moisture ranged from 1.4 to 12.5. The low value of 1.4 (from Boring B-2; 1' - 5') was determined from a high plastic clay sample with a liquid limit of 69 (plasticity index of 43). The remaining four samples with plasticity indices between 9 and 18 resulted in CBR values between 6.0 and 12.5, averaging 9.3. The CBR test from Boring B-2 also indicated some moderate swell potential of about 1.5% for samples at or above optimum moisture.

Bedrock cores revealed variable bedrock materials including predominantly limestone and dolomite with some shale. Core recovery was quite variable with values ranging from 27% to 100% and averaging about 85%. Rock Quality Designation (RQD) was determined for each core with values ranging from 0% to 89% and averaging 62%. Rock quality varied from very poor to excellent with the majority ranging from fair to good. Rock exhibiting poor rock quality were highly weathered throughout the length of core obtained, while rock exhibiting good to fair quality showed highly weathered rock generally within the upper one to three feet.

SEISMICITY

Based on the Kentucky Building Code (Edition 8, 2002), Section 1615.0, and the Army's Technical Instruction 809-04 a "C" Site Classification should be used for design of structures considering the firm to stiff soils and presence of relatively shallow underlying bedrock. Furthermore, the design of the structures should conform to seismic requirements stipulated by the local building code. In accordance with the Kentucky Building Code, Hardin County, Kentucky area has Spectral Response Acceleration Coefficients, S_s and S_1, of 0.25 and 0.14, respectively.

PRELIMINARY COMMENTS AND RECOMMENDATIONS

General

We have not been provided with a site grading plan, proposed building elevations, or specific design information for the proposed development. Therefore, the comments and recommendations contained in this preliminary geotechnical site assessment are provided as guidelines that are applicable, in general, to the overall study area but not necessarily applicable to any particular location. Our comments and recommendations must be reviewed, and if necessary, updated or revised in light of the final development design. A site specific geotechnical study should be performed for each structure or pavement once the locations, elevations, structural loadings and limits of those features are determined.

Based on the provided information we understand building development will consist of 1- to 2-story wood-framed, single or multi-family houses or town homes. For typical buildings with maximum column loads of less than about 75 kips and wall loads of less than about 2.0 kips/ft., we expect shallow spread foundations bearing upon stable natural soil or properly compacted engineered fill can be utilized. If significantly heavier structures are anticipated, or extremely settlement-sensitive structures, are planned, it should be possible to extend foundations to contact bedrock as either over-excavated spread footings or as drilled piers.

Although the number of karst features in the southwest portion of the study area is significant, developments within similar geologic settings have been successfully completed in the past when adequate engineering and remedial efforts are employed. Therefore, provided the Owner is willing to accommodate some karst features in an undisturbed state within the site plan and repair existing sinkholes where that is a reasonable approach, we are of the opinion the site can be developed.

With the exception of areas within and adjacent to closed depressions, and along drainage channels or perennial streams, the site conditions are judged to be fairly straightforward in regard to geotechnical issues associated with site development for residential-type structures. The upper interval of topsoil will require stripping operations to achieve a stable subgrade. Excavations deeper than about 10 feet have an increased chance to encounter bedrock. The non-organic soils on-site are generally suitable for use as engineered fill, although some very silty soils may be somewhat difficult to compact if the work is conducted during periods of wet weather and high plastic clay soils may present difficulty with handling and achieving a firm surface. Additionally, soft zones encountered within building footprints will require undercut and repair.

Site Preparation

Within the areas proposed for construction, topsoil, organic materials, fill materials and other deleterious materials will need to be removed from the proposed building areas. Stripping operations should extend a distance of at least 10 feet beyond the limits of the proposed structures where possible. Based on the exploration, stripping operations to remove the topsoil will be on the order of 6 to 8 inches. Existing utilities, structures, foundations, pavements and other buried infrastructure within the proposed building footprints should be completely removed or protected from damage. Any excavations resulting from abandoning utilities should be inspected to confirm all deleterious materials have been removed and that abandoned underground pipes and other utilities have been completely removed or properly severed, capped and/or grouted.

Subsequent to the stripping operations, the exposed subgrade within areas to receive fill should be systematically and thoroughly proofrolled with heavy, rubber-tired equipment in order to detect soft or unstable soils. If soft areas are detected during grading operations, the areas should be undercut to firm ground and the resulting excavation backfilled with engineered fill. Alternatively, if approved by the geotechnical engineer, unstable areas may be aerated and re-compacted. Upon reaching the required subgrade elevation within excavated areas, the soil subgrade should also be proofrolled and repaired as previously described.

Organic-free, low plasticity, soils derived from on-site excavations will be suitable for use as engineered fill. (It is noted that a percentage of the onsite soils do characterize as high plastic soils.) If used, off-site borrow should consist of organic-free soil with a plasticity index of less than 25. Borrow soil should be free of large rock fragments (i.e., greater than about 4 inches) or other deleterious materials. Engineered soil fill placed within the proposed building footprints should be compacted to at least 98% of the soil's maximum dry density in accordance with ASTM D 698 (standard *Proctor*) and placed in lifts not exceeding 8 inches in uncompacted thickness when heavy, self-propelled compaction equipment is utilized. When hand operated compaction equipment is used the loose lift thickness should be reduced to one-half this value. In order to reduce the potential for volume changes in response to changes in moisture content, the moisture content of engineered fill should be controlled to within ±2% of the standard Proctor optimum moisture content during placement. Extremely silty or high plastic soils should be controlled to within 1% of the standard Proctor optimum moisture content during placement. Contractors should be prepared to reduce or increase the soil's moisture, as required, to maintain the soil's moisture content within the specified range.

The site should be maintained in a well-drained condition, both during and after construction, to inhibit water from ponding on soil subgrades. Ponding water could lead to deterioration of the soil subgrade, necessitating over-excavation of the softened soil.

Embankment/Cut Slopes

We are unaware of any new, fill slopes (i.e., greater than about 10 feet) that will need to be constructed as part of the construction. Therefore, the following is provided as general information. If the final site design includes new slopes in excess of about 10 feet in height, we request we be given the opportunity to review the subsurface data and our recommendations in the light of the proposed design.

Cut and fill slopes in soil, should be designed no steeper than 2H:1V for slopes up to a maximum height of 10 feet; the limits of structures, as measured from the outside face of the nearest foundation member, must be at least 10 feet from the slope crest. Fill placed in the zone between the edge of the building and the slope crest should be compacted to engineered fill requirements. Higher slopes should be individually studied in light of the completed grading plan. If it is desirable for fill slopes to be maintained as landscaped areas, we recommend inclinations no steeper than 3H:1V be used. The Contractor must properly plan and design his excavations with safety in mind. All applicable OSHA requirements relating to braced and unbraced excavations must be followed.

During construction, isolated zones of perched water, as well as wet weather springs, may be encountered within the overburden. It is our opinion water emerging from cut slopes as groundwater seeps can be controlled by a perimeter drainage system consisting of surface ditches installed below the cut slope. Depending on the configuration of the slope(s) and the amount of water encountered, subsurface drains installed along the perimeter of the proposed building may also be needed. Intercepting surface water and shallow subsurface water flows in this manner should eliminate the need for under-floor-slab drains beneath the building.

Foundation Design

Provided the site is prepared in accordance with the recommendations stated previously, the proposed 1- and 2-story residential buildings can be supported by means of a conventionally designed, shallow foundation system bearing on either engineered fill, stable, natural soil or a combination of those mediums. Based on a safety factor of at least 3 with respect to general shear failure, we believe allowable load bearing capacities of 3.0 KSF and 2.5 KSF for individual and continuous building footings, respectively will be applicable for both the stable, natural soil and

properly compacted, engineered fill. A minimum footing width of 24 inches should be specified for all foundations, regardless of loading, in order to accommodate minor subgrade inconsistency and to resist punching failure. Further, the perimeter building footings should be designed to bear at least 24 inches below exterior, finished grades to provide frost protection, adequate confinement, and to provide a bearing level that is below the depth of significant seasonal moisture change.

If foundation excavations within the proposed building areas encounter bedrock, we recommend rock be removed to a minimum depth of 2 feet below the proposed foundation bearing surface and that the over-excavation be replaced with engineered fill compacted to a minimum of 98% of the standard Proctor maximum dry density.

Based on the available data, we estimate the maximum, total, long-term settlement of the proposed structures will be less than 1.0 inch. Differential settlement between adjacent foundation members could approach 50% of the total amount. Because measurable increments of settlement are likely to occur, the design of masonry walls should include provisions for liberally spaced, vertical control joints to minimize "cosmetic" cracking.

Based on the water level data generated during this study (borings were dry upon completion), we do not expect shallow foundation excavations will experience groundwater inflows. However, depending on the depth of excavation, as well as weather conditions immediately prior to and during the construction, perched zones of groundwater could be encountered. In that event, it will be necessary for the Contractor to maintain excavations in a dewatered condition during inspection and prior to concrete placement. The bottom of the excavations must be thoroughly cleaned prior to concrete placement; concrete should not be cast if the excavation contains loose soil, debris or water. Whenever possible, foundation excavations should be opened and cast with concrete on the same day. If soil excavations must remain open for an extended period, they must be protected from rainfall, excessive drying, and surface water infiltration. Footing excavations should be examined by a representative of the geotechnical engineer immediately prior to the placement of concrete in order to assess the condition of the bearing surface.

Slabs-On-Grade

Concrete slabs-on-grade are expected to perform satisfactorily if founded on a properly prepared subgrade as described above. A free-draining, granular base, at least 4-inches thick, and a vapor barrier should be incorporated into the slab design. Slab thickness and reinforcing requirements can be preliminarily designed based on an estimated subgrade reaction modulus of 120 PCI. An

appropriate number of control joints should be included in the slab design to accommodate minor differential settlement that may occur.

Pavement Design

For the purposes of pavement design recommendations, we have considered light duty loading resulting from approximately 200 cars per day. If the subgrade is prepared as previously recommended, we estimate the soil subgrade should develop minimum support characteristics equal to a California Bearing Ratio (CBR) of approximately 5. Based on that degree of subgrade support, we offer the follow flexible pavement section for your consideration. Once the material is identified which will provide support for the pavement, the material's CBR should be determined. Based on that test, the pavement thickness provided may need to be revised. The following design scenarios were developed considering an effective design life of 20 years.

FLEXIBLE PAVEMENT

Material	Light-Duty (200 Cars Per Day) Thickness (inches
Asphalt Surface (Hot Mix)	1.0
Asphalt Binder (Hot Mix)	2.0
Mineral Aggregate Base Course compacted to at least 98% of its maximum modified *Proctor* (ASTM D1556) dry density	6.0
Total Pavement Thicknes	**9.0**

Pavement materials and methods should conform to the requirements of the latest edition the state Department of Highway's *Standard Specifications for Road and Bridge Construction.*

To prevent the aggregate base course from becoming saturated, and thereby reducing the support capabilities of the subgrade, we recommend the subgrade be graded to provide positive drainage away form the paved areas. Immediately prior to the placement of the base course stone, the subgrade should be proofrolled in order to verify its stability. During the placement of the aggregate base, field compaction tests and thickness determinations should be performed in order to confirm compliance with the project documents. If a significant amount of time elapses between placement of the aggregate base and the asphalt courses, the surface of the stone should be proofrolled immediately prior to paving operations to confirm that its stability has been maintained.

Karst Planning Issues

Based on the presence of active karst activity within significant portions of the site, and in keeping with good practice, planning for developments in karst areas should consider: how to protect the public from hazards associated with karst activity; how to avoid or mitigate impacts to groundwater supplies; and, how to avoid negative impacts to surface water drainage. The discussion below considers how each of the above items can be addressed, and other issues you should consider as planning progresses.

The present state of the art of geotechnical engineering does not allow us to predict, with certainty, when or where future sinkholes might occur. However, in general, the highest potential risk of subsidence occurs within areas that have already experienced subsidence. Therefore, the most obvious approach in development to reduce potential risk is to avoid locating structures or roadways within existing closed depressions or in areas heavily impacted by karst features. However, given proper geotechnical study, a specific plan may be developed to address development in impacted areas.

Another issue to consider is the potential effect on groundwater created by development in karst areas. The blockage of existing sinkholes previously accepting surface water can influence the groundwater table. If water wells are being used in areas close to "plugged" sinkholes, the groundwater level could drop to make those wells less productive. Routing surface water runoff into sinkholes may raise groundwater contamination concerns or even accelerate the development of a sinkhole.

With specific application to the subject site, the observed karst features do influence surface and groundwater flow to some degree. Specifically, surface water is intercepted by the karst features, which diverts surface water underground; however, based on our site review, we believe most, if not all, of this water likely reappears in the form of springs located within the military reservation limits. Protection of the quality of water entering the sinkholes should be considered in any development plan. Runoff from paved areas should not be allowed to flow directly into sinkholes without some level of treatment. Treatment may include natural filtration through use of buffer zones or stormwater detention ponds to trap sediment and prevent floating contaminants such as oils from being discharged directly to sinkholes.

Federal EPA regulations may require certain precautions be employed when surface runoff is directed underground via use of "injection wells"; areas where surface runoff is directed

underground through sinkholes are included in EPA's definition of injection wells. Specific things that can be included within the site development plans in order to incorporate reasonable, prudent precautions to reduce impacts to water quality and the natural karst setting, and to limit the risk of karst-related damage to future structures, include the following:

1. Any sinkhole which accepts surface runoff and serves as part of a regional system to detain and/or transport surface runoff should be left in its natural condition. Several of the depressions in the southwest portion of the study area appear to accept surface water flow from beyond the limits of their specific closed depression. Sinkhole S-100 appears to be located at the downstream end of a natural drainage feature and receives surface water from a upstream areas.
2. Existing surface drainage should continue to flow to the same locations as exists now. If surface runoff beyond what currently occurs must be directed into sinkholes, a detailed geologic/hydrologic analysis should be completed to determine that the sinkhole is capable of transmitting that volume of runoff without causing flooding at that location, or within areas that are inter-connected to the sinkhole by bedrock channels. In addition, the quality of the surface water must be maintained. If the runoff crosses paved areas or can otherwise pick up debris or oily residue created by the development, pre-treatment should be included prior to discharge into the sinkhole. An injection well permit from the State will be required for any changes in the water quantity or quality entering sinkholes.
3. The naturally occurring bedrock channels, voids and joints which currently serve to transmit groundwater downward or laterally, should be left in such a condition to allow groundwater to follow its natural course. If structural repairs to bedrock cavities are required to prepare the subgrade for development, an open-graded stone should be employed to fill bedrock defects so that groundwater can continue to move through those channels. Concrete should not be allowed to plug any bedrock channels.
4. In areas where karst features are to be avoided to help reduce costs for sinkhole remediation, the building limit line should be located on the order of 50 feet beyond the limits of the sinkhole(s).
5. If surface water/groundwater interconnections will be altered, the location of water wells that may intercept groundwater channels influenced by water entering sinkholes on this property should be identified. If justified, studies should be completed to determine if the quantity or quality of water within those wells will be adversely affected by altering flows into sinkholes on this site. Our preliminary data indicates it is unlikely offsite properties will be affected

even if groundwater flows on this site are altered; however, we are not aware of the proximity of any offsite wells.

Sinkhole Remediation

The development of property underlain by solution-prone bedrock with a known history of sinkhole formation is always associated with risk. Specifically, existing sinkholes can continue to subside or enlarge in area, or new sinkholes may develop within presently stable areas. While engineering analysis and sinkhole remedial efforts can substantially lessen the potential risk of subsidence, some potential risk of future subsidence is inherent with the geologic setting of the property.

Where structures and roadways cannot be located to avoid closed depressions, proper measures must be taken to repair closed depressions that are in the path of development. Ideally, the relatively larger sinkholes or sinkhole areas could be incorporated for use in landscape areas.

Our general concerns regarding sinkholes, particularly those with soil subgrade, in this geological setting are as follows:

1. Soft, unconsolidated soils may consolidate and voids may collapse under the weight of fill materials or structures.
2. The continued movements of surface water into the subsurface via the existing depressions will continue to weather the bedrock and move soil downward into the bedrock, increasing the potential risk of subsidence.

Therefore, in order to reduce the potential risk of subsidence, we recommend, where applicable, unconsolidated soils be excavated from each closed depression and the bedrock surface exposed to locate openings into the bedrock. Subsequently, the openings should be plugged with an inverted stone filter (this stone filter can then be capped with concrete provided it does not plug groundwater channels) and the remaining excavation then backfilled with appropriate engineering fill. Repairs should be accomplished under the direction of the geotechnical engineer or his representative.

Ponding and subsequent infiltration of water into the subgrade is a significant factor in initiating ground subsidence and sinkhole formation. Therefore, preventing additional surface water from concentrating or ponding in sinkhole prone areas is essential. If possible, additional surface water runoff should be piped away from structures and discharged directly into existing drainage channels

or storm sewers when possible. If any incipient sinkholes are noted during construction, they should be repaired, as determined by the geotechnical engineer, on a case-by-case basis.

In summary, due to the presence of limestone and/or dolomite bedrock, the potential risk of sinkhole development at any location cannot be entirely eliminated. Within areas with active karst features, additional engineering and remediation efforts will be needed to provide site by site recommendations for development. Provided sinkhole remediation efforts are properly completed, we believe the long-term potential risk is similar to the potential risk associated with developing most other properties in this part of Hardin County which are underlain by limestone and/or dolomite bedrock.

CONSTRUCTION MONITORING

The satisfactory, long-term performance of the foundations, slabs and pavements will be dependent on the workmanship and adherence to details contained in our recommendations and the project specifications. We strongly recommend all aspects of the site preparation and foundation installation be monitored by a qualified technician responsible to the geotechnical engineer and the Owner. In particular, the proofrolling operations and any remedial treatment to the subgrade and sinkholes, and the placement and compaction of engineered fill should be continuously monitored and periodically tested. Additionally, prior to concrete placement, the geotechnical engineer or his representative should review all foundation excavations.

CLOSURE

We emphasize the information contained is this report represents a preliminary study, which while it provides appropriate design guidelines and recommendations for the anticipated development may not meet the standard of care both in the concentration of borings and site specific recommendations for specific design of any particular building. In order to develop detailed comments and recommendations concerning the geotechnical aspects of design and construction for specific structures, it will be necessary for us to perform a more detailed study that addresses site specific items relating to the proposed facilities.

AMEC appreciates this opportunity to be of service to RSP Architects and Ft. Knox Military Reservation. At your convenience, we are available to discuss the details of this report and any questions you may have, and the in-depth comprehensive geotechnical investigation that will be required to develop final recommendations.

Yours truly,

David G. Sawitzki, PE
Geotechnical Engineer

James B. Shepard, Vice President
General Manager - Louisville Office

Enclosures

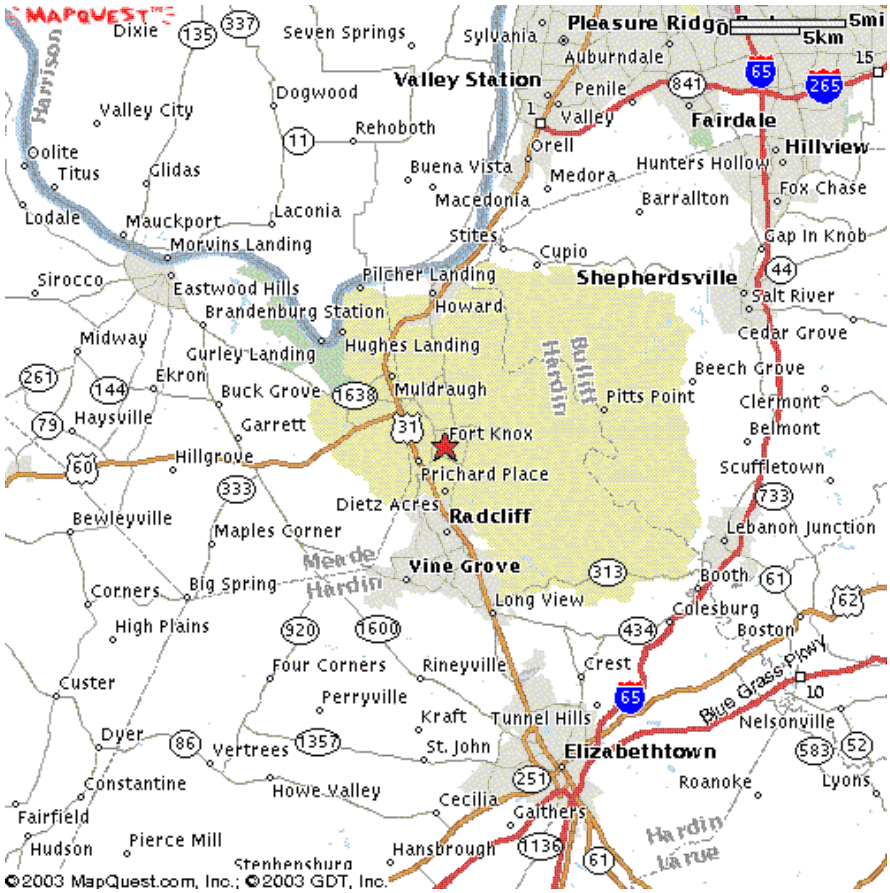
APPENDIX 2

BORING LOGS

THE BORING LOGS SHOWN DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS DRILLED AND AT THE PARTICULAR TIMES, WHICH MAY BE DESIGNATED ON THE LOGS. SUBSURFACE CONDITIONS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURING AT THESE BORING LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE SUBSURFACE CONDITIONS AT THE BORING LOCATIONS DRILLED

APPENDIX 3

LABORATORY TEST DATA SUMMARY,
GRAIN SIZE DISTRIBUTION CURVES,
MOISTURE DENSITY RELATIONSHIPS (PROCTORS)
UNCONFINED COMPRESSION TESTS AND
CBR TEST REPORTS



RSP Architects, Ltd.
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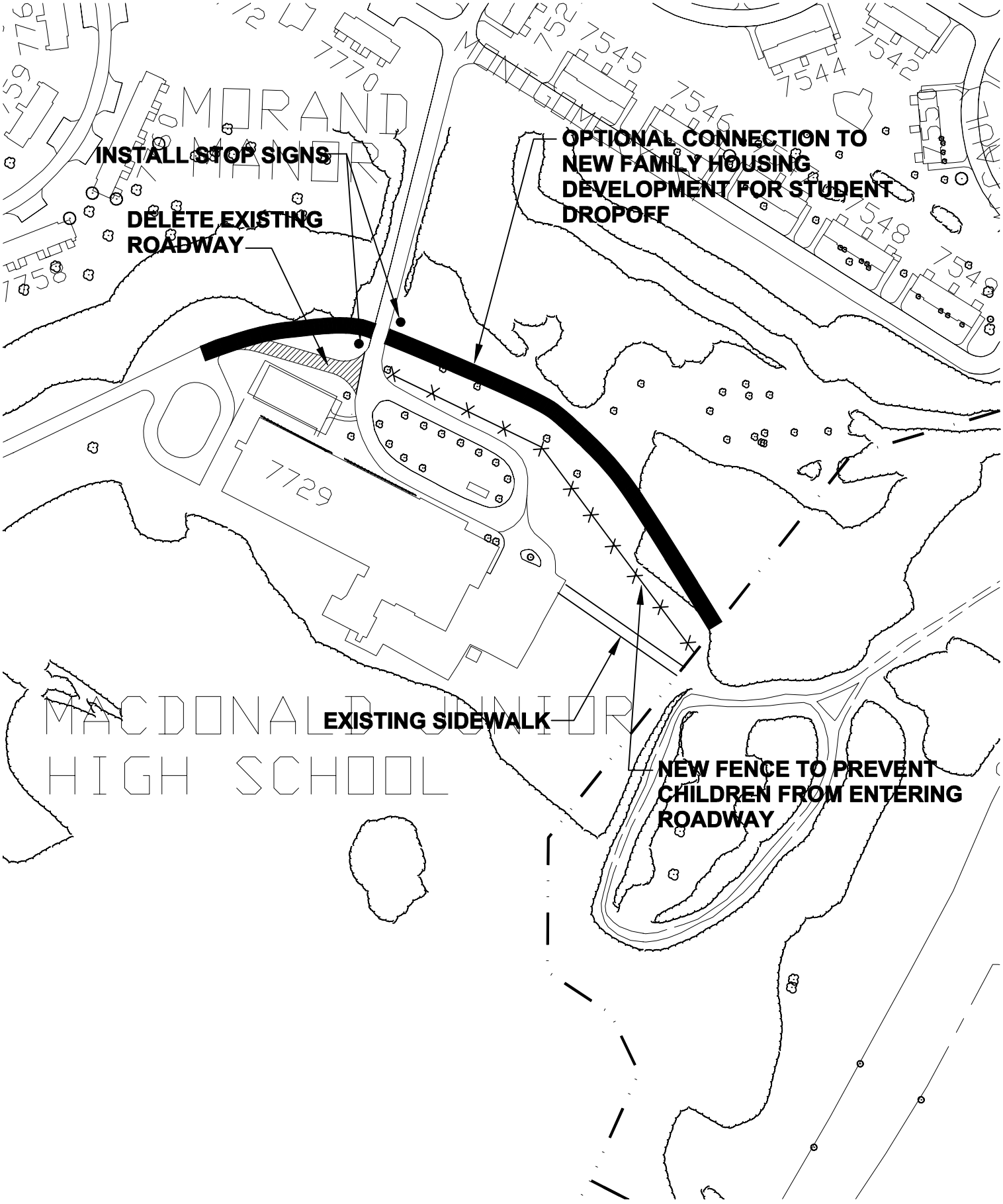
FORT KNOX KENTUCKY
AREA LOCATION MAP

US ARMY CORPS OF ENGINEERS LOUISVILLE DISTRICT



ATTACHMENT 10

OPTION "O"

McDONALD SCHOOL CONNECTION

SCALE: 1"=200'

FINAL DRAFT

Sustainable Project Rating Tool (SPiRiT)

Version 2.0

Based on the U.S. Green Building Council USGBC)
LEED™ 2.1 [Leadership in Energy and Environmental Design]
Green Building Rating System

APRIL 2003

U.S. Army Corps of Engineers

U. S. Army Assistant Chief of Staff for Installation Management

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NOTES

1) The Sustainable Project Rating Tool (SPiRiT) is a U.S. Army Corps of Engineers (USACE) developed tool prepared for the Army Chief of Staff for Installation Management (ACSIM) to insure that all future facilities be designed and built according to sustainable principles. SPiRiT is derived from the U. S. Green Building Council LEED™ 2.1 (Leadership in Energy and Environmental Design) Green Building Rating System. USACE has a licensed agreement with the U.S. Green Building Council (USGBC) permitting use of LEED™ 2.1 as part of SPiRiT.

2) SPiRiT is a self-evaluation system, which allows the rating of new and existing facilities by project teams made up of key stakeholders. Project Teams self-evaluate and self-certify projects based on the total credits earned. For classification as a Green building, facilities must satisfy all of the prerequisites and a minimum of 25 credit points. See U.S. Army Corps of Engineers Technical Letter (ETL) 1110-3-491, 1 May 2001, *Sustainable Design for Military Facilities*, and current directives for further guidance and policy.

3) The SPiRiT numbering scheme parallels, but does not match LEED 2.1. LEED does not number major sections, which it calls 'Credit Categories,' ex. 'Sustainable Sites,' rather it numbers criteria or 'credits' within each major section. SPiRiT credit numbers match those of LEED where there is a 1:1 comparison. Where additional credits have been added they fall at the end of major sections.

4) The SPiRiT Credits all follow the format: Intent, Requirement, Suggested Documentation, and Technologies/Strategies.

Intent: A statement of the primary goal for the credit;
Requirement: Quantifiable conditions necessary to achieve stated intent;
Suggested Documentation: Recommended documentation to validate credit attainment.
Technologies/Strategies: Suggested technologies, strategies and referenced guidance on the means to achieve identified requirements.

5) Projects are evaluated for each SPiRiT credit which are either 'Prerequisites' or result in a point score:

Prerequisites: These credits are a statement of minimum requirements that must be met. No certification is possible unless all listed prerequisites are achieved. These credits are recognizable by an 'R' in the number scheme, ex. 1.R1, and a 'Reqd.' in the score column.
Point Score: These credits are evaluated to determine a point score. No partial points are granted.

6) SPiRiT Sustainable Project Certification Levels:

SPiRiT Bronze	25 to 34 Points
SPiRiT Silver	35 to 49 Points
SPiRiT Gold	50 to 74 Points
SPiRiT Platinum	75 to 100 Points

6) SPiRiT credits have been developed to address facility life cycle phases including programming, design, construction, and commissioning. Additional rating tools will be developed to address installation/base master planning and facilities operations and maintenance, rehabilitation, recycling, and disposal.

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10) Army/USACE employees are members of the USGBC with membership privileges accessible via the USGBC web site, http://www.usgbc.org. For information on membership and access to available LEED resources to support use of SPiRiT and sustainable design in your projects, contact Richard Schneider at (217) 373-6752 or richard.l.schneider@erdc.usace.army.mil (Annette Stumpf at (217) 352-6511 ext. 7542 or annette.l.stumpf@erdc.usace.army.mil, alternate).

11) For the latest information on SPiRiT and for access to guidance, tools and resources supporting sustainable design initiatives, visit the CERL 'Sustainable Design and Development Resource' website, http://www.cecer.army.mil/SustDesign. There you may also join the CERL Sustainable Design ListServ to be directly notified of information pertinent to sustainable design.

1.0 Sustainable Sites — Score 20

1.R1 **Erosion, Sedimentation, and Water Quality Control**[1] **Reqd.**

Intent: Control erosion and pollutants to reduce negative impacts on water and air quality.

Requirement:

- ❑ Design, specific to a site, a sediment and erosion control plan that conforms to EPA Document No. EPA 832-R-92-005 (Stormwater Management for Construction Activities) OR local erosion and sedimentation contr standards and codes, whichever is more stringent. The plan shall meet the following objectives:
  - Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
  - Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter.
  - Prevent hazardous material discharge into storm water systems.
  - Prevent petroleum oils and lubricants (POL) discharge into storm water systems.

Suggested Documentation:

- ❑ *Specifications:* Include the language and specifically the objectives from 1.R1 in the general conditions of the specifications under the following the CSI Master Format Section: 01570 Temporary Controls, and 02370 Erosion and Sedimentation Control.
- ❑ *Drawings:* Highlight erosion and sedimentation controls on the appropriate site plan sheet such as the Site Grading Plan, Site Demolition Plan, or Site Development Plan.
- ❑ *Design Analysis:* OR Prepare an Erosion and Sedimentation Control Plan to be included in the Design Analysis. Reference this plan in the general conditions sections of the specifications listed above.

Technologies /Strategies: Adopt an erosion and sediment control plan for the project site during construction. Consider employing strategi such as temporary and permanent seeding, mulching, earth dikes, silt fencing, sediment traps, and sediment basins.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.C1 **Site Selection**[1]

Intent: Avoid development of inappropriate sites and reduce the environmental impact from the location of a building or site. Select site based on functional adjacencies/relationships and land use compatibility.

Requirement: ❑ Do not develop buildings on portions of sites that meet any one of the following criteria: **1**

- Prime training or maneuver land.
- Land whose elevation is lower than 5 ft. above the 100-year flood elevation as defined by FEMA.
- Land that provides habitat for any species on the Federal or State threatened or endangered list.
- Within 100 feet of any water including wetlands as defined by 40 CFR, Parts 230-233 and Part 22, and isolated wetland or areas of special concern identified by state or local rule OR greater than distances given in state or local regulations as defined by local or state rule or law, whichever is more stringent

Suggested Documentation: ❑ *Design Analysis:* Include a narrative describing the site selection process. Specifically mention endangered species, prime training lands or agricultural land, flood plain situation, and wetland situations for the site. When available, include FEMA maps, or USGS soil surveys maps.

Requirement ❑ Select site based on functional adjacencies/relationships and land use compatibility. **1**

- Select sites close to existing roads and utilities or use an existing structure to minimize the need for ne infrastructure.
- Select site in area of high density.
- Site facilities based on the strength of their relationships to other facilities/land-uses to limit travel distances. The stronger the relationship/functional interaction, the closer the distance between two facilities.
- Select for distance to installation/base transit systems and access to pedestrian ways and bike paths.
- Select for development previously used or developed suitable and available sites.

Suggested Documentation: ❑ *Design Analysis*: Include a narrative describing the functional adjacencies and the land use compatibility of the selected site. Specifically mention the sites integration with surrounding uses and connectivity to transit systems.

Technologies /Strategies: During the site selection process, give preference to those sites that do not include sensitive site elements and restrictive land types. Select a suitable building location and design the building with the minimal footprint to minimize site disruption. Strategies include stacking the building program, tuck-under parking, and sharing facilities with neighbors. Screen potential building sites for these criteria and/or ensure that these criteria are addressed by the designer during the conceptual design phase. Utilize landscape architects, ecologists, environmental engineers, civil engineers, and similar professionals for the screening process. New wetlands constructed as part of stormwater mitigation or other site restoration efforts are not affected by the restrictions of this credit.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.0 Sustainable Sites (SS) (Continued)

1.C2 Installation/Base Redevelopment[1]

Intent: Channel development to installation/base cantonment areas with existing infrastructure, protecting greenfields a preserving habitat and natural resources.

Requirement:
- ❑ Increase localized density to conform to existing or desired density goals by utilizing sites that are located within existing cantonment areas of high development density. **1**

Suggested Documentation:
- ❑ *Design Analysis:* Describe the density goals for the project and discuss any density requirements from the installation/base Master Plan. Calculate the radius to include in the local density by multiplying 3 times the square root of the site square footage (See LEED Reference Guide for more details). Include a table showing all buildings that fall within this radius (in whole or in part) and give the building gross square footage, and site area. Sum all the square footages and divide the total building area by total site area. Discuss how the local density fits with the project density goals. OR Develop typical densities for various areas of the installation and then show that the new building contributes to an increase in the local density where it is sited.

Requirement:
- ❑ Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure. **1**

Suggested Documentation:
- ❑ *Design Analysis:* Include a narrative describing of existing infrastructure at the site such as roads and utilities, and how the proposed project will take advantage of these existing features. Indicate that neither construction costs nor O&M costs were required for major capacity expansions of utility systems or roads to meet the building loads and infrastructure requirements due to this project.

Technologies /Strategies: During the site selection process give preference to previously developed sites with installation/base cantonment redevelopment potential such as facility reduction program cleared sites.

1.C3 Contaminated Site Redevelopment[1]

Intent: Rehabilitate damaged sites where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land.

Requirement:
- ❑ Develop on a site that has been documented as contaminated by the Defense Site Environmental Restoration Tracking System, or by means of an ASTM E1903-97 Phase II Environmental Site Assessment, or classified at the Local, State, or Federal level as a brownfield, and has been restored through remediation under the Installation Restoration Program or as required by EPA's Sustainable Redevelopment of Brownfields Program requirements. **1**

Suggested Documentation:
- ❑ *Specifications:* Include specific requirements for site remediation in the following CSI Master Format Section: 02200 Site Hazardous Materials Removal, and 02300 Site Decontamination.
- ❑ *Design Analysis:* For contaminated sites, include a Site Remediation Plan in accordance with the EPA's Brownfield Redevelopment program requirements. For previously remediated sites, include documentation from the site remediation that was performed showing compliance with the EPA standard mentioned or the Installation Restoration Program.

Technologies /Strategies: Screen potential damaged sites for these criteria prior to selection for rehabilitation. Utilize EPA OSWER Direct 9610.17 and ASTM Standard Practice E1739 for site remediation where requiredDevelop and implement a site remediation plan using strategies such as pump-and-treat, bioreactors, land farming, and in-situ remediation.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.C4 Alternative Transportation[1]

Intent: Reduce pollution and land development impacts from automobile use.

Requirement: ❑ Locate building within ½ mile of installation/base transit systems. **1**

Suggested Documentation: ❑ *Design Analysis*: Describe the proximity to mass transit system in a design narrative. Specify the distance bus stops or commuter rail, light rail, or subway stops.

Requirement: ❑ For administrative, training, and other operational buildings, provide secure bicycle storage, with convenient changing/shower facilities (within the building or within 200 yards of the building), for 5% or more of regular building occupants. For residential buildings, provide covered storage facilities for securing bicycles for 15% or more of building occupants in lieu of changing/shower facilities. **1**

Suggested Documentation:
- ❑ *Specifications:* Specify bike parking under one of the following CSI Master Format Sections: 05500 Metal Fabrications, and 11000 Equipment.
- ❑ *Drawings:* Highlight bike parking on the Landscaping Plan, Site Development Plan, or equivalent plan. Include details for bike storage installation in the Site Details sheets. Also highlight the location of showers on the architectural plans.
- ❑ *Design Analysis:* Provide calculations showing that bike storage and shower facilities are provided based on building type at the required level. The regular building occupant population is based on FTE. For training facilities only consider the permanent cadre. For residential buildings, it is based on permanent occupants. For multifunction buildings, consider each category of occupant and provide for each.

Requirement: ❑ Provide alternative fuel vehicles for 3% of building occupants AND provide preferred parking for these vehicles, OR install alternative-fuel refueling stations for 3% of the total vehicle parking capacity of the site, OR locate building within 2 miles of alternative-fuel refueling station(s). **1**

Suggested Documentation:
- ❑ *Drawing:* Show the number of parking spaces provided on the appropriate site plan drawing such as the Si Paving Plan, or Site Development Plan. Highlight alternative fuel vehicle preferred parking.
- ❑ *Design Analysis:* Provide a narrative discussing the provision of alternative fuel vehicles, OR provide a narrative and/or a site map showing the location of the alternative-fuel refueling stations on-site, OR provide a narrative and/or a site map showing the location of the alternative-fuel station and the project and showing the distance between them.

Requirement: ❑ Size the parking capacity not to exceed minimum installation/base cantonment requirements AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants, OR, if no installation guidelines exist, size the parking capacity according to the minimum requirements by building typology as outlined in the Portland, Oregon Title 33 Planning and Zoning -Chapter 33.266 for Parking and Loading, Table 266-1 and 266-2 AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants, OR, add no new parking and reduce the capacity of existing oversized parking for rehabilitation projects AND provide preferred parking for carpools or vanpools capable of serving 5% of the building occupants. **1**

Suggested Documentation:
- ❑ *Drawings:* Show the number of parking spaces provided on the appropriate site plan drawing such as the Site Paving Plan, or Site Development Plan. Highlight preferred parking for carpools or vanpools.
- ❑ *Design Analysis:* Include a narrative describing the source of the parking requirements and provide calculations demonstrating compliance with the minimum allowable requirements.

Technologies /Strategies: Perform a transportation survey of future building occupants to identify transportation needs. Select sites near public installation/base transit served by safe, convenient pedestrian pathways. Design the building with transportation amenities such as bicycle racks and shower/changing facilities. Provide transportation amenities such as alternative fuel refueling stations and carpool/vanpool programs. Consider sharing the costs and benefits of refueling stations with adjacent buildings. Minimize parking lot/garage size. Consider sharing parking facilities with adjacent buildings.

Referenced Standard: Portland, Oregon Title 33, Planning and Zoning – Chapter 33.266 Parking and Loading. The referenced chapter establishes standards for the amount of motor vehicle parking for areas of higher density and high quality public transit service. Other applicable installation policies may regulate other aspects of motor vehicle parking.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.C5 Reduced Site Disturbance[1]

Intent: Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Requirement:
- ❑ On greenfield sites, limit site disturbance including earthwork and clearing of vegetation to 40 feet beyond t building perimeter, 5 feet beyond primary roadway curbs, walkways, and main utility branch trenches, and feet beyond constructed areas with pervious surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the paved area; OR, on previously developed sites, restore a minimum of 50% of the site area (excluding the building footprint) by replacing impervious surfaces with native or adapted vegetation. Adjustment of the disturbed area is allowable consistent with force protection measures as long overall site disturbance is kept within 130% of the area defined by the site disturbance limits. **1**

Suggested Documentation:
- ❑ *Specifications*: 01560 Temporary barriers and enclosures, 02230 Site Clearing, 02300 Earthwork
- ❑ *Drawings*:
  - Show the boundary for site disturbance on the Site Grading Plan, Site Demolition/Development Plans, or equivalent plans demonstrating that all site disturbance is within the required dimensions.
  - OR For the restoration option discussed in this credit, show the planting areas as well as a planting schedule on the Landscape Plan. Distinguish between existing landscaping and restored landscaping.

Requirement:
- ❑ Reduce the development footprint (including building, access roads and parking) to exceed the installation/base's master plan or local zoning's open space requirement for the site by 25% or in accordan with installation/base policy on open space set asides, whichever is greater. If no zoning or open space policies exist, designate open space equal to the development footprint. **1**

Suggested Documentation:
- ❑ *Design Analysis*: Include a copy of the open space requirements from the Installation Master Plan or local zoning code. Provide calculations demonstrating that the requirement has been satisfied. When no zoning codes exist, demonstrate that an area equal to the development footprint (including building, access roads and parking) is designated as open space.

Technologies /Strategies: Perform a site survey to identify site elements and adopt a master plan for development of the project site. Select a suitable building location and design the building with a minimal footprint to minimize site disruption. Strategies include stacking the building program, tuck-under parking and sharing facilities with neighbors. Establish clearly marked construction boundaries to minimize disturbance of the existing site and restore previously degraded areas to their natural state. Note requirements on plans and in specifications.

Consider the implications of force protection requirements when developing the siting, orientation, and massing of the building. Consider site disturbance along with building orientation, the accesses to the building, and other major landscape features during conceptual development. The balance between open area on the site and the building requirements may affect both the shape and size of the building. The site layout process typically is the first stage of the building design process and may run in parallel with defining the building program and building massing or occur shortly after.

Establish contractual penalties for destruction of trees and site areas noted for protection. Delineate laydown, recycling, and disposal areas. Use areas to be paved or already paved as staging areas. Work with local horticultural extension services, native plant societies, or installation/base agronomy staff to select indigenous plant species for site restoration and landscaping.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.0 Sustainable Sites (SS) (Continued)

1.C6 **Stormwater Management**[1]

Intent: Limit disruption of natural water flows by minimizing storm water runoff, increasing on-site infiltration, and reduci contaminants.

Requirement:
- ❑ If existing imperviousness is less than or equal to 50%, implement a stormwater management plan that prevents the post-development 1.5 year, 24 hour peak discharge rate from exceeding the pre-development 1.5 year, 24 hour peak discharge rate. OR If existing imperviousness is greater than 50%, implement a stormwater management plan that results in a 25% decrease in the rate and quantity of stormwater runoff. **1**

Suggested Documentation:
- ❑ *Specifications*: 02600 Drainage and Containment, and 02700 Pavements.
- ❑ *Drawings:* On the appropriate site plan, such as the Site Paving Plan or Landscape Plan, highlight paved area and site contours showing how water is retained on site. Provide a paving schedule indicating the type of paving used in each area and a reference to the perviousness of the material. Also highlight locations of retaining ponds or other systems intended to minimize stormwater runoff.
- ❑ *Design Analysis*:
  - Provide cut sheets for pervious paving systems used to lower runoff.
  - OR Provide a stormwater management plan as described in the credit for sites with existing imperviousness. Provide calculations showing that run off has been reduced by 50% from undeveloped to developed conditions.

Requirement:
- ❑ Construct site stormwater treatment systems designed to remove 80% of the average annual post development total suspended solids (TSS) and 40% of the average annual post development total phosphorous (TP) based on the average annual loadings from all storms less than or equal to the 2-year/24-hour storm. Do so by implementing Best Management Practices (BMPs) outlined in Chapter 4, Part 2 (Urb Runoff), of the United States Environmental Protection Agency's (EPA's) *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, January 1993 (Document No. EPA-840-B-92-002) or the local government's BMP document (whichever is more stringent). **1**

Suggested Documentation:
- ❑ *Specifications*: 02300 Earthwork, and 11300 Fluid Waste Treatment and Disposal Equipment.
- ❑ *Drawings:* Show the location of passive systems on the appropriate site plan such as on the Site Grading Plan, Site Development Plan, or Landscape Plan. Include detail drawings for active systems such as mechanical filters.
- ❑ *Design Analysis:* Provide a design narrative and calculations describing how the designed treatment systems will meet the requirements of this credit.

Technologies /Strategies: Design the project site to maintain natural stormwater flows by promoting infiltration. Specify garden roofs and pervious paving to minimize impervious surfaces. Reuse stormwater volumes generated for non-potable uses such as landscape irrigation, toilet, and urinal flushing and custodial uses. Retain pervious and vegetated areas to capture rainwater from impervious areas of the building for groundwater recharge. Design mechanically-based or utilize biologically-based and innovative stormwater management features for pollutant load reduction such as constructed wetlands, stormwater filtering systems, bioswales, bio-retention basins, and vegetated filter strips to treat the site's stormwater. Use open vegetated swales to reduce drainage velocity and erosion, reduce system maintenance, increase vegetative variety and support wildlife habitat where space permits.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.C7 Landscape and Exterior Design to Reduce Heat Islands[2]

Intent: Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

Requirement: ❑ Provide shade (within 5 years) AND/OR use light-colored/high-albedo materials (reflectance of at least 0.3) or open grid pavement for 30% of the site's non-roof impervious surfaces, including parking lots, walkways, plazas, etc., OR place a minimum of 50% of parking spaces underground or covered by structured parking; OR use open-grid pavement system (less than 50% impervious) for a minimum of 50% of the parking lot area. **1**

Suggested Documentation:
- ❑ *Specifications*: 02700 Pavements, and 02900 Planting.
- ❑ *Drawings:*
  - On the Landscaping plans, show location, type of vegetation used for shading, and information about the mature size of selected vegetation. Highlight the impervious area to be shaded, or otherwise demonstrate with calculations and diagrams that 30% will be shaded with in 5 years.
  - **OR** Indicate on the Site Paving Plan the area where light-colored/high-albedo materials will be used a demonstrate that it accounts for at least 30% of the impervious areas.
  - **OR** Demonstrate that at least 50% of the total parking is under-ground by indicating the number of spaces located in the underground parking as well as the number of parking spaces above ground. When underground parking is provided, the first few sheets of the architectural plans are typically reserved for below-grade floors and parking information used to satisfy this credit should be shown on these sheets.
  - **OR** Indicate on the Site Paving Plan the area where pervious paving systems will be used and demonstrate that it accounts for at least 50% of the parking lot areas. Also include a note on the Pavi Plan drawings stating that the pervious paving system is to have an impervious area of LESS than 50

Requirement: ❑ Use ENERGY STAR Roof compliant, high-reflectance AND high emissivity roofing (emissivity of at least 0.9 when tested in accordance with ASTM E408) for a minimum of 75% of the roof surface; OR, install a "green" (vegetated) roof for at least 50% of the roof area. Combinations of high albedo and vegetated roof can be used providing they collectively cover 75A% of the total roof area. **1**

Suggested Documentation:
- ❑ *Specifications*: 07300 Steep Roofing, 07400 Roofing and Siding Panels, and 07500 Membrane Roofing.
- ❑ *Drawings:*
  - On the Roof Plan, show that a minimum of 75% of the roof area meets the requirements for reflectance and emissivity. Specify roofing type, reflectance, and emissivity on the Roof Plan as well as any area calculations.
  - For Green roofs, show on the Roof Plan that the green roof covers at least 50% of the total roof area or that a combination of green roof and high-reflectance and high emissivity roofing account for 75% of t total roof area. Also reference detail drawings for the green roof. (Detail drawings are typically includ toward the end of the Architectural pages of the Construction Documents.)

Technologies /Strategies: Shade constructed surfaces on the site with landscape features and minimize the overall building footprint. Consider replacing constructed surfaces (i.e. roof, roads, sidewalks, etc.) with vegetated surfaces such as garden roofs and open grid paving or specify high-albedo materials to reduce the heat absorption. Visit the ENERGY STAR® Web site,www.energystar.gov, to look for compliant products. Consider installing high-albedo and vegetated roofs to reduce heat absorption. Note albedo/ reflectance requirements in the drawings and specifications. Provide shade (calculated on June 21, noon solar time) using native or climate tolerant trees and large shrubs, vegetated trellises, or other exterior structures supporting vegetation. Explore elimination of blacktop and the use of new coatings and integral colorants for asphalt to achieve light colored surfaces.

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1.0 Sustainable Sites (SS) (Continued)

1.C8 Light Pollution Reduction[1]

Intent: Eliminate light trespass from the building site, improve night sky access, and reduce development impact on nocturnal environments.

Requirement:
- ❑ Meet or provide lower light levels and uniformity ratios than those recommended by the Illuminating Engineering Society of North America (IESNA) Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99). Design exterior lighting such that all exterior luminaires with more than 1000 initial lamp lumens are shielded and all luminaires with more than 3500 initial lamp lumens are Full Cutoff (IESNA Classification). The maximum candela value of all interior lighting shall fall within the building (not out through windows) and the maximum candela value of all exterior lighting shall fall within the site. Any luminaire within a distance of 2.5 times its mounting height from the site boundary shall have shielding such that no light or brightness from that luminaire crosses the site boundary. **1**

Suggested Documentation:
- ❑ *Specifications:* 16500 Lighting.
- ❑ *Drawings:* On electrical plans, highlight exterior lighting as needed to demonstrate compliance.
- ❑ *Design Analysis:* Include cut sheets and lighting calculations in the Design Analysis that demonstrate compliance. Diagrams drawn to scale may be helpful to demonstrate compliance with this requirement. If not clearly defined, the site boundary shall be considered to include all disturbed land with a 50 foot buffer.

Technologies /Strategies: Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution. Minimize site lighting where possible and model the site lighting using a computer model. Technologies to reduce light pollution include full cutoff luminaries, low-reflectance surfaces, and low-angle spotlights. Exterior lighting should be consistent with security lighting requirements.

1.C9 Optimize Site Features[3]

Intent: Optimize utilization of the site's existing natural features and placement of man-made features on the site.

Requirement:
- ❑ Perform both of the following: **1**
  - Plan facility orientation and layout to maximize the use of free site energy and to take advantage existing site amenities such as trees and water features.
  - Plan facility, parking, and roadways to "fit" existing site contours and limit cut and fill consistent with force protection measures.

Suggested Documentation:
- ❑ *Specifications*: 02230 Site Clearing, 02300 Earthwork, and 13600 Solar and Wind Energy Equipment.
- ❑ *Drawings*: On the Site Grading Plan show existing and proposed contours.
- ❑ *Design Analysis*:
  - Include a narrative describing the prevailing winds and solar properties of the site that were taken into consideration in the design. Also describe systems incorporated into the building to take advantage of free site energy to meet the requirements.
  - AND In the Design Analysis describe efforts taken to minimize cut and fill on the site in accordance with this credit. It may be helpful to reference the Site Grading Plan showing existing and proposed contours.

Technologies /Strategies: Evaluate site resources to ascertain how each can enhance the proposed project and visa versa. Work to maximum advantage of the site's solar and wind attributes. Use landscaping to optimize solar and wind conditions and to contribute to energy efficiency; Locate and orient the facility on the site to optimize solar and wind conditions.

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[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

[3] Added material not reviewed or endorsed by U. S. Green Building Council.

1.0 Sustainable Sites (SS) (Continued)

1.C10 **Facility Impact**[3]

Intent: Minimize negative impacts on the site and on neighboring properties and structures; avoid or mitigate excessive noise, shading on green spaces, additional traffic, obscuring significant views, etc.

Requirement: ❑ Cluster facilities to reduce impact, access distance to utilities and sufficient occupant density to support ma transit. **1**

Suggested Documentation
- ❑ *Design Analysis:*
  - Include a narrative describing the measures taken to minimize impact on the site through employing the appropriate densities and taking advantage of adjacencies. Explain how the proposed design meets intent of the Installation Master Plan
  - Include diagrams for solar access and the resulting shadows for winter and summer seasons. Indicate the prevailing winds on a site plan diagram.

Requirement: ❑ Collaborate with installation/base and community planners to identify and mitigate potential impacts of the project beyond site boundaries, and transportation planners to insure efficient public transport. **1**

Suggested Documentation ❑ *Design Analysis*: Include a narrative of measures taken to reduce excess noise, minimize blocking of significant views, and transportation planning measures. Refer to specific drawings when appropriate.

Technologies /Strategies: Involve local/regional planners and community members in installation/base master planning processes. Recognize the context and the impact of a project beyond site boundaries, and integrate it with the larger installation/base/community context/land use.

1.C11 **Site Ecology**[3]

Intent: Identify and mitigate all existing site problems including contamination of soil, water, and air, as well as any negative impacts caused by noise, eyesores, or lack of vegetation, enhancing or creating new site habitat.

Requirement: ❑ Develop site environmental management and mitigation plan. **1**

Suggested Documentation: ❑ *Design Analysis*: Include the Site Environmental Management and Mitigation Plan discussing how measure that are detrimental to the site environment/ecology will be avoided.

Technologies /Strategies: Understand site and surrounding ecosystem interdependence and interconnectivity. Plan landscaping scheme to incorporate biodiversity. Preserve/enhance existing trees, hydrological features, ecosystems, habitats, and cultural resources. Increase the existence of healthy habitat for native species. Reintroduce native plants and trees where they have been destroyed by previous development.

[3] Added material not reviewed or endorsed by U. S. Green Building Council.

2.0 Water Efficiency (WE) Score 5

2.C1 Water Efficient Landscaping[2]

Intent: Limit or eliminate the use of potable water for landscape irrigation.

Requirement: ❑ Use high efficiency irrigation technology, OR, use captured rain or recycled site water to reduce potable water consumption for irrigation by 50% over conventional means. **1**

Suggested Documentation:
- ❑ *Specifications*: 02810 Irrigation systems, 02900 Plantings, and 02600 Drainage and Containment
- ❑ *Drawings*: Show and highlight the location of rainwater collection cistern on the Site plan.
- ❑ *Design Analysis*:
  - Include a narrative describing the irrigation system and the features that make it efficient. Provide baseline calculations and design calculations for the insulation system. Also include an explanation of native or adapted planting.
  - **OR** Provide a narrative describing the gray water irrigation system. Provide baseline calculations and design calculations for the insulation system. Also include an explanation of native or adapted plantin

Requirement: ❑ Use only captured rain or recycled site water for an additional 50% reduction (100% total reduction) of potable water for site irrigation needs, OR, do not install permanent landscape irrigation systems. **1**

Suggested Documentation:
- ❑ *Specifications*: 02810 Irrigation systems, 02900 Plantings, and 02600 Drainage and Containment.
- ❑ *Drawings*:
  - Show and highlight the location of rainwater collection cistern on the Site plan.
  - Note on Landscape plans "NO PERMANENT LANDSCAPE IRRIGATION SYSTEM TO BE INSTALLED"
- ❑ *Design Analysis*:
  - Include a narrative describing the gray water irrigation system. Provide baseline calculations and design calculations showing that the system is capable of providing 100% of the irrigation required for the site.
  - **OR** Provide a narrative describing how the site will not require permanent irrigation.

Technologies /Strategies: Perform a soil/climate analysis to determine appropriate landscape types and design the landscape with indigenous plants to reduce or eliminate irrigation requirements. Use high-efficiency irrigation systems and consider using stormwater and/or greywater for irrigation.Develop a landscaping water use baseline according t the methodology outlined in the LEED Reference Guide.

2.C2 Innovative Wastewater Technologies[2]

Intent: Reduce generation of wastewater and potable water demand, while increasing local aquifer recharge.

Requirement: ❑ Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%, OR, treat 100% of wastewater on site to tertiary standards. **1**

Suggested Documentation:
- ❑ *Specifications*: 15400 Plumbing Fixtures and Equipment, 11300 Wastewater Biological Systems Equipment, 13220 Wastewater Filtration Equipment, and 13260 Wastewater Handling and Treatment Equipment.
- ❑ *Drawings*:
  - Highlight fixtures and schedules on the Plumbing Plans for systems used to reduce potable water use.
  - OR Show organic or natural treatment systems on the Site Plan or on the Landscape Plan. Show location of mechanical treatments systems on the Floor Plan and submit shop drawings. Highlight high-efficiency plumbing fixtures on the Mechanical or Plumbing sheets.
- ❑ *Design Analysis*:
  - Describe measures taken to reduce potable water consumption. Provide design calculations and baseline calculations for municipally provided potable water.
  - OR Provide design calculations for the on-site wastewater system. Describe how the system works a demonstrate that it is capable of treating all wastewater to the required levels.

Technologies /Strategies: Specify high-efficiency fixtures and dry fixtures such as composting toilets and waterless urinals to reduce wastewater volumes. Consider reusing stormwater or greywater for sewage conveyance or on-site wastewater treatment systems (mechanical and/or natural). Develop a wastewater baseline according to the methodology outlined in the LEED Reference Guide. Implement decentralized on-site wastewater treatment and reuse systems. Provide advanced wastewater treatment after use by employing innovative, ecological, on-site technologies including constructed wetlands, a mechanicarecirculating sand filter, or aerobic treatment systems

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2.0 Water Efficiency (WE) (Continued)

2.C3 **Water Use Reduction**[2]

Intent: Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Requirement:
- ❑ Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements. **1**

Suggested Documentation:
- ❑ *Specifications*: 15400 Plumbing Fixtures and Equipment, 15700 HVAC Equipment, and Division 11 Equipment.
- ❑ *Design Analysis*: Describe the strategies used to reduce the water consumption from the baseline by the required percentage for the given points. Provide design calculations and baseline calculations demonstrating that the requirement has been met.

Requirement:
- ❑ Employ strategies that in aggregate use 30% less water than the water use baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements. **1**

Suggested Documentation:
- ❑ *Specifications*: 15400 Plumbing Fixtures and Equipment, 15700 HVAC Equipment, and Division 11 Equipment.
- ❑ *Design Analysis*: Describe the strategies used to reduce the water consumption from the baseline by the required percentage for the given points. Provide design calculations and baseline calculations demonstrating that the requirement has been met.

Technologies /Strategies: Estimate the potable and non-potable water needs for the building. Use high efficiency fixtures, dry fixtures such as composting toilets and waterless urinals, and occupant sensors to reduce the potable water demand. Consic reuse of stormwater and greywater for non-potable applications such as toilet and urinal flushing, mechanical systems and custodial uses. Develop a water use baseline including all water consuming fixtures, equipment, ar seasonal conditions according to methodology guidance outlined in the LEED Reference Guide. Specify high water efficiency equipment (dishwashers, laundry, cooling towers, etc.). Use recycled or storm water for HVAC/process make up water. Install cooling tower systems designed to minimize water consumption from drift, evaporation and blowdown.

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3.0 Energy and Atmosphere (EA) Score 28

3.R1 Fundamental Building Systems Commissioning[2] Reqd.

Intent: Verify and ensure that fundamental building elements and systems are designed, installed, and calibrated to operate as intended.

Requirement:
- ❑ Implement all of the following fundamental best practice commissioning procedures.
  - Engage a commissioning authority.
  - Develop design intent and basis of design documentation.
  - Include commissioning requirements in the construction documents.
  - Develop and utilize a commissioning plan.
  - Verify installation, functional performance, training and documentation.
  - Complete a commissioning report.

Suggested Documentation:
- ❑ *Specifications*: 01800 Facility Operation, and 15950 Testing/Adjusting/Balancing.
- ❑ *Design Analysis*: Provide a copy of the contract with the commissioning agent and a copy of the commissioning plan. Include a narrative that describes how the other aspects of this requirement have been satisfied.

Technologies /Strategies: Engage a commissioning authority and adopt a commissioning plan. Include commissioning requirements in bid documents and task the commissioning agent to produce a commissioning report once commissioning activities are completed. Introduce standards and strategies into the design process early, and then carry through selected measures by clearly stating target requirements in the construction documents. Tie contractor final payments to documented system performance. Consult Engineer Regulation 1110-345-723, Systems Commissioning Procedures for additional guidance.

3.R2 Minimum Energy Performance[1] Reqd.

Intent: Establish the minimum level of energy efficiency for the base building and systems.

Requirement:
- ❑ Design the building to comply with the latest version of ASHRAE/IESNA Standard 90.1.

Suggested Documentation:
- ❑ *Design Analysis*:
  - Provide a narrative or summary table of design features that comply with TI-800-01 which references UFC 3-400-01, Design: Energy Conservation.
  - Provide a copy of the report from energy simulation software (BLAST, DOE-2, EnergyPlus) as per requirements of ASHRAE 90.1-2001.

Technologies /Strategies: Design the building envelope and systems to maximize energy performance. Use a computer simulation model assess the energy performance and identify the most cost effective energy measures. Quantify energy performance compared to the baseline building.

Use building modeling and analysis techniques to establish and document compliance. ASHRAE/IESNA 90.1-2001, Appendix G, provides guidance for establishing building base case development and analysis. Refer to the LEED Reference Guide for a wide variety of energy efficiency strategy resources.

3.R3 CFC Reduction in HVAC&R Equipment[2] Reqd.

Intent: Reduce ozone depletion.

Requirement:
- ❑ Zero use of CFC-based refrigerants in new base building HVAC&R systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phaseout conversion.

Suggested Documentation:
- ❑ *Specifications*: 15600 Refrigeration Equipment, 15700 HVAC Equipment and 01800 Facility Operation.
- ❑ *Design Analysis*: Provide or include a review of the CFC phase-out/conversion in the commissioning plan demonstrating compliance as outlined.

Technologies /Strategies: When reusing existing HVAC systems, conduct an inventory to identify equipment that uses CFC refrigerants and adopt a replacement schedule for these refrigerants. For new buildings, specify new HVAC equipment that uses no CFC refrigerants.

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3.C1 Optimize Energy Performance[1]

Intent: Achieve increasing levels of energy performance above the prerequisite standard to reduce environmental impacts associated with excessive energy use.

Requirement: ❑ Reduce design energy cost compared to the energy cost budget for energy systems regulated by the latest version of ASHRAE/IESNA Standard 90.1, as demonstrated by a whole building simulation using the Energy Cost Budget Method described in Section 11 and Appendix G of the Standard. **20**

- 1 Point will be awarded for every reduction in design energy cost of 2.5% for both new and existing facilities for a maximum score of 20 points.

Regulated energy components include HVAC systems, building envelope, service hot water systems, lighting and other regulated systems as defined by ASHRAE.

Suggested Documentation: ❑ *Design Analysis*:

- Provide a narrative describe the energy saving measures incorporated in the building. Show a table of model variables that differ from the baseline case to the proposed design and give the values used in the energy simulation.
- Provide a copy of the report from energy simulation software (BLAST, DOE-2, EnergyPlus) showing the percentage that the Design Energy Use (DEU) is less than the Design Energy Budget (EUB) as defined in ASHRAE 90.1-2001. Unit of measure for performance shall be annual energy cost. Life-Cycle energy costs shall be determined using rates for purchased energy, such as electricity, gas, oil, propane, steam, and chilled water and approved by the adopting authority. Life Cycle Costing is to be done in accordance with 10 CFR 436.

Technologies /Strategies: Design the building envelope and building systems to maximize energy performance. Use a computer simulation model to assess the energy performance and identify the most cost-effective energy efficiency measures. Quantify energy performance as compared to a baseline building.

Perform interactive energy use analysis for selected design elements that affect energy performance and document compliance. Life-Cycle energy costs shall be determined using rates for purchased energy, such as electricity, gas, oil, propane, steam, and chilled water and approved by the adopting authority. Refer to the LEED Reference Guide or Whole Building Design Guide for a wide variety of energy efficiency resources and strategies including conservation measures, electromechanical energy efficiency technologies (for example ground-source heat pumps), passive heating and cooling strategies, solar hot water, and daylighting.

Life-Cycle costing will be done in accordance with 10 CFR 436.

Consider installation of an Energy Management and Control System (EMCS), which is compatible with exiting installation systems to optimize performance. Use sensors to control loads based on occupancy, schedule and/or the availability of natural resources use (day light or natural ventilation).

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

3.0 Energy and Atmosphere (EA) (Continued)

3.C2 Renewable Energy[1]

Intent: Encourage and recognize increasing levels of self-supply through renewable technologies to reduce environmental impacts associated with fossil fuel energy use.

Requirement: ❑ Supply a net fraction of the building's total energy use through the use of on-site renewable energy systems

% of Total Annual Energy Usage in Renewables	
5%	**1**
10%	**2**
15%	**3**
20%	**4**

Suggested Documentation:
- ❑ *Specifications*: 01800 Facility Operation, 13600 Solar and Wind Energy Equipment, and 16200 Electrical Power.
- ❑ *Drawings*: Highlight the location of renewable energy systems on the Site Plan and on the architectural plans where appropriate.
- ❑ *Design Analysis*: Provide calculations showing the percentage of building energy provided by on-site renewable energy systems. Include a narrative describing energy saving measures incorporated in the building. Include a section in the Commissioning Plan to insure that the percentage of power provided by renewable systems is maintained throughout the facility life cycle.

Technologies /Strategies: Assess the project for non-polluting and renewable energy potential including solar, wind, geothermal, low-impact hydro, biomass, and bio-gas strategies. When applying these strategies, take advantage of net metering with the local utility.

Employ the use of on-site non-polluting-source renewable technologies contributing to the total energy requirements of the project. Passive solar, solar hot water heating, ground-source heat pumps, and daylighting not qualify for points under this credit. Credit for these strategies is given in Energy & Atmosphere Credit 1: Optimizing Energy Performance.

3.C3 Additional Commissioning[2]

Intent: Verify and ensure that the entire building is designed, constructed, and calibrated to operate as intended.

Requirement: ❑ In addition to the Fundamental Building Commissioning prerequisite, implement the following additional commissioning tasks: **1**

1. Conduct a focused review of the design prior to the construction documents phase.
2. Conduct a focused review of the construction documents when close to completion.
3. Conduct a selective review of contractor submittals of commissioned equipment.
4. Develop a system and energy management manual.
5. Have a contract in place for a near-warranty end or post occupancy review.

Items 1, 2, and 3 must be performed by someone other than the designer.

Suggested Documentation:
- ❑ *Specifications*: 01800 Facility Operation, and 15950 Testing/Adjusting/Balancing.
- ❑ *Design Analysis*: Include a copy of the contract for additional commissioning in the Design Analysis.

Technologies /Strategies: Engage the commissioning authority early in the design phases.

3.C4 << Deleted >>[1]

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[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

3.C5 Measurement and Verification[2]

Intent: Provide for the ongoing accountability and optimization of building energy and water consumption performance over time.

Requirement: ❑ Install continuous metering equipment for the following end-uses: **1**

- Lighting systems and controls.
- Constant and variable motor loads.
- Variable frequency drive (VFD) operation.
- Chiller efficiency at variable loads (kW/ton).
- Cooling load.
- Air and water economizer and heat recovery cycles.
- Air distribution static pressures and ventilation air volumes.
- Boiler efficiencies.
- Building specific process energy efficiency systems and equipment.
- Indoor water risers and outdoor irrigation systems.

Develop a Measurement and Verification plan that incorporates the monitoring information from the above end-uses and is consistent with Option B, C or D of the 2001 *International Performance Measurement & Verification Protocol (IPMVP) Volume I: Concepts and Options for Determining Energy and Water Savings.*

Suggested Documentation:
- ❑ *Specifications*: 16290 Power Measure & Control, and 15900 HVAC Instrumentation and Control.
- ❑ *Drawings*: Highlight the equipments installed in the building for purposes of monitoring on the Mechanical Plan, and Electrical Plan.
- ❑ *Design Analysis*: Include a list of all measurement devices installed in the building. Also provide a copy of the measurement and verification plan with a summary schedule of instruments and controls related to each monitoring category.

Technologies /Strategies: Model the energy and water systems to predict savings. Design the building with equipment to measure energy and water performance. Draft a Measurement & Verification Plan to apply during building operation that compares predicted savings to those actually achieved in the field.Employ building automation systems to perform M&V functions where applicable. Tie contractor final payments to documented M&V system performan and include in the commissioning report. Provide for ongoing M&V system maintenance and operating plan in building operations and maintenance manuals. Consider installation of an Energy Management and Control System (EMCS), which is compatible with exiting installation/base systems to optimize performance.

3.C6 Green Power[2]

Intent: Encourage the development and use of grid-source, renewable energy technologies on a net zero pollution bas

Requirement: ❑ Provide at least 50% of the building's electricity from renewable sources by engaging in at least a two-year renewable energy contract. Renewable sources are as defined by the Center for Resource Solutions (CRS) Green-e products certification requirements. **1**

Suggested Documentation: ❑ *Design Analysis*: Provide calculations for the expected building power consumption. Include a copy of a minimum 2-year contract to purchase power equal to the projected building consumption

Technologies /Strategies: Determine the energy needs of the building and investigate opportunities to engage in a green power contract w the local utility. Green power is derived from solar, wind, geothermal, biomass or low-impact hydro sources. Green power may be procured from a Green-e certified power marketer, a Green-e accredited utility program, through Green-e certified Tradable Renewable Certificates, or from a supply that meets the Green-e renewable power definition. Visit www.green-e.org for details about the Green-e program.

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3.C7 **Distributed Generation**[3]

Intent: Encourage the development and use of distributed generation technologies, which are less polluting than grid-source energy.

Requirement:
- ❑ Reduce total energy usage and emissions by considering source energy implications and local cogeneration and direct energy conversion. Generate at least 50% of the building's projected annual consumption by on-site distributed generation sources. **1**

Suggested Documentation:
- ❑ *Specifications*: 01800 Facility Operation, 13600 Solar and Wind Energy Equipment, and 16200 Electrical Power
- ❑ *Drawings*: Highlight the location of generation equipment/facilities on the Site Plan.
- ❑ *Design Analysis*: Provide narrative including calculations demonstrating that the on-site energy generation system is capable of supplying 50% of the building energy requirements. Include a section in the Commissioning Plan to insure that the percentage of power provided by renewable systems is maintained throughout the facility life cycle.

Technologies /Strategies: Investigate the use of integrated generation and delivery systems, such as co-generation, fuel cells, micro-turbines and off-peak thermal storage.

[3] Added material not reviewed or endorsed by U. S. Green Building Council.

4.0 Materials and Resources (MR) Score 13

4.R1 **Storage & Collection of Recyclables**[2] **Reqd.**

Intent: Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Requirement:
- ❑ Provide an easily accessible area that serves the entire building that is dedicated to the separation, collecti and storage of materials for recycling including (at a minimum) paper, glass, plastics, and metals.

Suggested Documentation:
- ❑ *Specifications*: 11170 Solid Waste Handling Equipment.
- ❑ *Drawings*: Highlight the area for collection of recyclables on the floor plans. Also highlight locations of was collection chutes and receptacle areas.
- ❑ *Design Analysis*: Provide a narrative substantiating that the space allotted for collection of recyclables is adequate for the facility.

Technologies /Strategies: Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area. Identify local waste handlers and buyers for glass, plastic, office paper, newspaper, cardboard and organic wastes. Instruct occupants on building recycling procedures. Consider employing cardboard balers, aluminum can crushers, recycling chutes and other waste management technologies to further enhance the recycling program.

Establish a waste management plan which meets requirements of the installation/base environmental and/or solid waste management plans in cooperation with users to encourage recycling. Reserve space for recycling functio early in the building occupancy programming process and show areas dedicated to collection of recycled materials on space utilization plans. Broader recycling support space considerations should allow for collection and storage of the required elements and newspaper, organic waste (food and soiled paper), and dry waste. When collection bins are used, bin(s) should be able to accommodate a 75% diversion rate and be easily accessible to custodial staff and recycling collection workers. Consider bin designs that allow for easy cleaning to avoid health issues.

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4.C1 **Building Reuse**[(2)]

Intent: Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste, and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Requirement: Reuse large portions of existing structures during renovation or redevelopment projects.

- ❑ Maintain at least 75% of existing building structure and shell (exterior skin and framing, excluding window assemblies and non-structural roofing material). **1**

Suggested Documentation:
- ❑ *Specifications*: 02225 Selective Demolition.
- ❑ *Drawings*: Note and highlight on the Demolition Plans the structural elements which are to be preserved. C the Elevations, note and highlight the shell elements to be preserved.
- ❑ *Design Analysis*: Provide calculations substantiating that at least 75% of the existing building structure and shell are being preserved.

Requirement:
- ❑ Maintain an additional 25% (100% total) of existing building structure and shell (exterior skin and framing, excluding window assemblies and non-structural roofing material). **1**

Suggested Documentation:
- ❑ Specifications: 02225 Selective Demolition
- ❑ Drawings: Note and highlight on the Demolition Plans the structural elements which are to be preserved. C the Elevations, note and highlight the shell elements to be preserved.
- ❑ Design Analysis: Provide calculations substantiating that 100% of the existing building structure and shell are being preserved.

Requirement:
- ❑ Maintain 100% of existing building structure and shell (exterior skin and framing, excluding window assemblies and non-structural roofing material) AND at least 50% of non-shell areas (interior walls, doors, floor coverings and ceiling systems). **1**

Suggested Documentation:
- ❑ *Specifications*: 02225 Selective Demolition.
- ❑ *Drawings*: Note and highlight on the Demolition Plans the structural and non-structural elements which are to be preserved. On the Elevations, note and highlight the shell elements to be preserved.
- ❑ *Design Analysis*: Provide calculations substantiating that 100% of the existing building structure and shell are being preserved AND 50% of the non-shell components.

Technologies /Strategies: Consider reuse of existing buildings, including structure, shell, and non-shell elements. Remove elements that pose contamination risk to building occupants and upgrade outdated components such as windows, mechanical systems, and plumbing fixtures. Quantify the extent of building reuse.Evaluate retention of existing structure. Consider facade preservation, particularly in installation/base areas. During programming and space planning, consider adjusting needs and occupant use patterns to fit within existing building structure and interior partition configurations. Identify and effectively address energy, structural, and indoor environmental (lead & asbestos) issues in building reuse planning and deconstruction documents. Percentage of reused non-shell building portions will be calculated as the total area (in Square Feet (SF)) of reused walls, floor covering, and ceiling systems, divided by the existing total area (SF) of walls, floor covering, and ceiling systems.

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4.C2 Construction Waste Management[2]

Intent: Divert construction, demolition, and land clearing debris from landfill disposal. Redirect recyclable material back to the manufacturing process. Redirect reusable materials to appropriate sites.

Requirement: Develop and implement a waste management plan, quantifying material diversion goals:

- ❑ Recycle and/or salvage at least 50% (by weight) of construction, demolition, and land clearing waste. Calculations can be done by weight or volume, but must be consistent throughout. **1**

Suggested Documentation:
- ❑ *Specifications*: 01505 Construction Waste Management.
- ❑ *Design Analysis*: Include a Construction Waste Management Plan.

Requirement:
- ❑ Recycle and/or salvage an additional 25% (75% total) of the construction, demolition, and land clearing waste. Calculations can be done by weight or volume, but must be consistent throughout. **1**

Suggested Documentation:
- ❑ *Specifications*: 01505 Construction Waste Management.
- ❑ *Design Analysis*: Include a Construction Waste Management Plan.

Technologies /Strategies: Establish goals for landfill diversion and adopt a construction waste management plan which meets requirements of the installation/base environmental and/or solid waste management plans to achieve these goals. Consider recycling land clearing debris, cardboard, metal, brick, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Designate a specific area on the construction site for recycling and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated materials. Note that salvage may include donation of materials to charitable organizations such as Habitat for Humanity.

Consider deconstruction, salvage, and recycling strategies and processes, including waste auditing; and documenting the cost for recycling, salvaging, and reusing materials. Source reduction on the job site should be an integral part of the plan.

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4.C3 **Resource Reuse**[2]

Intent: Reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

Requirement: ❑ Use salvaged, refurbished, or reused materials, products and furnishings for at least 5% of building materials. **1**

Suggested Documentation:
- ❑ *Specifications*: XX050 for each material division
- ❑ *Design Analysis*: Provide a table listing all sections of the specifications where salvaged or refurbished material have been specified including the respective estimated dollar values of these materials. Demonstrate that this accounts for 5% of the building materials used.

Requirement: ❑ Use salvaged, refurbished, or reused materials, products and furnishings for at least 10% of building materials. **1**

Suggested Documentation:
- ❑ *Specifications*: XX050 for each material division.
- ❑ *Design Analysis*: Provide a table listing all sections of the specifications where salvaged or refurbished material have been specified including the respective estimated dollar values of these materials. Demonstrate that this accounts for 10% of the building materials used.

Technologies /Strategies: Identify opportunities to incorporate salvaged materials into building design and research potential material suppliers. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick and decorative items. See the LEED Reference Guide for calculation tools and guidelines.

Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars* (see exclusions) of the salvaged or refurbished material.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: In total dollar calculations, exclude; labor costs; all mechanical and electrical material and labor cos and project overhead and fees. *If the cost of the salvaged or refurbished material is below market value, use replacement cost to estimate the material value, otherwise use actual cost to the project.

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4.C4 **Recycled Content**[2]

Intent: Increase demand for building products that incorporate recycled content materials, therefore reducing impacts resulting from extraction and processing of new virgin materials.

Requirement: ❑ Use materials with recycled content so that the sum of the post-consumer recycled content plus one-half of the post-industrial recycled content constitutes at least 5% of the total value of materials in the project. **1**

Requirement: ❑ Use materials with recycled content so that the sum of the post-consumer recycled content plus one-half of the post-industrial recycled content constitutes at least 10% of the total value of materials in the project. **1**

The value of the recycled content portion of a material or furnishing shall be determined by dividing the weight of recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item.

Mechanical and electrical components shall not be included in this calculation. Recycled content materials shall be defined in accordance with the Federal Trade Commission document, *Guides for the Use of Environmental Marketing Claims, 16 CFR 260.7 (e)*, available at www.ftc.gov/bcp/grnrule/guides980427.htm.

Suggested Documentation:
- ❑ *Specifications*: XX050 for each material division.
- ❑ *Design Analysis*: Provide a table listing all sections of the specifications where recycled materials or materials with recycled content are available. List the percentage of recycled content per material, the estimated quantity, the cost, and the total estimated project cost. Provide calculations showing the total recycled content as a percentage.

Technologies /Strategies: Establish a project goal for recycled content materials and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed and quantify the total percentage of recycled content materials installed.

Select products and materials with supporting information from the AIA Resource Guide or the EPA Environmentally Preferable Purchasing (EPP) Program. Common building materials and products with recycled content include; wall, partition, and ceiling materials and systems; insulation; tiles and carpets; cement, concrete, and reinforcing metals; structural and framing steel. For products/materials not listed, selection should be made on the basis of EPP criterion and/or:

- Toxicity;
- Embodied energy;
- Production use of water, energy and ozone depleting substances (ODSs);
- Production limits on toxic emissions and effluents;
- Minimal, reusable or recycled/recyclable packaging;
- Impact on indoor environmental quality (IEQ);
- Installation that limits generation of waste;
- Materials that limit waste generation over their life;
- EPA guideline compliance; and
- Harvested on a sustainable yield basis.

See the LEED Reference Guide for a summary of the EPA guidelines and calculation methodology guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars (see exclusions) of the material that contain recycled content.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees)

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4.C5 Local/Regional Materials[2]

Intent: Increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the regional economy and reducing the environmental impacts resulting from transportation.

Requirement:
- ❑ Use a minimum of 20% of building materials and products that are manufactured* regionally within a radius 500 miles. **1**

* Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen. For example, if the hardware comes from Dallas, Texas, the lumber from Vancouver, British Columbia, and the joist is assembled in Kent, Washington; then the location of the final assembly is Kent, Washington.

Suggested Documentation:
- ❑ *Specifications*: XX050 for each division.
- ❑ *Design Analysis*: Provide a table listing all sections of the specifications for which regionally manufactured materials are available within a 500 mile radius. List the estimated quantity, unit cost, and the total estimat project cost. Demonstrate that 20% of the building materials were manufactured within a 500 mile radius.

Requirement:
- ❑ Of the regionally manufactured materials documented for MR Credit 4.C5.1, above, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site. **1**

Suggested Documentation:
- ❑ *Specifications*: XX050 for each material division.
- ❑ *Design Analysis*: Provide an expansion of the table above, showing which materials were harvested, extracted, or recovered (as well as manufactured) within a 500 mile radius. Demonstrate that 50% of the building materials are so defined.

Technologies /Strategies: Establish a project goal for locally sourced materials and identify materials and materials suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed.

Contact the state and local waste management boards for information about regional building materials. See the LEED Reference Guide for calculation methodology guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars (see exclusions) of material that is locally or regionally manufactured.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees.

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4.C6 Rapidly Renewable Materials[2]

Intent: Reduce the use and depletion of finite raw and long cycle renewable materials by replacing them with rapidly renewable materials.

Requirement:
- ❑ Use rapidly renewable building materials and products (made from plants that are typically harvested within ten-year cycle or shorter) for 5% of the total value of all building materials and products used in the project. **1**

Suggested Documentation:
- ❑ *Specifications*: XX050 for each division, and 09600 Flooring.
- ❑ *Drawings*: Note on appropriate architectural finish drawings where rapidly renewable materials are require
- ❑ *Design Analysis*:
  - Provide a table listing sections of the specifications that call for rapidly renewable materials.
  - Show calculations that demonstrate that rapidly renewable materials account for 5% of total building materials. Determine percentages in terms of dollar value using the following steps:
    1. Calculate total dollars (see exclusions) of materials that are considered to be rapidly renewable
    2. Calculate total dollars (see exclusions) of all building materials.
    3. Divide Step 1 by Step 2 to determine the percentage.

  Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees.

Technologies /Strategies: Establish a project goal for rapidly renewable materials and identify materials and suppliers that can achieve this goal. Consider materials such as bamboo flooring, wool carpets, straw board, cotton batt insulation, linoleum flooring, poplar OSB, sunflower seed board, wheatgrass cabinetry and others. During construction, ensure that the specified rapidly renewable materials are installed.See the LEED Reference Guide for additional calculation methodology guidelines.

4.C7 Certified Wood[2]

Intent: Encourage environmentally responsible forest management.

Requirement:
- ❑ Use a minimum of 50% of wood-based materials certified in accordance with the Forest Stewardship Council's Principals and Criteria, for wood building components including, but not limited to, structural framing and general dimensional framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers. **1**

Suggested Documentation:
- ❑ *Specifications*: 06100 Rough Carpentry, 06200 Finish Carpentry, and 06400 Architectural Woodwork.
- ❑ *Drawings*: Note on applicable architectural and structural drawings where certified wood is to be used.
- ❑ *Design Analysis*: Provide a list of all wood-based products used and their costs. Highlight those that are certified wood and demonstrate that certified wood accounts for 50% of the costs for all wood-based products used for the project. Supply copies of chain of custody certification documentation from the supplier.

Technologies /Strategies: Establish a project goal for FSC-certified wood products and identify suppliers that can achieve this goal. During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.

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5.0 Indoor Environmental Quality (IEQ) Score 17

5.R1 **Minimum IAQ Performance**[1] **Reqd.**

Intent: Establish minimum indoor air quality (IAQ) performance to prevent the development of indoor air quality problems in buildings, thus contributing to the comfort and well-being of the occupants.

Requirement:
- ❑ Meet the minimum requirements of voluntary consensus standard ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda (see ASHRAE 62-2001, Appendix H, for a complete compilation of Addenda) using the Ventilation Rate Procedure.

Suggested Documentation:
- ❑ *Specifications*: 01800 Facility Operation, and 15950 Testing/Adjusting/Balancing.
- ❑ *Drawings*: Include a note on the first sheet of the mechanical drawings stating compliance with ASHRAE62-1999. Also state design criteria and assumptions.
- ❑ *Design Analysis*: Include a letter from the Mechanical Engineer stating that the design complies with ASHRAE 62-1999. The letter should describe the design criteria and any assumptions made.

Technologies /Strategies: Design the HVAC system to meet the ventilation requirements of the referenced standard. Identify potential IAQ problems on the site and locate air intakes away from contaminant sources.

Include proactive design details that will eliminate some of the common causes of indoor air quality problems in buildings. Incorporate references to targets in plans and specifications. Ensure ventilation system outdoor air capacity can meet standards in all modes of operation. Locate building outdoor air intakes (including operable windows) away from potential pollutants/contaminant sources such as sporulating plants (allergens), loading areas, building exhaust fans, cooling towers, sanitary vents, dumpsters, vehicular exhaust, and other sources of contamination. Include operational testing in the building commissioning report. Design cooling coil drain pans to ensure complete draining. Include measures to control and mitigate radon buildup in areas where it is prevalent. Limit humidity to a range that minimizes mold growth and promotes respiratory health.

5.R2 **Environmental Tobacco Smoke (ETS) Control**[2] **Reqd.**

Intent: Prevent exposure of building occupants and systems to Environmental Tobacco Smoke (ETS).

Requirement:
- ❑ Zero exposure of nonsmokers to ETS by EITHER:
  - Prohibition of smoking in the building,

OR
  - Providing a designated smoking room designed to effectively contain, capture and remove ETS from tl building. At a minimum, the smoking room shall be directly exhausted to the outdoors with no recirculation of ETS-containing air to the non-smoking area of the building, enclosed with impermeable structural deck-to-deck partitions and operated at a negative pressure compared with the surrounding spaces of at least 7 Pa (0.03 inches of water gauge).

Performance of smoking rooms shall be verified using tracer gas testing methods as described in ASHRAE Standard 129-1997. Acceptable exposure in non-smoking areas is defined as less than 1% of the tracer gas concentration in the smoking room detectable in the adjoining non-smoking areas. Smoking room testing as described in the ASHRAE Standard 129-1997 is required in the contract documents and critical smoking facility systems testing results must be included in the building commissioning plan and report or as a separate document.

Suggested Documentation:
- ❑ *Specifications*: 01800 Facility Operation, and 15950 Testing/Adjusting/Balancing.
- ❑ *Drawings*: Indicate designated outdoor smoking areas on the Site Plan (if applicable).

Technologies /Strategies: Prohibit smoking in the building or provide separate smoking rooms with isolated ventilation systems.

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[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

5.C1 IAQ Monitoring[1]

Intent: Provide capacity for indoor air quality (IAQ) monitoring to help sustain long-term occupant comfort and well-beir

Requirement:
- ❑ Install a permanent carbon dioxide (CO_2) monitoring system that provides feedback on space ventilation performance in a form that affords operational adjustments. Refer to the CO_2 differential for all types of occupancy in accordance with ASHRAE 62-2001, Appendix D. **1**

Suggested Documentation:
- ❑ *Specifications*:
  - 01800 Facility Operation, 13850 Detection and Alarm, and 15950 Testing/Adjusting/Balancing.
  - Specifically note that indoor CO2 levels should never be permitted to exceed outdoor levels by more than 530 parts per million
- ❑ *Drawings*: Highlight the location of CO2 monitoring equipment in the Mechanical Drawings. Also state the set-point parameters.

Technologies /Strategies: Design the HVAC system with carbon dioxide monitoring sensors and integrate these sensors with the building automation system (BAS). Situate monitoring locations in areas of the building with high occupant densities and at the ends of the longest runs of the distribution ductwork. Specify that system operation manuals require calibration of all of the sensors per manufacturer recommendations but not less than one year. Include sensor and system operational testing and initial set point adjustment in the commissioning plan and report. Also consider periodic monitoring of carbon monoxide (CO), total volatile organic compounds (TVOCs), and particulates (including PM10).

5.C2 Increase Ventilation Effectiveness[2]

Intent: Provide for the effective delivery and mixing of fresh air to support the safety, comfort, and well-being of building occupants.

Requirement:
- ❑ For mechanically ventilated buildings, design ventilation systems that result in an air change effectiveness (Eac) greater than or equal to 0.9 as determined by ASHRAE 129-1997. For naturally ventilated spaces demonstrate a distribution and laminar flow pattern that involves not less than 90% of the room or zone area in the direction of air flow for at least 95% of hours of occupancy. **1**

Suggested Documentation:
- ❑ *Design Analysis*: Provide plan and elevation drawings including furniture for each major room type. Graphically show how the airflow patterns are designed to meet the requirements of this credit. Also include a specification table of all the terminal vents, grills and registers cross-referenced in the drawings.

Technologies /Strategies: Design the HVAC system and building envelope to optimize air change effectiveness. Air change effectiveness can be optimized using a variety of ventilation strategies including displacement ventilation, low-velocity ventilation, plug-flow ventilation such as under floor or near floor delivery, and operable windows. Test the air change effectiveness of the building after construction. See the LEED Reference Guide for compliance methodology guidelines.

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5.C3 Construction IAQ Management Plan[2]

Intent: Prevent indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

Requirement: ❑ Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows: **1**

- During construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, chapter 3.
- Protect stored on-site or installed absorptive materials from moisture damage.
- If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill, as determined by ASHRAE 52.2-1999.
- Replace all filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999 for media installed at the end of construction.

Suggested Documentation: ❑ *Design Analysis*:

- Provide a copy of the Construction IAQ Management Plan to be implemented during construction and pre-occupancy. Highlight areas that demonstrate how the SMACNA guidelines have been met or exceeded. Describe in a narrative the techniques used to protect absorptive materials from moisture damage.
- When air handlers are used during construction, include cutsheets for filtration media showing it meets the MERV of 8. Establish a payment clause in the contract with the contractor to insure filters are replaced with MERV 13 filters prior to occupancy.

Requirement: ❑ After construction ends and prior to occupancy conduct a minimum two-week building flush-out with new Minimum Efficiency Reporting Value (MERV) 13 filtration media at 100% outside air. After the flushout, replace the filtration media with new MERV 13 filtration media, except the filters solely processing outside a OR Conduct a baseline indoor air quality testing procedure consistent with current EPA's current *Protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445*. **1**

Suggested Documentation: ❑ *Design Analysis*: Provide a letter from the architect or engineer detailing the building flush-out process, or provide a letter specifying how, when, and by whom an indoor air quality test will be performed. Supplement the Design Analysis with a copy of the testing results.

Technologies /Strategies: Adopt an IAQ management plan to protect the HVAC system during construction, control pollutant sources, and interrupt contamination pathways. Sequence the installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile, and gypsum wall board. Prior to occupancy, perform a two-week building flush-out or test the contaminant levels in the building.

Specify containment control strategies including protecting the HVAC system, controlling pollutant sources, interrupting pathways for contamination, enforcing proper housekeeping and coordinating schedules to minimize disruption. Specify the construction sequencing to install absorptive materials after the prescribed dry or cure tin of wet finishes to minimize adverse impacts on indoor air quality. Materials directly exposed to moisture through precipitation, plumbing leaks, or condensation from the HVAC system are susceptible to microbial contamination. Appoint an IEQ Manager with owner's authority to inspect IEQ problems and require mitigation as necessary.

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5.C4 Low-Emitting Materials[2]

Intent: Reduce the quantity of indoor air contaminants that are odorous, potentially irritating, and/or harmful to the comf and well-being of installers and occupants.

Requirement: The VOC content of adhesives, sealants, paints, composite wood products, and carpet systems must be less th the current VOC limits as follows:

- ❑ The VOC content of adhesives and sealants used must be less than the current VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule #1168, AND all sealants used as fillers must meet exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51. **1**
- ❑ VOC emissions from interior paints and coatings must not exceed the VOC and chemical component limits Green Seal's Standard GS-11 requirements. **1**
- ❑ Carpet systems must meet or exceed the requirements of the Carpet and Rug Institute Green Label Indoor Air Quality Test Program. **1**
- ❑ Composite wood or agrifiber products must contain no added urea-formaldehyde resins. **1**

Suggested Documentation:
- ❑ *Specifications*: Ensure that VOC limits are clearly stated in specifications: 05950 Paints & Protective Coatings, 06100 Rough Carpentry, 06600 Plastic Fabrications, 07900 Joint Sealers, 09600 Flooring, 09700 Wall Finishes, and 09900 Paints & Coatings.

Technologies /Strategies: Specify Low-VOC materials in construction documents. Ensure that VOC limits are clearly stated in each section where adhesives and sealants are addressed. Specify Low-VOC paints and coatings in construction documents. Ensure that VOC limits are clearly stated in each section where paints are addressed. Specify Low-VOC carpet products and systems in construction documents. Ensure that VOC limits are clearly stated where carpet systen are addressed. Specify wood and agrifiber products that contain no added urea-formaldehyde resins.

5.C5 Indoor Chemical and Pollutant Source Control[1]

Intent: Avoid exposure of building occupants to potentially hazardous chemicals that adversely impact air quality.

Requirement:
- ❑ Design to minimize cross-contamination of regularly occupied areas by chemical pollutants: **1**
  - Employ permanent entryway systems (grills, grates, etc.) to capture dirt, particulates, etc. from entering the building at all high volume entryways.
  - Where chemical use occurs (including housekeeping areas and copying/print rooms) provide segregated areas with structural deck to deck partitions with separate outside exhaust at a rate of 0.50 cubic feet per minute per square foot, no air recirculation and maintaining a negative pressure of at lea 7 PA (0.03 inches of water gauge).
  - Provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs.

Suggested Documentation:
- ❑ *Specifications*: 08400 Entrances, 12400 Furnishings and Accessories, and 15100 Building Services Piping.
- ❑ *Drawings*: Note permanent entryway systems such as grills, grates, etc., at all exterior entrances on the Fi Floor Plan or other plan sheets with building entrances from outdoors. Cross-reference and highlight positi pressure systems for entryways with the Mechanical Plans. Also highlight the exhaust air systems used in chemical use areas (housekeeping and copy/print rooms). Highlight drainage systems for rooms where chemical and water mixing may occur in the Plumbing Plans and Plumbing Schematics.

Technologies /Strategies: Design separate exhaust and plumbing systems for rooms with contaminants to achieve physical isolation from the rest of the building. Install permanent architectural entryway systems such as grills or grates to prevent occupant borne contaminants from entering the building.

Consider utilization of EPA registered anti-microbial treatments in carpet, textile or vinyl wall coverings, ceiling til or paints where microbial contamination is a concern. Utilize "breathable" wall finishes where circumstances require, to reduce moisture build-up and prevent microbial contamination. Minimize selection of fibrous materials, e.g. insulation, carpet and padding and flexible fabrics, whose exposed surfaces when exposed to the air stream or occupied space can contribute significant emissions and absorb and re-emit other contaminants over time.

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[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

5.C6 **Controllability of Systems**[2]

Intent: Provide a high level of thermal, ventilation and lighting system control by individual occupants or specific groups multi-occupant spaces (i.e. classrooms or conference areas) to promote the productivity, comfort and wellbeing of building occupants.

Requirement:
- ❑ Provide at least an average of one operable window and one lighting control zone per 200 square feet for all regularly occupied areas within 15 feet of the perimeter wall. **1**

Suggested Documentation:
- ❑ *Specifications*: 08500 Windows, and 15900 HVAC Instrumentation and Controls.
- ❑ *Drawings*: Provide a window schedule highlighting the operable windows for rooms with floor area within 15 feet of the perimeter. Highlight the location lighting controls on the Electrical Plan.
- ❑ *Design Analysis*: Provide a floor plan diagram showing a line indicating 15 feet from building perimeter. Demonstrate with calculations that each room within 15 feet of the perimeter has at least one operable window and one lighting control zone for every 200 square feet of floor area that is regularly occupied.

Requirement:
- ❑ Provide controls for each individual for airflow, temperature, and lighting for at least 50% of the occupants in non perimeter, regularly occupied areas. **1**

Suggested Documentation:
- ❑ *Specifications*: 08500 Windows, and 15900 HVAC Instrumentation and Controls.
- ❑ *Drawings*: Indicate lighting controls on the Electrical Plan. Highlight temperature and airflow controls on the Mechanical Plan, or Air Distribution Plan. Indicate the expected occupancy of each non-perimeter room on the Floor Plan.
- ❑ *Design Analysis*: Provide a floor plan diagram showing a line indicating 15 feet from building perimeter. Demonstrate with a table or other calculations that lighting and airflow controls have been provided for each occupant for all regularly occupied rooms not within 15 feet of the building perimeter.

Technologies /Strategies: Design the building with occupant controls for airflow, temperature, and lighting. Strategies to consider include lighting controls, task lighting and operable windows.

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5.C7 **Thermal Comfort**[2]

Intent: Provide for a thermally comfortable environment that supports the productivity and well-being of building occupants.

Requirement:
- ❑ Comply with ASHRAE Standard 55-1992, Addenda 1995 for thermal comfort standards including humidity control within established ranges per climate zone.For naturally ventilated buildings, utilize the adaptive comfort temperature boundaries, using the 90% acceptability limits as defined in the California High Performance Schools (CHPS) Best Practices Manual, Appendix C – A Field Based Thermal Comfort Standard for Naturally Ventilated Buildings, Figure 2. **1**

Suggested Documentation:
- ❑ *Specifications*: 13400 Measurement and Control Instrumentation, 13500 Recording Instrumentation, and 13800 Building Automation and Control.
- ❑ *Design Analysis*: Provide a letter from the mechanical engineer stating that the system design is done in accordance with ASHRAE standard 55-1992 Addenda 1995. For naturally ventilated systems, provide a letter from the mechanical engineer stating that the project complies with the 90% acceptability limits of the adaptive comfort temperature boundaries in the California High Performance Schools (CHPS) Best Practices Manual Appendix C – A Field Based Thermal Comfort Standard for Naturally Ventilated Buildings, Figure 2.

Requirement:
- ❑ Install a permanent temperature and humidity monitoring system configured to provide operators control ov thermal comfort performance and effectiveness of humidification and/or dehumidification systems in the building. **1**

Suggested Documentation:
- ❑ *Specifications*: 13400 Measurement and Control Instrumentation, 13500 Recording Instrumentation, and 13800 Building Automation and Control.
- ❑ *Drawings*: Highlight the location of temperature and humidity monitoring systems on the Mechanical Plan or Air Distribution Plan.
- ❑ *Design Analysis*: Provide a narrative from the mechanical engineer describing the location of, and monitoring instrumentation installed. Reference appropriate plan sheets where the equipment discussed is shown.

Technologies /Strategies: Establish temperature and humidity comfort ranges and design the building envelope and HVAC system to maintain these comfort ranges. Install and maintain a temperature and humidity monitoring system in the building to automatically adjust building conditions as appropriate.

Employ integrated envelope and HVAC system design strategies that achieve thermal comfort conditions based on mean radiant temperature, local air velocity, relative humidity, and air temperature. Consider integrating monitoring and controls with the building automation system. Specify in system operation manuals that all sensors require quarterly calibration. Include criteria verification and system operation in commissioning plan and report.

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5.C8 Daylight and Views[2]

Intent: Provide for the building occupants a connection between indoor spaces and the outdoor environment through the introduction of daylight and views into the regularly occupied areas of the building.

Requirement: ❑ Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks. Spaces excluded from this requirement include copy rooms, storage areas, mechanical plant rooms, laundry, and other low occupancy support areas. Other exceptions for spaces where tasks would be hindered by the use of daylight will be considered on their merits. **1**

Suggested Documentation: ❑ *Design Analysis*: Provide calculations based on the Daylight Factor equation from the LEED2.0 Reference Guide showing that 75% of all spaces occupied for critical visual tasks have at least a 2% daylight factor.

Requirement: ❑ Achieve direct line of sight to vision glazing from 90% of all regularly occupied spaces. Examples of exceptions include copy rooms, storage areas, mechanical, laundry, and other low occupancy support area Other exceptions will be considered on their merits. **1**

Suggested Documentation: ❑ *Design Analysis*: Provide calculations with supporting floor plan diagrams indicating the lines of sight and access to views for 90% of occupied spaces.

Technologies /Strategies: Design the building to maximize interior daylighting. Strategies to consider include building orientation, shallow floor plates, increased building perimeter, exterior and interior permanent shading devices, high performance glazing, and photo-integrated light sensors. Predict daylighting via calculations or model daylighting strategies with a physical or computer model to assess footcandle levels and daylight factors achieved. Design the building to maximize view opportunities.

5.C9 Acoustic Environment /Noise Control[3]

Intent: Provide appropriate interior acoustic conditions that avoid deleterious noise effects and produce a basis for a positive soundscape acceptable to occupants and appropriate to their tasks.

Requirement: ❑ Meet the following criteria to minimize environmental noise through appropriate use of insulation, sound-absorbing materials and noise source isolation: **1**

- Recurrent background noise from external and internal sources shall not exceed 70db.
- All continuously occupied office space shall meet a NCC (Noise Criterion Curve) of no greater than NC-50.
- All classroom space shall meet an NCC of no greater than NC-45.
- Reverberation time for all continuously occupied space shall be no less than 0.4 seconds and no great than 0.8 seconds.
- Speech Interference Level (SIL) for continuously occupied office spaces shall not be greater than 55db, OR Articulation Index shall not be < .55.

Suggested Documentation: ❑ *Specifications*: 13080 Sound, Vibration and Seismic Control.
❑ *Design Analysis*: Provide a narrative detailing the existing environmental noise issues and describe the measures employed to mitigate the environmental noise issues.

Technologies /Strategies: Evaluate each occupied environment and determine the appropriate layout, materials and furnishings design. Consult U. S. Army Corps of Engineers *Design Guide for Interiors* DG 1110-3-122.

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[3] Added material not reviewed or endorsed by U. S. Green Building Council.

5.C10 **Facility In-Use IAQ Management Plan**[3]

Intent: Insure the effective management of facility air quality during its life.

Requirement: ❑ Perform all of the following: **1**

- Develop an air quality action plan to include scheduled HVAC system cleaning.
- Develop an air quality action plan to include education of occupants and facility managers on indoor pollutants and their roles in preventing them.
- Develop an air quality action plan to include permanent monitoring of supply and return air, and ambient air at the fresh air intake, for carbon monoxide (CO), carbon dioxide (CO 2), total volatile organic compounds (TVOCs), and particulates (including PM10).

Suggested Documentation:
❑ *Specifications:* 15900 HVAC Instrumentation and Controls.
❑ *Design Analysis:* Provide a draft version of the Air Quality Action Plan outlining occupant/manager training and also a systems maintenance schedule.

Technologies /Strategies: Provide action plan for periodic system maintenance, monitoring, occupant/manager training.

[3] Added material not reviewed or endorsed by U. S. Green Building Council.

6.0 Facility Delivery Process (FDP) Score 7

6.C1 **Holistic Delivery of Facility**[3]

Intent: Encourage a facility delivery process that actively engages all stakeholders in the design process to deliver a facility that meets all functional requirements while effectively optimizing tradeoffs among sustainability, first cos life cycle costs and mission requirements.

Requirement:	❑	Choose team leaders that are experienced in holistic delivery of facilities.	**1**
Suggested Documentation:	❑	*Design Analysis*: Provide a list of team leaders with a brief biographical synopsis stating qualifications and previous experience with projects where holistic delivery was a prime objective.	
Requirement:	❑	Train the entire team in the holistic delivery process. The team must include all stakeholders in the facility delivery, including the users, the contracting staff, the construction representatives, project manager, and design/engineering team members.	**1**
Suggested Documentation:	❑	*Design Analysis*: Provide a list of all stakeholders as well as training meeting dates and agendas for the meetings. Also submit a statement of qualifications for the person(s) performing the training. Training should include discussion of the SPiRiT or LEED Green Building Rating Systems, the importance of integrated design, and sample projects and methods used to meet the rating systems.	
Requirement:	❑	Identify project goals and metrics.	**1**
Suggested Documentation:	❑	*Design Analysis*: Provide a list goals and objectives for the project. Discuss in a narrative how these goals will be measured.	
Requirement:	❑	Plan and execute a project planning charrette with team members.	**1**
Suggested Documentation:	❑	*Design Analysis:*Include a section on the planning charrette, summarizing the results and indicating how it influenced the planning process.	
Requirement:	❑	Plan and execute an ecological design charrette with team members.	**1**
Suggested Documentation:	❑	*Design Analysis:*Include a section on the ecological design charrette, summarizing the results and indicating how it influenced the design process. Also enclose the preliminary SPiRiT scoring sheet indicating the planned SPiRiT Certification Level and credits to be attained.	
Requirement:	❑	Identify and resolve tradeoffs among sustainability, first costs, life cycle costs, and mission requirements through charrettes and other collaborative processes.	**1**
Suggested Documentation:	❑	*Design Analysis:* Provide a list of the life-cycle cost critical facility elements determined during the charrette process. For each, show which tradeoffs were made and how the project benefited over the life-cycle from the decisions reached. Relate each to the mission.	
Requirement:	❑	Document required results for each phase of project deliverables that achieve the project goals and are measurable throughout the facility life span. Plan and execute SPiRiT Self-Assessment Scoring Charrettes with team members at final design and beneficial occupancy.	**1**
Suggested Documentation:	❑	*Design Analysis*: Provide a list of project benchmarks. Define what deliverables are necessary to document each of these benchmarks. Establish criteria to evaluate how well the project goals have been met at each of these benchmarks. Include a list of who should attend the Self-Assessment Scoring Charrettes at final design. Provide a copy of the self-assessment scoring sheets.	

Technologies /Strategies: Develop performance specifications or choose competitive range of products that meet environmental criteria. Follow the suggested design and project management guidelines provided in the SPiRiT Scoring Through Self-Assessment Charrettes Guide.

Use automated modeling and analysis tools to assess site and facility design alternatives.

Conduct life-cycle cost analysis (LCCA) in the design process according to the Federal Facilities Council Technical Report, Sustainable Federal Facilities: A Guide To Integrating Value Engineering, Life Cycle Costing, and Sustainable Development, FFC # 142, 2000.

Conduct a full ecological assessment to include soil quality, water resources and flows, vegetation and trees, wildlife habitats and corridors, wetlands, and ecologically sensitive areas to identify the least sensitive site areas for development. Evaluate space utilization/functions to reduce overall space requirements, considering networking, flextime, flexi-place, dual-use, and other strategies to reduce space requirements/optimize facility size.

[3] Added material not reviewed or endorsed by U. S. Green Building Council.

7.0 Current Mission (CM) Score 6

7.C1 **Operation and Maintenance**[3]

Intent: Encourage the development of a facility delivery process that enhances effective operation and maintenance of the facility contributing to the productivity and well-being of the building occupants.

Requirement: ❑ Develop a facility operations and maintenance program to include comprehensive facility operations and maintenance instructions for system operation, performance verification procedures and results, an equipment inventory, warrantee information, and recommended maintenance schedule. The instructions should include a comprehensive, preventive maintenance program to keep all facility systems functioning as designed and ensure effective indoor air quality. **1**

Suggested Documentation: ❑ *Design Analysis*: Submit a copy of the facility operations and maintenance manual that includes, at a minimum, a section on each in the areas listed in the requirement portion of this credit.

Requirement: ❑ Develop a periodic training program for occupants, facilities managers, and maintenance staff in all facility operations and maintenance activities including: **1**

- Instructions on sustainable cleaning and integrated pest management practices.
- A comprehensive site/facility recycling/waste management plan.
- An air quality action plan to include scheduled HVAC system cleaning.

Suggested Documentation: ❑ *Design Analysis*: Submit a copy of the training program with a schedule of when trainings should be held. Training topics should, at a minimum, include the areas listed in the requirement portion of this credit.

Requirement: ❑ Provide surfaces, furnishings, and equipment that are appropriately durable and cost effective, according to life cycle cost analysis. Surfaces to be considered, at a minimum, are flooring, counter tops, wall coverings, modular furniture included in the construction contract, cabinetry, and bathroom fixtures and enclosures. **1**

Suggested Documentation: ❑ *Design Analysis*: Submit a narrative describing the criteria used in the selection of surfaces, furnishings, and equipment for the facility and showing their life-cycle cost effectiveness. Provide cut sheets showing the durability of the selected items.

Technologies /Strategies: Plan for facility elements, systems, and subsystems to be maintained on a routine maintenance schedule to ensure integrity and longevity. Develop a plan for scheduled cleaning and maintenance activities to be accomplished with nontoxic environmentally preferable cleaning products and procedures. The plan should also include keeping air ducts clean and free of microorganisms through a structured program of preventive maintenance and cleaning of lighting systems following a regular maintenance schedule to ensure optimum light output and energy efficiency. Set up and integrated pest management plan that uses pesticides and herbicides sparingly and only when necessary with preference to natural methods and materials over poisons and toxic agents.

[3] Added material not reviewed or endorsed by U. S. Green Building Council.

7.C2 Soldier and Workforce Productivity and Retention[3]

Intent: Provide high-quality, functional, and safe work and living environments to promote the well-being of building occupants and promote solder and workforce retention.

Requirement:	❑ Provide a high quality indoor environment by obtaining at least 11 IEQ credits and following the design methods defined in the Engineer Interior Design Guide 1110-3-122, especially Appendix B.	**1**
Suggested Documentation:	❑ *Design Analysis*: Prepare a narrative of design considerations and steps taken in the design process to enhance the quality of the indoor environment, and contribute to the well-being and safety of the building occupants. Specifically address each of the credits obtained.	
Requirement:	❑ Provide a high quality indoor environment by obtaining an additional 3 IEQ credits (for a total of 14 IEQ credits) and following the design methods defined in the Engineer Interior Design Guide 1110-3-122, especially Appendix B.	**1**
Suggested Documentation	❑ *Design Analysis*: Prepare a narrative of design considerations and steps taken in the design process to enhance the quality of the indoor environment, and contribute to the well-being and safety of the building occupants. Specifically address each of the credits obtained.	
Requirement	❑ Provide a high quality indoor environment by obtaining all 17 IEQ credits and following the design methods defined in the Engineer Interior Design Guide 1110-3-122, especially Appendix B.	**1**
Suggested Documentation	❑ *Design Analysis*: Prepare a narrative of design considerations and steps taken in the design process to enhance the quality of the indoor environment, and contribute to the well-being and safety of the building occupants. Specifically address each of the credits obtained.	

Technologies /Strategies: Use a registered/certified interior designer to provide stimulating interior environments with pleasant colors, surface treatments, room proportions and ceiling heights, external views, natural lighting, and quality detailing for interior furnishings, equipment, materials, and finishes. Use IES standards to provide light to occupied space with variations in level, comfortable contrasts, natural color rendition, natural/man-made, and adequate controls to optimize light aesthetic qualities. Provide occupant control of individual work areas configuration, and lighting, thermal and ventilation systems.

Collaborate with end users to identify functional and technical requirements and to perform adjacency studies. Configure occupied space to address the specific workers/occupants functions and activities that will be carried out there. Meet TI 800-01 Design Guide requirements. Design and configure occupied space, and select furniture and equipment using human ergonomics. Identify existing user amenities, such as dining, recreation, socialization, shopping, and child care facilities. Identify what amenities should be incorporated into the project or provided in the future, nearby facility. Provide ventilation air in sufficient volume free from natural and man made contaminants.

[3] Added material not reviewed or endorsed by U. S. Green Building Council.

8.0 Future Missions (FM) Score 4

8.C1 Functional Life of Facility and Supporting Systems[3]

Intent: Assess the functional life of a facility and its supporting systems to optimize the infrastructure investment.

Requirement: ❑ Identify how long the designed function is likely to occupy the current facility. **1**

Suggested Documentation: ❑ *Design Analysis*: Provide a narrative discussing the typical or likely lifespan of the function(s) to be accommodated in the facility. Forecast eventual adaptation to a different use(s). Assess the life spans of t various building systems/components to forecast their revision/replacement during the facility lifespan.

Requirement: ❑ Identify how long the envelope, structure, HVAC, plumbing, communications, electrical, and other systems are likely to last before requiring replacement or upgrade. Consider economic, functional, and physical obsolescence. **1**

Suggested Documentation: ❑ *Design Analysis*: Provide a narrative discussing the typical or likely lifespan of the function(s) to be accommodated in the facility. Forecast eventual adaptation to a different use(s). Assess the life spans of t various building systems/components to forecast their revision/replacement during the facility lifespan.

Technologies /Strategies: Assess the typical or likely lifespan of the function(s) to be accommodated to forecast eventual adaptation to a different use(s). Assess the life spans of the various building systems/components to forecast their revision/replacement during the facility lifespan and design in a manner that facilitates revision/replacement.

Consider the life span of the weapon systems, doctrines, or other programs supported by the facility.

Use life cycle data and other sources to identify the life span of the embodied systems.

8.C2 Adaptation, Renewal and Future Uses

Intent: Encourage facility design that is responsive to change over time to maximize accommodation of future uses without creating waste and insuring maximum useful life of products.

Requirement: ❑ Identify possible future uses for the facility; consider alternatives that expand the list of possible future uses. AND Design the building to accommodate as wide a range of future uses, as practical. AND Design the installation of building systems to accommodate foreseeable change with a minimum amount of disruption, cost, and additional materials. **1**

Suggested Documentation: ❑ *Design Analysis*: Discuss in a narrative possible future uses of the facility. Describe the design features that have been implemented to accommodate possible future uses. Also discuss measures taken to reduce the disruption and cost of adapting the building or building systems for a future use.

Requirement: ❑ Build the smallest facility necessary to meet current mission functional requirements, using the most efficient shape and form, while taking into consideration expansion capabilities and potential future mission requirements. AND Design the facility for recycling of materials and systems. **1**

Suggested Documentation: ❑ *Design Analysis*: Discuss in a narrative how the design optimizes the use of the available space. Discuss features that make the building more space efficient. Also discuss which building materials and systems can be recycled and measures taken to insure that these will be recycled rather than discarded at the end of the useful life.

Technologies /Strategies: Create durable, long-lasting, and adaptable facility shell and structural system. Create an adaptable, flexible facility design using open planning, service corridors, interstitial space, access floors, demountable walls/partitions, modular furniture, and other adaptable space configuration/utilization strategies.

Select materials that are recyclable, avoiding composite materials, such as reinforced plastics and carpet fibers and backing. Consider selecting materials and labeling construction materials with identification information to facilitate recycling. Use pre-cut/pre-fabricated materials and use standard lengths and sizes (dimensional modularity) in design. Design facility systems and subsystems for reconfiguration and/or disassembly/recycling using reversible/reusable connectors.

[3] Added material not reviewed or endorsed by U. S. Green Building Council.

Facility Points Summary

1.0	Sustainable Sites (SS)	Score		Max 20
1.R1	❑ Erosion, Sedimentation and Water Quality Control			[Required]
1.C1	❑ Site Selection			2
1.C2	❑ Installation/Base Redevelopment			2
1.C3	❑ Contaminated Site Redevelopment			1
1.C4	❑ Alternative Transportation			4
1.C5	❑ Reduced Site Disturbance			2
1.C6	❑ Stormwater Management			2
1.C7	❑ Landscape and Exterior Design to Reduce Heat Islands			2
1.C8	❑ Light Pollution Reduction			1
1.C9	❑ Optimize Site Features			1
1.C10	❑ Facility Impact			2
1.C11	❑ Site Ecology			1

2.0	Water Efficiency (WE)	Score		Max 5
2.C1	❑ Water Efficient Landscaping			2
2.C2	❑ Innovative Wastewater Technologies			1
2.C3	❑ Water Use Reduction			2

3.0	Energy and Atmosphere (EA)	Score		Max 28
3.R1	❑ Fundamental Building Systems Commissioning			[Required]
3.R2	❑ Minimum Energy Performance			[Required]
3.R3	❑ CFC Reduction in HVAC&R Equipment			[Required]
3.C1	❑ Optimize Energy Performance			20
3.C2	❑ Renewable Energy			4
3.C3	❑ Additional Commissioning			1
3.C4	❑ <<Deleted>>			-
3.C5	❑ Measurement and Verification			1
3.C6	❑ Green Power			1
3.C7	❑ Distributed Generation			1

4.0	Materials and Resources (MR)	Score		Max 13
4.R1	❑ Storage & Collection of Recyclables			[Required]
4.C1	❑ Building Reuse			3
4.C2	❑ Construction Waste Management			2
4.C3	❑ Resource Reuse			2
4.C4	❑ Recycled Content			2
4.C5	❑ Local/Regional Materials			2
4.C6	❑ Rapidly Renewable Materials			1
4.C7	❑ Certified Wood			1

5.0	Indoor Environmental Quality (IEQ) [Q]	Score		Max 17
5.R1	❑ Minimum IAQ Performance			[Required]
5.R2	❑ Environmental Tobacco Smoke (ETS) Control			[Required]
5.C1	❑ IAQ Monitoring			1
5.C2	❑ Increase Ventilation Effectiveness			1
5.C3	❑ Construction IAQ Management Plan			2
5.C4	❑ Low-Emitting Materials			4
5.C5	❑ Indoor Chemical and Pollutant Source Control			1
5.C6	❑ Controllability of Systems			2
5.C7	❑ Thermal Comfort			2
5.C8	❑ Daylight and Views			2
5.C9	❑ Acoustic Environment /Noise Control			1
5.C10	❑ Facility In-Use IAQ Management Plan			1

Facility Points Summary (Continued)

			Maximum Points
6.0	**Facility Delivery Process (FDP)**	**Score**	**Max 7**
6.C1	❑ Holistic Delivery of Facility		7
7.0	**Current Mission (CM)**	**Score**	**Max 6**
7.C1	❑ Operation and Maintenance		3
7.C2	❑ Soldier and Workforce Productivity and Retention		3
8.0	**Future Missions (FM)**	**Score**	**Max 4**
8.C1	❑ Functional Life of Facility and Supporting Systems		2
8.C2	❑ Adaptation, Renewal and Future Uses		2

Total Score | **Max 100**

SPiRiT Sustainable Project Certification Levels

SPiRiT Bronze		**25 to 34 Points**
SPiRiT Silver		**35 to 49 Points**
SPiRiT Gold		**50 to 74 Points**
SPiRiT Platinum		**75 to 100 Points**

Project Points of Contact

SPiRiT Comment Sheet

Please forward any comments that you may have on this Sustainable Project Rating Tool, preferably by Email, to:

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SPiRiT Para.

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

22-Jul-2003

FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
1.0 Sustainable Sites (S)	**20**	**0**			**0**
1.R1 Erosion, Sedimentation and Water Quality Control	**Req'd.**	**-**			
Design a site sediment and erosion control plan and a pollution prevention plan that conforms to best management practices in the EPA's Storm Water Management for Construction Activities, EPA Document No. EPA-833-R-92-00(1), Chapter 3, OR local Erosion and Sedimentation Control standards and codes, whichever is more stringent. The plan shall meet the following objectives:			Required by SPiRiT rating.		
Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling fo reuse.			Required by SPiRiT rating.		
Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter			Required by SPiRiT rating.		
Prevent hazardous material discharge into storm water systems.			Required by SPiRiT rating. Use only natural ("green") fertilizers.		
Prevent petroleum oils and lubricants (POL) discharge into storm water systems.			Required by SPiRiT rating.		
1.C1 Site Selection	**2**	**0**			**0**
Do not develop buildings on portions of sites that meet any one of the following criteria: (1)					
Prime training or maneuver land.					
Land whose elevation is lower than 5 ft. above the (1)00-year flood elevation as defined by FEMA.					
Land that provides habitat for any species on the Federal or State threatened or endangered list.					
Within 100 feet of any wetland as defined by 40 CFR, Parts 230-233 and Part 22, OR as defined by local or state rule or law, whichever is more stringent.					

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

22-Jul-2003

FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Select site based on functional adjacencies/relationships and land use compatibility. (1)					
Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure.					
Select site in area of high density					
Site facilities based on the strength of their relationships to other facilities/land-uses to limit travel distances. The stronger the relationship/functional interaction, the closer the distance between two facilities.					
Select for distance to installation/base transit systems and access to pedestrian ways and bike paths.					
Select for development previously used or developed suitable and available sites.					
1.C2 Installation/Base Urban Redevelopment	**2**	**0**			**0**
Increase localized density to conform to existing or desired density goals by utilizing sites that are located within existing cantonment areas of high development density. (1)					
Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure. (1)					
1.C3 Brownfield Redevelopment	**1**	**0**			**0**
Develop on a site classified as a brownfield and provide remediation as required by EPA's Brownfield Redevelopment program requirements OR Develop a brownfield site (a site that has been contaminated by previous uses). (1)					
1.C4 Alternative Transportation	**4**	**0**			**0**
Locate building within ½ mile of installation/base transit systems. (1)					

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Provide suitable means for securing bicycles, with convenient changing/shower facilities for use by cyclists, 5% or more of building occupants. (1)					
Locate building within 2 miles of alternative-fuel refueling station(s). (1)					
Size parking capacity not to exceed minimum installation/base cantonment requirements AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants, OR, add no new parking for rehabilitation projects AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants. (1)					
1.C5 Reduced Site Disturbance	**2**	**0**			**0**
On greenfield sites, limit site disturbance including earthwork and clearing of vegetation to 40 feet beyond the building perimeter, 5 feet beyond primary roadway curbs, walkways, and main utility branch trenches, and 25 feet beyond pervious paving areas that require additional stagi areas in order to limit compaction in the paved area; OR, on previously developed sites, restore a minimum of 50% of the remaining open area by planting native or adapted vegetation. (1)					
Reduce the development footprint (including building, access roads and parking) to exceed the installation/base's/base's master plan local zoning's open space requirement for the site by 25% or in accordance with installation/base policy on open space set asides, whichever is greater. (1)					
1.C6 Storm water Management	**2**	**0**			**0**

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Implement a stormwater management plan that results in:					
No net increase in the rate or quantity of stormwater runoff from undeveloped to developed conditions; OR, if existing imperviousness is greater than 50%, implement a stormwater management plan that results in a 25% decrease in the rate and quantity of stormwater runoff. (1)					
Treatment systems designed to remove 80% of the average annual post development total suspended solids (TSS), and 40% of the average annual post development total phosphorous (TP), by implementing Best Management Practices (BMPs) outlined in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (EPA-840-B-92-002 1/93). (1)					
1.C7 Landscape and Exterior Design to Reduce Heat Islands	**2**	**0**			**0**
Provide shade (within 5 years) on at least 30% of non-roof impervious surface on the site, including parking lots, walkways, plazas, etc., OR, use light-colored/ high-albedo materials (reflectance of at least 0.3) for 30% of the site's non-roof impervious surfaces, OR place a minimum of 50% of parking space under-ground OR use open-grid pavement system (net impervious area of LESS than 50%) for a minimum of 50% of the parking lot area. (1)					
Use ENERGY STAR Roof compliant, high-reflectance AND low emissivity roofing (initial reflectance of at least .65 and three-year-aged reflectance of at least .5 when tested in accordance with ASTM E408) for a minimum of 75% of the roof surface; OR, install a "green" (vegetated) roof for at least 50% of the roof area. (1)					
1.C8 Light Pollution Reduction	**1**	**0**			**0**

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Do not exceed Illuminating Engineering Society of North America (IESNA) footcandle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments, AND design interior and exterior lighting such that zero direct-beam illumination leaves the building site. (1)					
1.C9 Optimize Site Features	1	0			0
Perform both of the following: (					
Maximize the use of free site energy.					
Plan facility, parking and roadways to "fit" existing site contours and limit cut and fill.					
1.C10 Facility Impact	2	0			0
Cluster facilities to reduce impact, access distance to utilities and sufficient occupant density to support mass transit. (1)					
Collaborate with installation/base and community planners to identify and mitigate potential impacts of the project beyond site boundaries, and transportation planners to insure efficient public transport. (1)					
1.C11 Site Ecology	1	0			0
Develop site environmental management and mitigation plan. (1)					
2.0 Water Efficiency (W)	5	0			0
2.C1 Water Efficient Landscaping	2	0			0

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Use high efficiency irrigation technology, OR, use captured rain or recycled site water to reduce potable water consumption for irrigation by 50% over conventional means. (1)					
Use only captured rain or recycled site water for an additional 50% reduction (100% total reduction) of potable water for site irrigation needs, OR, do not install permanent landscape irrigation systems. (1)					
2.C2 Innovative Wastewater Technologies	**1**	**0**			**0**
Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%, OR, tr 100% of wastewater on site to tertiary standards.					
2.C3 Water Use Reduction	**2**	**0**			**0**
Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting Energy Policy Act (EPACT) of 1992 fixture performance requirements. (1)					
Exceed the potable water use reduction by an additional 1((30% total efficiency increase). (1)					
3.0 Energy and Atmosphere (E)	**28**	**0**			**0**
3.R1 Fundamental Building Systems Commissioning	**Req'd.**				
Implement all of the following fundamental best practice commissioning procedures.			Required by SPiRiT rating.		
Engage a commissioning authority.			Required by SPiRiT rating.		
Develop design intent and basis of design documentation.			Required by SPiRiT rating.		
Include commissioning requirements in the construction documents.			Required by SPiRiT rating.		
Develop and utilize a commissioning plan.			Required by SPiRiT rating.		
Verify installation, functional performance, training and documentation.			Required by SPiRiT rating.		
Complete a commissioning report.			Required by SPiRiT rating.		
3.R2 Minimum Energy Performance	**Req'd.**				
Design to meet building energy efficiency and performance as required by TI 800-01 (Design Criteria).			Required by SPiRiT rating.		
3.R3 CFC Reduction in HVAC&R Equipment	**Req'd.**				

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Zero use of CFC-based refrigerants in new base building HVAC&R systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phaseout conversion.			Required by SPiRiT rating.		
3.C1 Optimize Energy Performance	**20**	**0**			**0**
Reduce design energy usage (DEU) compared to the energy use budget (EUB) in joules per square meter per year for regulated energy components as described in the requirements of Chapter 11 of the TI 800-01 (Design Criteria), as demonstrated by a whole building simulation.					
1 Point will be awarded for every reduction in design energy use of 2.5% for both new and existing facilities for a maximum score of 20 points. (20)					
Regulated energy components include HVAC systems, building envelope, service hot water systems, lighting and other regulated systems as defined by ASHRAE					
3.C2 Renewable Energy	**4**	**0**			**0**
Supply a net fraction of the building's total energy use through the use of on-site renewable energy systems.					
% of Total Annual Energy Usage in Renewables					
5% = 1					
10% = 2					
15% = 3					
20% = 4					
3.C3 Additional Commissioning	**1**	**0**			**0**

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
In addition to the Fundamental Building Commissioning prerequisite, implement the following additional commissioning tasks: (1)					
1. Conduct a focused review of the design prior to the construction documents phase.					
2. Conduct a focused review of the construction documents when close to completion.					
3. Conduct a selective review of contractor submittals of commissioned equipment.					
4. Develop a system and energy management manual.					
5. Have a contract in place for a near-warranty end or post occupancy review.					
Items 1, 2, and 3 must be performed by someone other than the designer.					
3.C4 Elimination of HCFC's and Halons (DELETED)					
3.C5 Measurement and Verification	**1**	**0**			**0**
Comply with the installed equipment requirements for continuous metering as stated in selected Measurement and Verification Methods - Option B: Retrofit Isolation of the US DOE's International Performance Measurement and Verification Protocol (IPMVP) for the following: (1)					
Lighting systems and controls.					
Constant and variable motor loads.					
Variable frequency drive (VFD) operation.					
Chiller efficiency at variable loads (kW/ton).					
Cooling load.					
Air and water economizer and heat recovery cycles.					
Air distribution static pressures and ventilation air volumes.					
Boiler efficiencies.					
Building specific process energy efficiency systems and					
Indoor water risers and outdoor irrigation systems.					
3.C6 Green Power	**1**	**0**			**0**
Engage in a two year contract to purchase the amount of power equal to projected building consumption generated from renewable sources that meet the Center for Resource Solutions (CRS) Green-E requirements. (					
3.C7 Distributed Generation	**1**	**0**			**0**

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Reduce total energy usage and emissions by considering source energy implications and local cogeneration and direct energy conversion. Generate at least 50% of the building's projected annual consumption by on-site distributed generation sources. (					
4.0 Materials and Resources (M)	**13**	**0**			**0**
4.R1 Storage & Collection of Recyclable	**Req'd.**				
Provide an easily accessible area that serves the entire building that is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, glass, plastics, and metals.			Required by SPiRiT rating.		
4.C1 Building Reuse	**3**	**0**			**0**
Reuse large portions of existing structures during renovation or redevelopment projects.					
Maintain at least 75% of existing building structure and shell (exterior skin and framing excluding window assemblies). (1)					
Maintain an additional 25% (100% total) of existing building structure and shell (exterior skin and framing excluding window assemblies). (1					
Maintain 100% of existing building structure and shell AND 50% non-shell (walls, floor coverings, and ceiling systems). (1)					
4.C2 Construction Waste Management	**2**	**0**			**0**
Develop and implement a waste management plan, quantifying material diversion by weight:					
Recycle and/or salvage at least 50% (by weight) of construction, demolition, and land clearing waste. (1)					
Recycle and/or salvage an additional 25% (75% total by weight) of the construction, demolition, and land clearing debris. (1)					
4.C3 Resource Reuse	**2**	**0**			**0**
Specify salvaged or refurbished materials for 5% of building materials. (1)					
Specify salvaged or refurbished materials for 10% of building materials. (1					

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
4.C4 Recycled Content	2	0			0
Specify a minimum of 25% of building materials that contain in aggregate a minimum weighted average of 20% post-consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. (1					
Specify an additional 25% (50% total) of building materials that contain in aggregate, a minimum weighted average of 20% post consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. (1					
4.C5 Local/Regional Materials	2	0			0
Specify a minimum of 20% of building materials that are manufactured regionally within a radius of 500 miles.					
Of these regionally manufactured materials, specify a minimum of 50% that are extracted, harvested, or recovered within 500 miles. (1)					
4.C6 Rapidly Renewable Materials	1	0			0
Specify rapidly renewable building materials for 5% of total building materials.(1					
4.C7 Certified Wood	1	0			0
Use a minimum of 50% of wood-based materials certified in accordance with the Forest Stewardship Council guidelines for wood building components including but not limited to framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.(1)					
5.0 Indoor Environmental Quality (IEQ) (Q)	17	0			0
5.R1. Minimum IAQ Performance	Req'd.				
Meet the minimum requirements of voluntary consensus standard ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda			Required by the SPiRiT rating.		
5.R2 Environmental Tobacco Control (ETS) Control	Req'd.				

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Zero exposure of nonsmokers to ETS by prohibition of smoking in the building, OR, by providing a designated smoking room designed to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room shall be directly exhausted to the outdoors with no recirculation of ETS-containing air to the non-smoking area of the building, enclosed with impermeable structural deck-to-deck partitions and operated at a negative pressure compared with the surrounding spaces of at least 7 Pa (0.03 inches of water gauge). Performance of smoking rooms shall be verified using tracer gas testing methods as described in ASHRAE Standard 129-1997. Acceptable exposure in non-smoking areas is defined as less than 1% of the tracer gas concentration in the smoking room detectable in the adjoining non-smoking areas. Smoking room testing as described in the ASHRAE Standard 129-1997 is required in the contract documents and critical smoking facility systems testing results must be included in the building commissioning plan and report or as a separate document.			Required by the SPiRiT rating.		
5.C1 IAQ Carbon Dioxide (CO2) Monitoring	**1**	**0**			**0**
Install a permanent carbon dioxide (CO2) monitoring system that provides feedback on space ventilation performance in a form that affords operational adjustments, AND specify initial operational set point parameters that maintain indoor carbon dioxide levels no higher than outdoor levels by more than 530 parts per million at any time. (1)					
5.C2 Increase Ventilation Effectiveness	**1**	**0**			**0**
For mechanically ventilated buildings, design ventilation systems that result in an air change effectiveness (E) great than or equal to 0.9 as determined by ASHRAE(1)29-1997. For naturally ventilated spaces demonstrate a distribution and laminar flow pattern that involves not less than 90% of the room or zone area in the direction of air flow for at least 95% of hours of occupancy. (1)					
5.C3 Construction IAQ Management Plan	**2**	**0**			**0**
Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:					

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
During construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, AND protect stored on-site or installed absorptive materials from moisture damage, AND replace all filtration media immediately prior to occupancy (Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999). (1)					
Conduct a minimum two-week building flushout with new filtration media at 100% outside air after construction ends and prior to occupancy, OR, conduct a baseline indoor air quality testing procedure consistent with current EPA protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445. (1)					
5.C4 Low-Emitting Materials	**4**	**0**			**0**
Meet or exceed VOC limits for adhesives, sealants, paints, composite wood products, and carpet systems as follows:					
Adhesives must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 by, AND all sealants used as a filler must meet or exceed Bay Area Air Resources Board Reg. 8, Rule 51. (1)					
Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements. (1)					
Carpet systems must meet or exceed the Carpet and Rug Institute Green Label Indoor Air Quality Test Program.					
Composite wood or agrifiber products must contain no added urea-formaldehyde resins. (1)					
5.C5 Indoor Chemical and Pollutant Source Control	**1**	**0**			**0**
Design to minimize cross-contamination of regularly occupied areas by chemical pollutants: (1)					

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Employ permanent entryway systems (grills, grates, etc.) to capture dirt, particulates, etc. from entering the building at all high volume entryways, AND provide areas with structural deck to deck partitions with separate outside exhausting, no air recirculation and negative pressure where chemical use occurs (including housekeeping areas and copying/print rooms), AND provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs					
5.C6 Controllability of Systems	2	0			0
Provide a minimum of one operable window and one lighti control zone per 200 s.f. for all occupied areas within 15 feet of the perimeter wall. (1)					
Provide controls for each individual for airflow, temperature, and lighting for 50% of the non perimeter, regularly occupi areas. (1)					
5.C7 Thermal Comfort	2	0			0
Comply with ASHRAE Standard 55-1992, Addenda 1995 for thermal comfort standards including humidity control within established ranges per climate zone. (1)					
Install a permanent temperature and humidity monitoring system configured to provide operators control over therm comfort performance and effectiveness of humidification and/or dehumidification systems in the building.(1)					
5.C8 Daylight and Views	2	0			0
Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. Exceptions include those spaces where tasks would be hindered by the use of daylight or where accomplishing the specific tasks within a space would be enhanced by the direct penetration of sunlight. (					
Direct line of sight to vision glazing from 90% of all regularly occupied spaces, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. (1)					

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
5.C9 Acoustic Environmental/Noise Control	1	0			0
Minimize environmental noise through appropriate use of insulation, sound-absorbing materials and noise source isolation. (1)					
5.C10 Facility In-Use IAQ Management Plan	1	0			0
Perform all of the following: (1					
Develop an air quality action plan to include scheduled HVAC system cleaning.					
Develop an air quality action plan to include education of occupants and facility managers on indoor pollutants and their roles in preventing them.					
Develop an air quality action plan to include permanent monitoring of supply and return air, and ambient air at the fresh air intake, for carbon monoxide (CO), carbon dioxide (CO 2), tota volatile organic compounds (TVOCs), and particulates (including PM10).					
6.0 Facility Delivery Process (P)	7	0			0
6.C1 Holistic Delivery of Facility	7	0			0
Choose team leaders that are experienced in holistic delivery of facilities. (1)					
Train the entire team in the holistic delivery process. The team must include all stakeholders in the facility delivery, including the users, the contracting staff, the construction representatives, project manager, and design/engineering team members. (1)					
Identify project goals and metrics. (1)					
Plan and execute charrettes with team members at critical phases of the facility delivery. (1)					
Identify and resolve tradeoffs among sustainability, first costs, life cycle costs and mission requirements through charrettes and other collaborative processes. (2)					

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Document required results for each phase of project deliverables that achieve the project goals and are measurable throughout the facility life span. (1)					
7.0 Current Mission	**6**	**0**			**0**
7.C1 Operation and Maintenance	**3**	**0**			**0**
Develop a facility operations and maintenance program to include: (2)					
Commissioning instructions for all facility systems.					
Comprehensive facility operations and maintenance instructions for system operation, performance verification procedures and results, an equipment inventory, warrantee information, and recommended maintenance schedule. The instructions should include a comprehensive, preventive maintenance program to keep all facility systems functioning as designed.					
A periodic training program for occupants, facilities managers, and maintenance staff in all facility operations and maintenance activities.					
Instructions on sustainable cleaning and pest control practices.					
Develop a comprehensive site/facility recycling/waste management plan.					
Provide surfaces, furnishings, and equipment that are appropriately durable, according to life cycle cost analysis. (1)					
7.C2 Design for Soldier and Workforce Productivity and Retention	**3**	**0**			**0**
Provide a high quality indoor environment to enhance user/occupant quality of life (QOL). (					
Provide a highly functional work environment to promote user/occupant work productivity. (					
Provide a healthy and safe work environment to sustain Q and productivity. (1					
8.0 Future Missions	**4**	**0**			**0**
8.C1 Assess the Life Span of the Designed Use and Supporting System	**2**	**0**			**0**

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Identify how long the designed function is likely to occupy the current facility. (1)					
Identify how long the envelope, structure, HVAC, plumbing, communications, electrical, and other systems are likely to last before requiring replacement or upgrade. Consider economic, functional and physical obsolescence. (1)					
8.C2 Design for Adaption, Renewal and Future Uses	**2**	**0**			**0**
Identify possible future uses for the facility; consider alternatives that expand the list of possible future uses. AND Design the building to accommodate as wide a range future uses, as practical. AND Design the installation of building systems to accommodate foreseeable change with a minimum amount of disruption, cost, and additional materials. (1					
Build the smallest facility necessary to meet current mission functional requirements, using the most efficient shape and form, while taking into consideration expansion capabilities and potential future mission requirements. AND Design the facility for recycling of materials and systems. (1)					
TOTALS	**100**	**0**			**0**

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
1.0 Sustainable Sites (S)	**20**	**12**			**0**
1.R1 Erosion, Sedimentation and Water Quality Control	**Req'd.**	**-**			
Design a site sediment and erosion control plan and a pollution prevention plan that conforms to best management practices in the EPA's Storm Water Management for Construction Activities, EPA Document No. EPA-833-R-92-00(1), Chapter 3, OR local Erosion and Sedimentation Control standards and codes, whichever is more stringent. The plan shall meet the following objectives:			Required by SPiRiT rating. Consider using native grasses leading to retention areas, around sink holes, streams, and swales to filter out sediment and help prevent erosion.		
Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling fo reuse.			Required by SPiRiT rating.		
Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter			Required by SPiRiT rating.		
Prevent hazardous material discharge into storm water systems.			Required by SPiRiT rating. Use only natural ("green") fertilizers.		
Prevent petroleum oils and lubricants (POL) discharge into storm water systems.			Required by SPiRiT rating.		
1.C1 Site Selection	**2**	**2**			**0**
Do not develop buildings on portions of sites that meet any one of the following criteria: (1)		**1**	Building on sites with slopes 25% or greater is prohibited by the RFP. Consider avoiding slopes of 15% - 25% wherever possible. Consider utilizing existing vegetation to provide summer shade and to buffer from winter winds. Also consider reducing lawn mowing by promoting non-maintained, highly detailed turf areas.		
Prime training or maneuver land.			OK. Site has been determined not to be in training or maneuver land.		
Land whose elevation is lower than 5 ft. above the (1)00-year flood elevation as defined by FEMA.			OK. Site has been determined to be beyond 100-year base flood elevation as defined by FEMA.		
Land that provides habitat for any species on the Federal or State threatened or endangered list.			OK. Endangered species of tree bats are present on site - Indiana Bat and Grey Bat Habitat, but cutting of trees during the period of 4/1 to 10/31 is prohibited by the RFP. Consider preserving maximum amount of mature vegetation possible.		
Within 100 feet of any wetland as defined by 40 CFR, Parts 230-233 and Part 22, OR as defined by local or state rule or law, whichever is more stringent.			OK. It has been determined that no wetlands are located within 100 feet of site.		

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Select site based on functional adjacencies/relationships and land use compatibility. (1)		1			
Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure.			OK. The site is close to Wilson Road and existing utilities located there.		
Select site in area of high density			OK. Site within Cantonment area.		
Site facilities based on the strength of their relationships to other facilities/land-uses to limit travel distances. The stronger the relationship/functional interaction, the closer the distance between two facilities.					
Select for distance to installation/base transit systems and access to pedestrian ways and bike paths.			OK. Interior walks and biking paths are a requirement o the RFP. Bus stops are also a requirement of the RFP.		
Select for development previously used or developed suitable and available sites.			OK. Site was previously developed as a golf course - this is an increase of density.		
1.C2 Installation/Base Urban Redevelopment	**2**	**0**			**0**
Increase localized density to conform to existing or desired density goals by utilizing sites that are located within existing cantonment areas of high development density. (1)					
Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure. (1)					
1.C3 Brownfield Redevelopment	**1**	**0**			**0**
Develop on a site classified as a brownfield and provide remediation as required by EPA's Brownfield Redevelopment program requirements OR Develop a brownfield site (a site that has been contaminated by previous uses). (1)			Site has been determined not to be a brownfield per COE Architect Doug Pohl and Mr. Richard Schneider of USACE Sustainability Center of Expertise.		
1.C4 Alternative Transportation	**4**	**1**			**0**
Locate building within ½ mile of installation/base transit systems. (1)		1	OK. Per Mr. Schneider, "The extent to which the plan 'accommodates' a future transit system, even to the point of constructing bus stop shelters, pull-outs, etc., should be taken in consideration in justifying the point. If in your case, the school bus stops would accommodate a future transit system, I'd recommend the point." Bus stops are a requirement of the RFP.		

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Provide suitable means for securing bicycles, with convenient changing/shower facilities for use by cyclists, 5% or more of building occupants. (1)			**(303683-Pohl)**		
Locate building within 2 miles of alternative-fuel refueling station(s). (1)		**0**			
Size parking capacity not to exceed minimum installation/base cantonment requirements AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants, OR, add no new parking for rehabilitation projects AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants. (1)		**N/A**			
1.C5 Reduced Site Disturbance	**2**	**1**			**0**
On greenfield sites, limit site disturbance including earthwork and clearing of vegetation to 40 feet beyond the building perimeter, 5 feet beyond primary roadway curbs, walkways, and main utility branch trenches, and 25 feet beyond pervious paving areas that require additional stagi areas in order to limit compaction in the paved area; OR, on previously developed sites, restore a minimum of 50% of the remaining open area by planting native or adapted vegetation. (1)			**(303689-Pohl)**		
Reduce the development footprint (including building, access roads and parking) to exceed the installation/base's/base's master plan local zoning's open space requirement for the site by 25% or in accordance with installation/base policy on open space set asides, whichever is greater. (1)		**1**	**OK. Reduce the development footprint to exceed tl installation/base's/base's master plan local zoning s open space requirement for the site by 25% .(30369 Pohl)**		
1.C6 Storm water Management	**2**	**2**			**0**

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Implement a stormwater management plan that results in:					
No net increase in the rate or quantity of stormwater runoff from undeveloped to developed conditions; OR, if existing imperviousness is greater than 50%, implement a stormwater management plan that results in a 25% decrease in the rate and quantity of stormwater runoff. (1)		**1**	OK. No net increase is a requirement of the RFP.		
Treatment systems designed to remove 80% of the average annual post development total suspended solids (TSS), and 40% of the average annual post development total phosphorous (TP), by implementing Best Management Practices (BMPs) outlined in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (EPA-840-B-92-002 1/93). (1)		**1**			
1.C7 Landscape and Exterior Design to Reduce Heat Islands	**2**	**2**			**0**
Provide shade (within 5 years) on at least 30% of non-roof impervious surface on the site, including parking lots, walkways, plazas, etc., OR, use light-colored/ high-albedo materials (reflectance of at least 0.3) for 30% of the site's non-roof impervious surfaces, OR place a minimum of 50% of parking space under-ground OR use open-grid pavement system (net impervious area of LESS than 50%) for a minimum of 50% of the parking lot area. (1)		**1**	**Possible. Provide shade (within 5 years) on at least 30% of non-roof impervious surface on the site, including parking lots, walkways, plazas, etc. (303696-Pohl)**		
Use ENERGY STAR Roof compliant, high-reflectance AND low emissivity roofing (initial reflectance of at least .65 and three-year-aged reflectance of at least .5 when tested in accordance with ASTM E408) for a minimum of 75% of the roof surface; OR, install a "green" (vegetated) roof for at least 50% of the roof area. (1)		**1**	**Possible. Provide ENERGY STAR Roof compliant, high-reflectance AND low emissivity roofing. (303700-Pohl)**		
1.C8 Light Pollution Reduction	**1**	**1**			**0**

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FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Do not exceed Illuminating Engineering Society of North America (IESNA) footcandle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments, AND design interior and exterior lighting such that zero direct-beam illumination leaves the building site. (1)		1	OK. Providing fixtures throughout that produce downward lighting so as to prevent light pollution of adjacent residents and off site.		
1.C9 Optimize Site Features	1	1			0
Perform both of the following: (		1			
Maximize the use of free site energy.			Possible. Consider designing buildings oriented for southern exposure and maintaining existing vegetation for windbreaks.		
Plan facility, parking and roadways to "fit" existing site contours and limit cut and fill.			Possible. Consider the design of a balanced site with minimal spoilage.		
1.C10 Facility Impact	2	1			0
Cluster facilities to reduce impact, access distance to utilities and sufficient occupant density to support mass transit. (1)					
Collaborate with installation/base and community planners to identify and mitigate potential impacts of the project beyond site boundaries, and transportation planners to insure efficient public transport. (1)		1	**Possible. Consider the future widening of Wilson a well as the integration with future development parcels. Consider the use proper planning and design techniques to minimize negative impacts on the site and on neighboring properties and structures. (303703-Pohl)**		
1.C11 Site Ecology	1	1			0
Develop site environmental management and mitigation plan. (1)		1	**Possible. The RFP recommends the preservation and enhancement of existing trees, ecosystems, a habitats. The RFP requires that 85% of identified significant trees on the site be preserved. Consid the preservation of 95% of significant trees. (303707-Pohl)**		
2.0 Water Efficiency (W)	5	3			0
2.C1 Water Efficient Landscaping	2	1			0

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Use high efficiency irrigation technology, OR, use captured rain or recycled site water to reduce potable water consumption for irrigation by 50% over conventional means. (1)					
Use only captured rain or recycled site water for an additional 50% reduction (100% total reduction) of potable water for site irrigation needs, OR, do not install permanent landscape irrigation systems. (1)		**1**	**OK. No irrigation is to be provided for this project. (303715-Pohl)**		
2.C2 Innovative Wastewater Technologies	**1**	**0**			**0**
Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%, OR, tr 100% of wastewater on site to tertiary standards.					
2.C3 Water Use Reduction	**2**	**2**			**0**
Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting Energy Policy Act (EPACT) of 1992 fixture performance requirements. (1)		**1**	Possible. Consider the use of low-volume flush toilets, restricted flow shower heads, high-efficiency garbage disposals and dishwashers that minimize water use.		
Exceed the potable water use reduction by an additional 1((30% total efficiency increase). (1)		**1**	**Possible. Same as above but additional percent increase. (303721-Pohl)**		
3.0 Energy and Atmosphere (E)	**28**	**9**			**0**
3.R1 Fundamental Building Systems Commissioning	**Req'd.**				
Implement all of the following fundamental best practice commissioning procedures.			Required by SPiRiT rating.		
Engage a commissioning authority.			Required by SPiRiT rating.		
Develop design intent and basis of design documentation.			Required by SPiRiT rating.		
Include commissioning requirements in the construction documents.			Required by SPiRiT rating.		
Develop and utilize a commissioning plan.			Required by SPiRiT rating.		
Verify installation, functional performance, training and documentation.			Required by SPiRiT rating.		
Complete a commissioning report.			Required by SPiRiT rating.		
3.R2 Minimum Energy Performance	**Req'd.**				
Design to meet building energy efficiency and performance as required by TI 800-01 (Design Criteria).			Required by SPiRiT rating.		
3.R3 CFC Reduction in HVAC&R Equipment	**Req'd.**				

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Zero use of CFC-based refrigerants in new base building HVAC&R systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phaseout conversion.			Required by SPiRiT rating.		
3.C1 Optimize Energy Performance	**20**	**8**			**0**
Reduce design energy usage (DEU) compared to the energy use budget (EUB) in joules per square meter per year for regulated energy components as described in the requirements of Chapter 11 of the TI 800-01 (Design Criteria), as demonstrated by a whole building simulation.			Possible. Consider the use of ENERGY STAR rated appliances in obtaining these points.		
1 Point will be awarded for every reduction in design energy use of 2.5% for both new and existing facilities for a maximum score of 20 points. (20)		**8**	**Possible. This requires a variable percentage reduction from baseline. This will depend on the proposer and their ability to meet the requirement TI 801-01 as well as being able to demonstrate a whole building simulation. The use of ENERGY STAR appliances will help in reducing design ener usage. These points will vary depending on overall strategy employed. The points can vary from 1-20. Provide Geothermal Heat Pumps as required by the RFP. These points can be obtained by using an overall design strategy and not just one specific strategy. (303875-Pohl)**		
Regulated energy components include HVAC systems, building envelope, service hot water systems, lighting and other regulated systems as defined by ASHRAE			Possible. Consider the use of ENERGY STAR rated appliances in obtaining these points.		
3.C2 Renewable Energy	**4**	**0**			**0**
Supply a net fraction of the building's total energy use through the use of on-site renewable energy systems.			This point is not applicable for this RFP. There are no alternative power sources available.		
% of Total Annual Energy Usage in Renewables					
5% = 1					
10% = 2					
15% = 3					
20% = 4					
3.C3 Additional Commissioning	**1**	**1**			**0**

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In addition to the Fundamental Building Commissioning prerequisite, implement the following additional commissioning tasks: (1)		1	OK. The RFP requires additional commissioning for all units. The mechanical specification should provide language for building commissioning in addition to the requirements in the Statement of Work.		
1. Conduct a focused review of the design prior to the construction documents phase.					
2. Conduct a focused review of the construction documents when close to completion.					
3. Conduct a selective review of contractor submittals of commissioned equipment.					
4. Develop a system and energy management manual.					
5. Have a contract in place for a near-warranty end or post occupancy review.					
Items 1, 2, and 3 must be performed by someone other than the designer.					
3.C4 Elimination of HCFC's and Halons (DELETED)					
3.C5 Measurement and Verification	**1**	**0**			**0**
Comply with the installed equipment requirements for continuous metering as stated in selected Measurement and Verification Methods - Option B: Retrofit Isolation of the US DOE's International Performance Measurement and Verification Protocol (IPMVP) for the following: (1)		**N/A**			
Lighting systems and controls.					
Constant and variable motor loads.					
Variable frequency drive (VFD) operation.					
Chiller efficiency at variable loads (kW/ton).					
Cooling load.					
Air and water economizer and heat recovery cycles.					
Air distribution static pressures and ventilation air volumes.					
Boiler efficiencies.					
Building specific process energy efficiency systems and					
Indoor water risers and outdoor irrigation systems.					
3.C6 Green Power	**1**	**0**			**0**
Engage in a two year contract to purchase the amount of power equal to projected building consumption generated from renewable sources that meet the Center for Resource Solutions (CRS) Green-E requirements. (		**N/A**			
3.C7 Distributed Generation	**1**	**0**			**0**

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Reduce total energy usage and emissions by considering source energy implications and local cogeneration and direct energy conversion. Generate at least 50% of the building's projected annual consumption by on-site distributed generation sources. (		**N/A**			
4.0 Materials and Resources (M)	**13**	**8**			**0**
4.R1 Storage & Collection of Recyclable	**Req'd.**				
Provide an easily accessible area that serves the entire building that is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, glass, plastics, and metals.			Required by SPiRiT rating. Provide an in-residence recycling storage/collection area preferably near the garbage bin area. Provide a dedicated area in the garage.		
4.C1 Building Reuse	**3**	**0**			**0**
Reuse large portions of existing structures during renovation or redevelopment projects.					
Maintain at least 75% of existing building structure and shell (exterior skin and framing excluding window assemblies). (1)		**N/A**			
Maintain an additional 25% (100% total) of existing building structure and shell (exterior skin and framing excluding window assemblies). (1		**N/A**			
Maintain 100% of existing building structure and shell AND 50% non-shell (walls, floor coverings, and ceiling systems). (1)		**N/A**			
4.C2 Construction Waste Management	**2**	**1**			**0**
Develop and implement a waste management plan, quantifying material diversion by weight:					
Recycle and/or salvage at least 50% (by weight) of construction, demolition, and land clearing waste. (1)		**1**	Possible. Consider specifying targets to be achieved by the Contractor. Consider salvaging material during the demolition of Binter Court neighborhood and the Golf Cart Maintenance building.		
Recycle and/or salvage an additional 25% (75% total by weight) of the construction, demolition, and land clearing debris. (1)					
4.C3 Resource Reuse	**2**	**1**			**0**
Specify salvaged or refurbished materials for 5% of building materials. (1)		**1**	Possible. Consider specifying targets to be achieved by the Contractor. Use of salvaged or refurbished materia shall be specified.		
Specify salvaged or refurbished materials for 10% of building materials. (1					

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4.C4 Recycled Content	2	2			0
Specify a minimum of 25% of building materials that contain in aggregate a minimum weighted average of 20% post-consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. (1)		1	Possible. Consider specifying the use of steel, concrete, aluminum doors/windows, etc. that denote recycled content. RFP Requirement - incorporate into specifications for floors, cabinets, etc. Use products such as trex recycled plastic in lieu of wood at fencing/screening. Consider specifying plantation grow woods.		
Specify an additional 25% (50% total) of building materials that contain in aggregate, a minimum weighted average of 20% post consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. (1		1	Possible. Consider specifying recycled content items: steel, concrete aggregate, wall board, etc.		
4.C5 Local/Regional Materials	2	2			0
Specify a minimum of 20% of building materials that are manufactured regionally within a radius of 500 miles.		1	Possible. Consider specifying and purchasing locally or regionally manufactured materials.		
Of these regionally manufactured materials, specify a minimum of 50% that are extracted, harvested, or recovered within 500 miles. (1)		1	Possible. Same as above but additional percent increase.		
4.C6 Rapidly Renewable Materials	1	1			0
Specify rapidly renewable building materials for 5% of total building materials.(1		1	Possible. Consider using bamboo flooring and other rapidly renewable products.		
4.C7 Certified Wood	1	1			0
Use a minimum of 50% of wood-based materials certified in accordance with the Forest Stewardship Council guidelines for wood building components including but not limited to framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.(1)		1	Possible. Consider the use of materials or products approved by the Forestry Stewardship Council for wood building components.		
5.0 Indoor Environmental Quality (IEQ) (Q)	**17**	**13**			**0**
5.R1. Minimum IAQ Performance	**Req'd.**				
Meet the minimum requirements of voluntary consensus standard ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda			Required by the SPiRiT rating.		
5.R2 Environmental Tobacco Control (ETS) Control	**Req'd.**				

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Zero exposure of nonsmokers to ETS by prohibition of smoking in the building, OR, by providing a designated smoking room designed to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room shall be directly exhausted to the outdoors with no recirculation of ETS-containing air to the non-smoking area of the building, enclosed with impermeable structural deck-to-deck partitions and operated at a negative pressure compared with the surrounding spaces of at least 7 Pa (0.03 inches of water gauge). Performance of smoking rooms shall be verified using tracer gas testing methods as described in ASHRAE Standard 129-1997. Acceptable exposure in non-smoking areas is defined as less than 1% of the tracer gas concentration in the smoking room detectable in the adjoining non-smoking areas. Smoking room testing as described in the ASHRAE Standard 129-1997 is required in the contract documents and critical smoking facility systems testing results must be included in the building commissioning plan and report or as a separate document.			Required by the SPiRiT rating.		
5.C1 IAQ Carbon Dioxide (CO2) Monitoring	**1**	**0**			**0**
Install a permanent carbon dioxide (CO2) monitoring system that provides feedback on space ventilation performance in a form that affords operational adjustments, AND specify initial operational set point parameters that maintain indoor carbon dioxide levels no higher than outdoor levels by more than 530 parts per million at any time. (1)					
5.C2 Increase Ventilation Effectiveness	**1**	**1**			**0**
For mechanically ventilated buildings, design ventilation systems that result in an air change effectiveness (E) great than or equal to 0.9 as determined by ASHRAE(1)29-1997. For naturally ventilated spaces demonstrate a distribution and laminar flow pattern that involves not less than 90% of the room or zone area in the direction of air flow for at least 95% of hours of occupancy. (1)		**1**	Possible. Consider provisions in the mechanical design and specification for obtaining this point. This should be verified using the techniques outlined in ASHRAE(1)29-1997.		
5.C3 Construction IAQ Management Plan	**2**	**2**			**0**
Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:					

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During construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, AND protect stored on-site or installed absorptive materials from moisture damage, AND replace all filtration media immediately prior to occupancy (Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999). (1)		**1**	Possible. The Design-Build Team should work together to incorporate best management practices during construction and provide a Construction Indoor Air Quality Management Plan.		
Conduct a minimum two-week building flushout with new filtration media at 100% outside air after construction ends and prior to occupancy, OR, conduct a baseline indoor air quality testing procedure consistent with current EPA protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445. (1)		**1**	Possible. The Design-Build Team should work together to incorporate best management practices during construction and ensure that a flushout is performed according to the guidelines of 5.C3.		
5.C4 Low-Emitting Materials	**4**	**3**			**0**
Meet or exceed VOC limits for adhesives, sealants, paints, composite wood products, and carpet systems as follows:					
Adhesives must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 by, AND all sealants used as a filler must meet or exceed Bay Area Air Resources Board Reg. 8, Rule 51. (1)		**1**	Possible. Consider specifying targets to be achieved by the Contractor. These targets must meet or exceed VOC limits in 5.C4.		
Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements. (1)		**1**	Possible. Consider specifying and using paint products and coatings that meet or exceed the VOC and chemical component limits of Green Seal requirements. A manufacturer's Safety and Data Sheet should be provided as well as a product sample for each product used.		
Carpet systems must meet or exceed the Carpet and Rug Institute Green Label Indoor Air Quality Test Program.		**N/A**			
Composite wood or agrifiber products must contain no added urea-formaldehyde resins. (1)		**1**	Possible. Consider using products that contain no added urea-formaldehyde resins of other low- or non-VOC emmitting products.		
5.C5 Indoor Chemical and Pollutant Source Control	**1**	**1**			**0**
Design to minimize cross-contamination of regularly occupied areas by chemical pollutants: (1)		**1**	Possible. Consider having a post construction ventilation for the entire building for each unit.		

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Employ permanent entryway systems (grills, grates, etc.) to capture dirt, particulates, etc. from entering the building at all high volume entryways, AND provide areas with structural deck to deck partitions with separate outside exhausting, no air recirculation and negative pressure where chemical use occurs (including housekeeping areas and copying/print rooms), AND provide drains plumbed for appropriate disposal of liquid waste i spaces where water and chemical concentrate mixing occurs			Possible. Avoid exposure of the residents to potentially hazardous chemicals that adversely impact air quality. Consider the design of a separate storage area, preferably an exterior storage, that is not adjacent to ventilation systems. This area would need separate ventilation. Educate residents in proper handling and storage of harmful chemicals.		
5.C6 Controllability of Systems	2	2			0
Provide a minimum of one operable window and one lighti control zone per 200 s.f. for all occupied areas within 15 feet of the perimeter wall. (1)		1	Possible. Operable windows are a requirment of the RFP.		
Provide controls for each individual for airflow, temperature, and lighting for 50% of the non perimeter, regularly occupi areas. (1)		1	Possible. Consider providing task lighting, motion sensors, light level sensors. Consider providing individual or integrated control systems that control lighting, airflow, and temperature in individual rooms.		
5.C7 Thermal Comfort	2	1			0
Comply with ASHRAE Standard 55-1992, Addenda 1995 for thermal comfort standards including humidity control within established ranges per climate zone. (1)		1	Possible. Consider designing unit HVAC to comply.		
Install a permanent temperature and humidity monitoring system configured to provide operators control over therm comfort performance and effectiveness of humidification and/or dehumidification systems in the building.(1)		N/A			
5.C8 Daylight and Views	2	2			0
Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. Exceptions include those spaces where tasks would be hindered by the use of daylight or where accomplishing the specific tasks within a space would be enhanced by the direct penetration of sunlight.		1	Possible. Consider designing windows to meet requirement.		
Direct line of sight to vision glazing from 90% of all regularly occupied spaces, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. (1)		1	Possible. Consider designing windows to meet requirement.		

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5.C9 Acoustic Environmental/Noise Control	1	1			0
Minimize environmental noise through appropriate use of insulation, sound-absorbing materials and noise source isolation. (1)		1	Possible. Consider specifying wall insulation and materials and subflooring that have better acoustical ratings. Also consider designs that create noise-source isolation (i.e., house keeping pads that isolate vibrations created by mechanical systems).		
5.C10 Facility In-Use IAQ Management Plan	1	0			0
Perform all of the following: (1					
Develop an air quality action plan to include scheduled HVAC system cleaning.					
Develop an air quality action plan to include education of occupants and facility managers on indoor pollutants and their roles in preventing them.					
Develop an air quality action plan to include permanent monitoring of supply and return air, and ambient air at the fresh air intake, for carbon monoxide (CO), carbon dioxide (CO 2), tota volatile organic compounds (TVOCs), and particulates (including PM10).					
6.0 Facility Delivery Process (P)	7	7			0
6.C1 Holistic Delivery of Facility	7	7			0
Choose team leaders that are experienced in holistic delivery of facilities. (1)		1	Possible. Preparation of the RFP complied with all of these Section 6.C1 factors. Consider continuing compliance during completion of the project design.		
Train the entire team in the holistic delivery process. The team must include all stakeholders in the facility delivery, including the users, the contracting staff, the construction representatives, project manager, and design/engineering team members. (1)		1	Possible. Team training should be done after award and prior to construction.		
Identify project goals and metrics. (1)		1	Possible. Identifying project goals and metrics should be done after award and prior to construction.		
Plan and execute charrettes with team members at critical phases of the facility delivery. (1)		1	Possible. Design Reviews can serve as charettes if organized properly.		
Identify and resolve tradeoffs among sustainability, first costs, life cycle costs and mission requirements through charrettes and other collaborative processes. (2)		2	OK. As design is completed, tradeoffs among sustainability, first cost, life cycle costs and mission requirements can be compared.		

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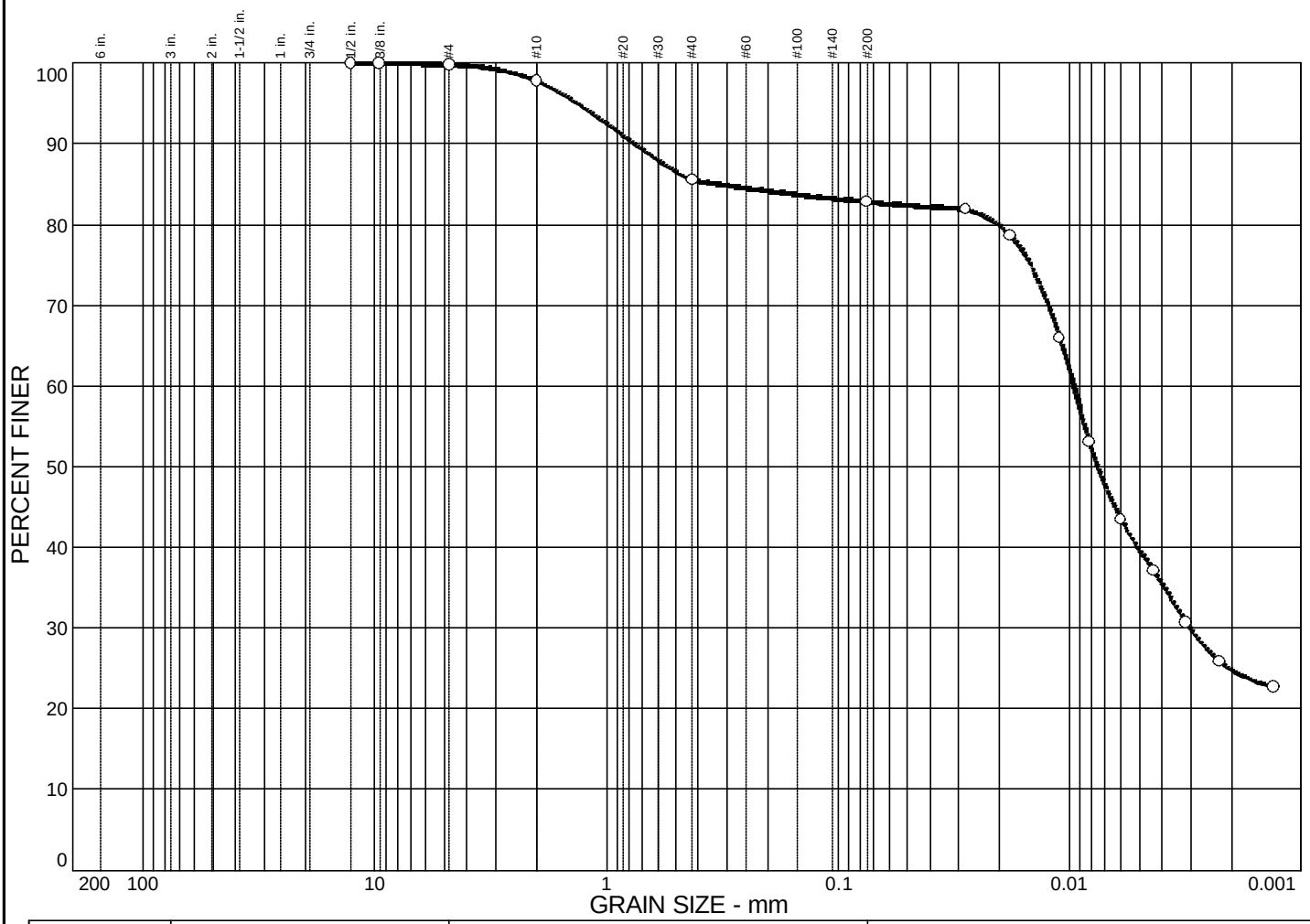
FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Document required results for each phase of project deliverables that achieve the project goals and are measurable throughout the facility life span. (1)		1	Possible. Documentation would need to be provided during each phase of the project.		
7.0 Current Mission	**6**	**4**			**0**
7.C1 Operation and Maintenance	**3**	**3**			**0**
Develop a facility operations and maintenance program to include: (2)		2	Possible. Consider providing the necessary materials to help educate the residents along with the housing managers and maintenance personnel. A facility operations and maintenance program should be done in conjunction with the housing managers and maintenance personel prior to project closeout.		
Commissioning instructions for all facility systems.					
Comprehensive facility operations and maintenance instructions for system operation, performance verification procedures and results, an equipment inventory, warrantee information, and recommended maintenance schedule. The instructions should include a comprehensive, preventive maintenance program to keep all facility systems functioning as designed.					
A periodic training program for occupants, facilities managers, and maintenance staff in all facility operations and maintenance activities.					
Instructions on sustainable cleaning and pest control practices.					
Develop a comprehensive site/facility recycling/waste management plan.					
Provide surfaces, furnishings, and equipment that are appropriately durable, according to life cycle cost analysis. (1)		1	Possible. Consider specifying, during the design phase and providing, during the construction phase, the use o surfaces, furnishings, and appropriately durable items according to a life cycle cost analysis.		
7.C2 Design for Soldier and Workforce Productivity and Retention	**3**	**1**			**0**
Provide a high quality indoor environment to enhance user/occupant quality of life (QOL). (		1	OK. RFP requires a high quality environment.		
Provide a highly functional work environment to promote user/occupant work productivity. (		N/A			
Provide a healthy and safe work environment to sustain Q and productivity. (1		N/A			
8.0 Future Missions	**4**	**2**			**0**
8.C1 Assess the Life Span of the Designed Use and Supporting System	**2**	**2**			**0**

SUSTAINABLE PROJECT RATING TOOL - FORT KNOX

22-Jul-2003

FACILITY SUMMARY POINTS	Max. Points	Team Goals	Action/Status	Responsibility	Points Status
Identify how long the designed function is likely to occupy the current facility. (1)		1	Possible. Consider assessing the life span of the designed use and supporting systems of this project by identifying these items during the design and construction phases of the project.		
Identify how long the envelope, structure, HVAC, plumbing, communications, electrical, and other systems are likely to last before requiring replacement or upgrade. Consider economic, functional and physical obsolescence. (1)		1	Possible. Consider assessing the life span of the designed use and supporting systems of this project by identifying how long the envelope, structure, HVAC, plumbing, communications, electrical and other systems will last before requiring replacement or upgrades. Consider providing infromation regarding life spans of the listed items in the Operations and Maintenance manuals.		
8.C2 Design for Adaption, Renewal and Future Uses	**2**	**0**			**0**
Identify possible future uses for the facility; consider alternatives that expand the list of possible future uses. AND Design the building to accommodate as wide a range future uses, as practical. AND Design the installation of building systems to accommodate foreseeable change with a minimum amount of disruption, cost, and additional materials. (1		N/A			
Build the smallest facility necessary to meet current mission functional requirements, using the most efficient shape and form, while taking into consideration expansion capabilities and potential future mission requirements. AND Design the facility for recycling of materials and systems. (1)		N/A			
TOTALS	**100**	**58**	**GOLD**		**0**

Particle Size Distribution Report



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.2	2.0	12.3	2.7	43.1	39.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	35	20	0.327	0.0096	0.0075	0.0030				

MATERIAL DESCRIPTION	USCS	AASHTO
○ BROWN SILTY CLAY	CL	A-6(12)

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

○ **Source:** BORING 19 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

Remarks:

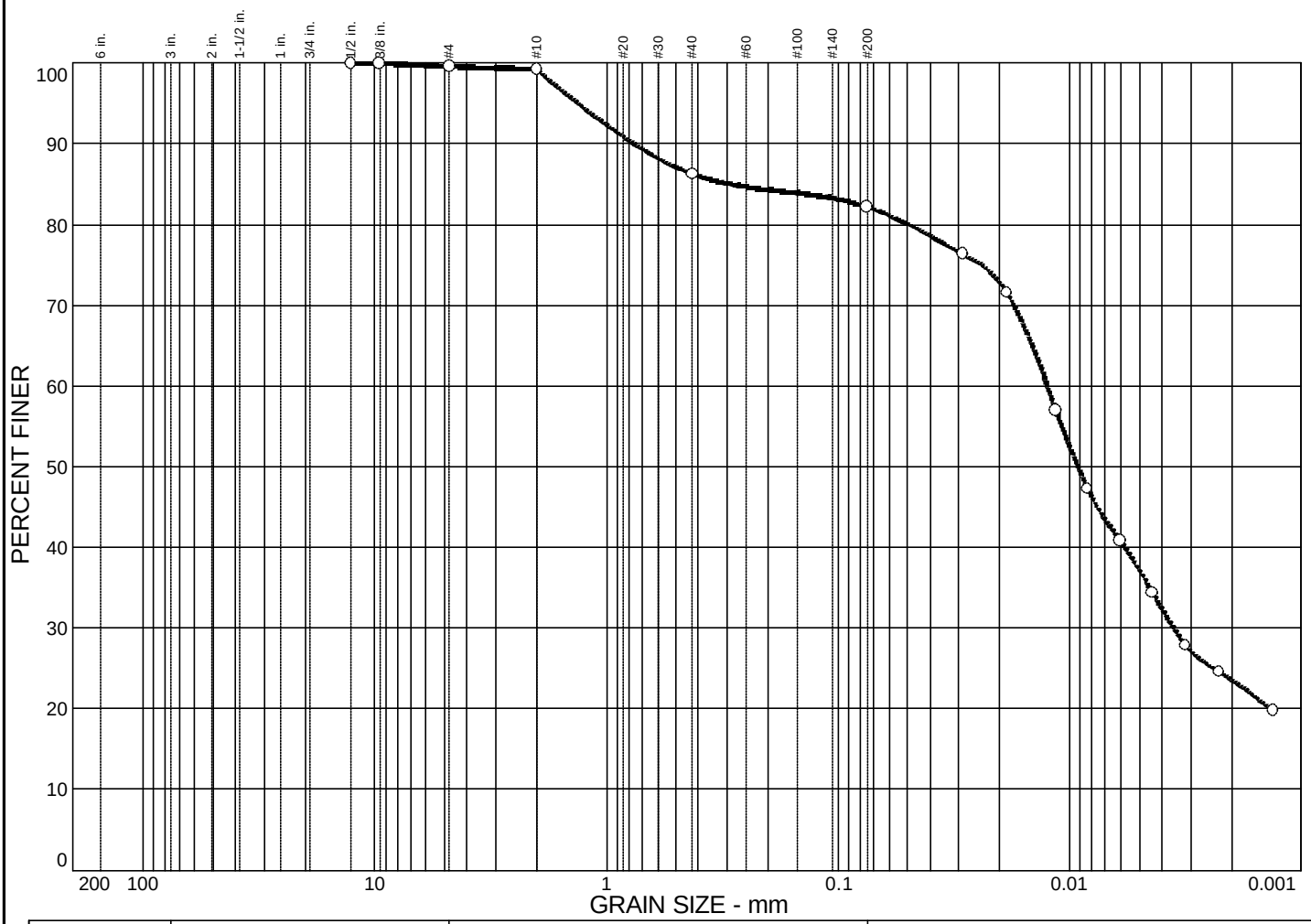
○

Particle Size Distribution Report

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-19,S-1

Particle Size Distribution Report



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.4	0.4	12.9	4.1	45.1	37.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	35	19	0.290	0.0125	0.0092	0.0036				

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAY AND BRWON CLAYEY SILT	CL	A-6(12)

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

○ **Source:** BORING 19 **Sample No.:** S-2 **Elev./Depth:** 5.0'-10.0'

Remarks:

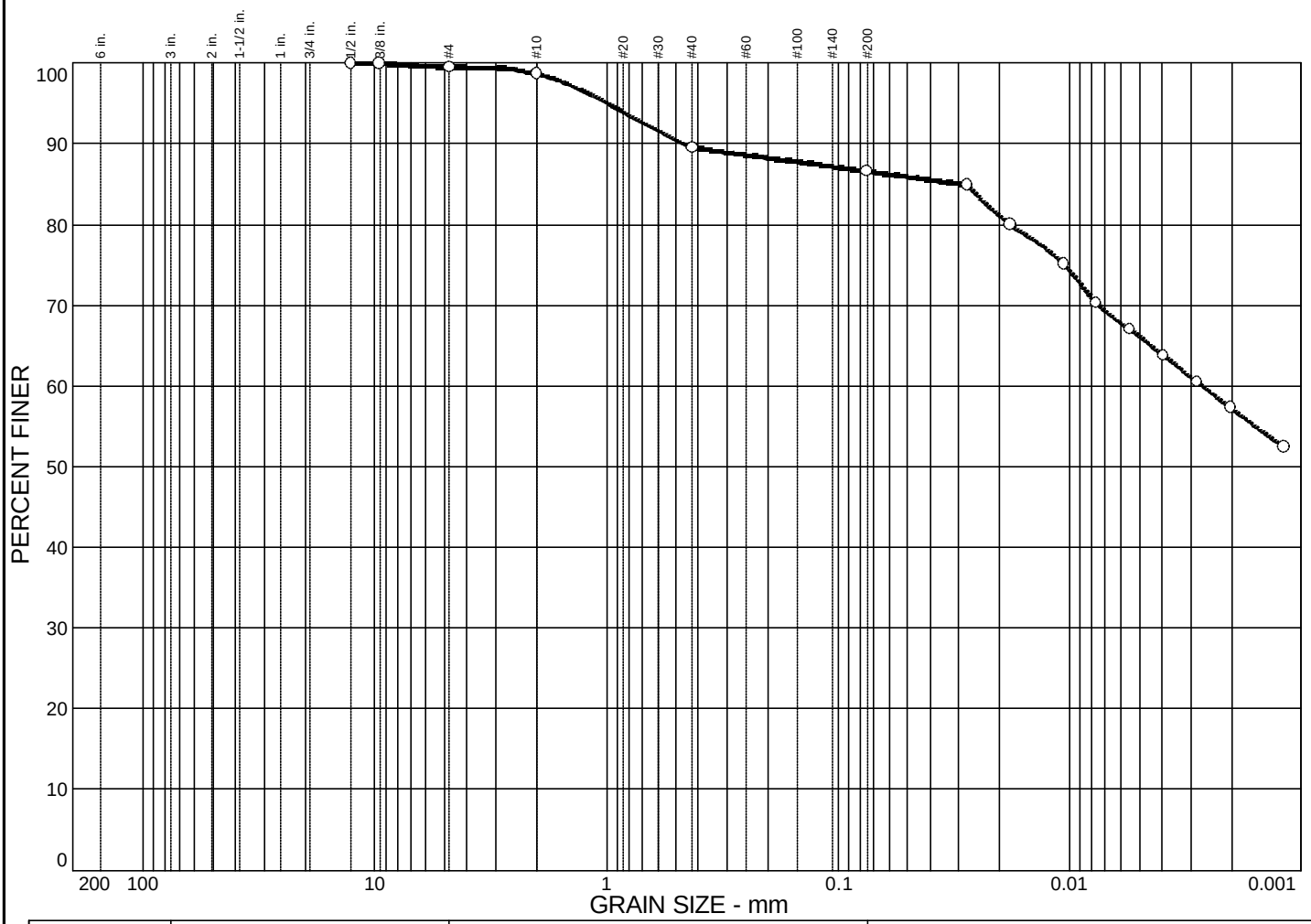
○

Particle Size Distribution Report

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-19,S-2

Particle Size Distribution Report



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	0.5	0.8	9.2	2.9	20.5	66.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	69	26	0.0295	0.0027						

MATERIAL DESCRIPTION	USCS	AASHTO
○ REDDISH-BROWN SILTY CLAY	CH	A-7-6(42)

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

○ **Source:** BORING 2 **Sample No.:** S-1 **Elev./Depth:** 1.0'-5.0'

Remarks:

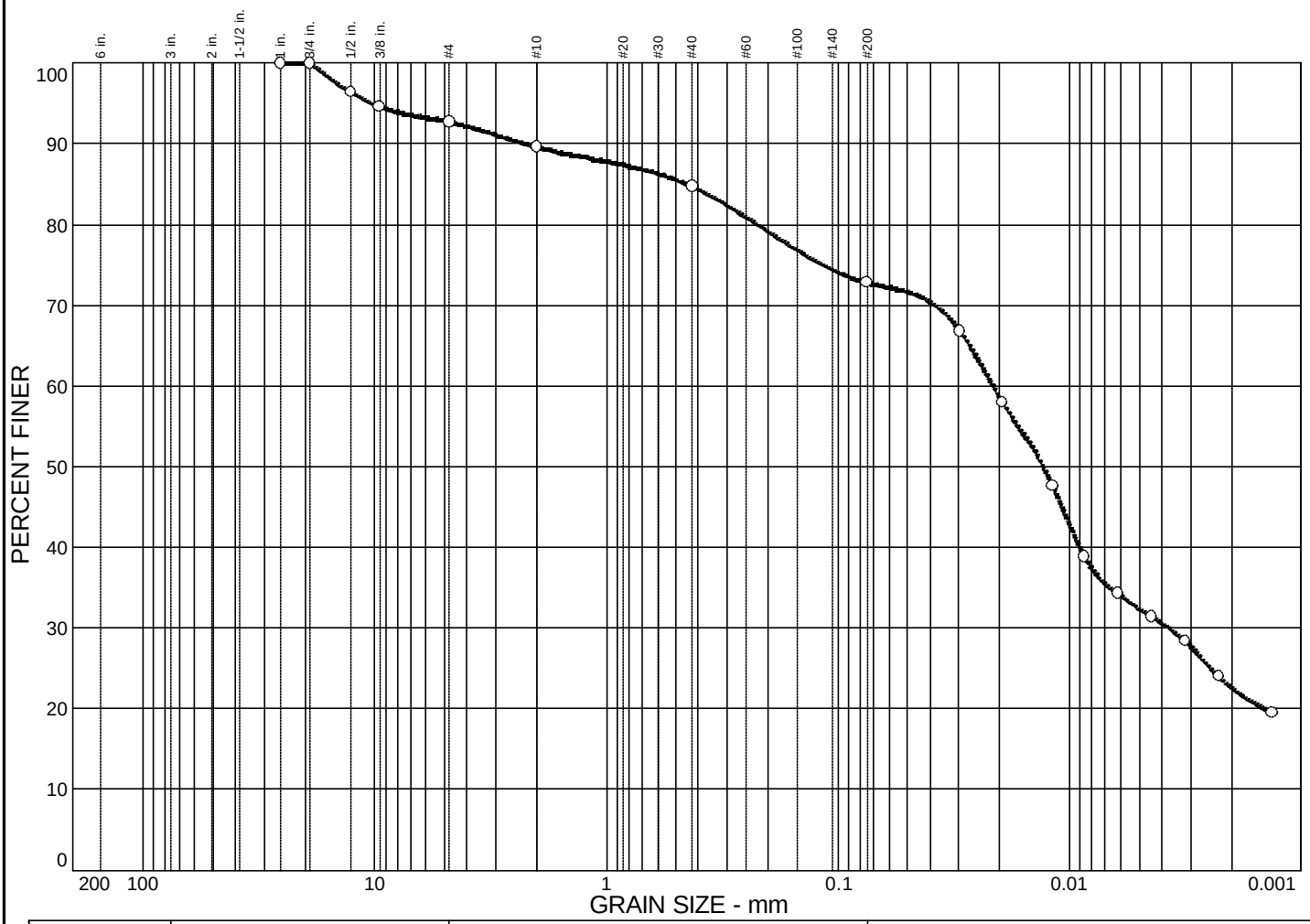
○

Particle Size Distribution Report

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-2,S-1

Particle Size Distribution Report



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	7.3	3.1	4.9	11.9	40.4	32.4

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	35	17	0.449	0.0215	0.0130	0.0037				

MATERIAL DESCRIPTION	USCS	AASHTO
○ REDDISH-BROWN SILTY CLAY	CL	A-6(11)

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

○ **Source:** BORING 25 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

Remarks:

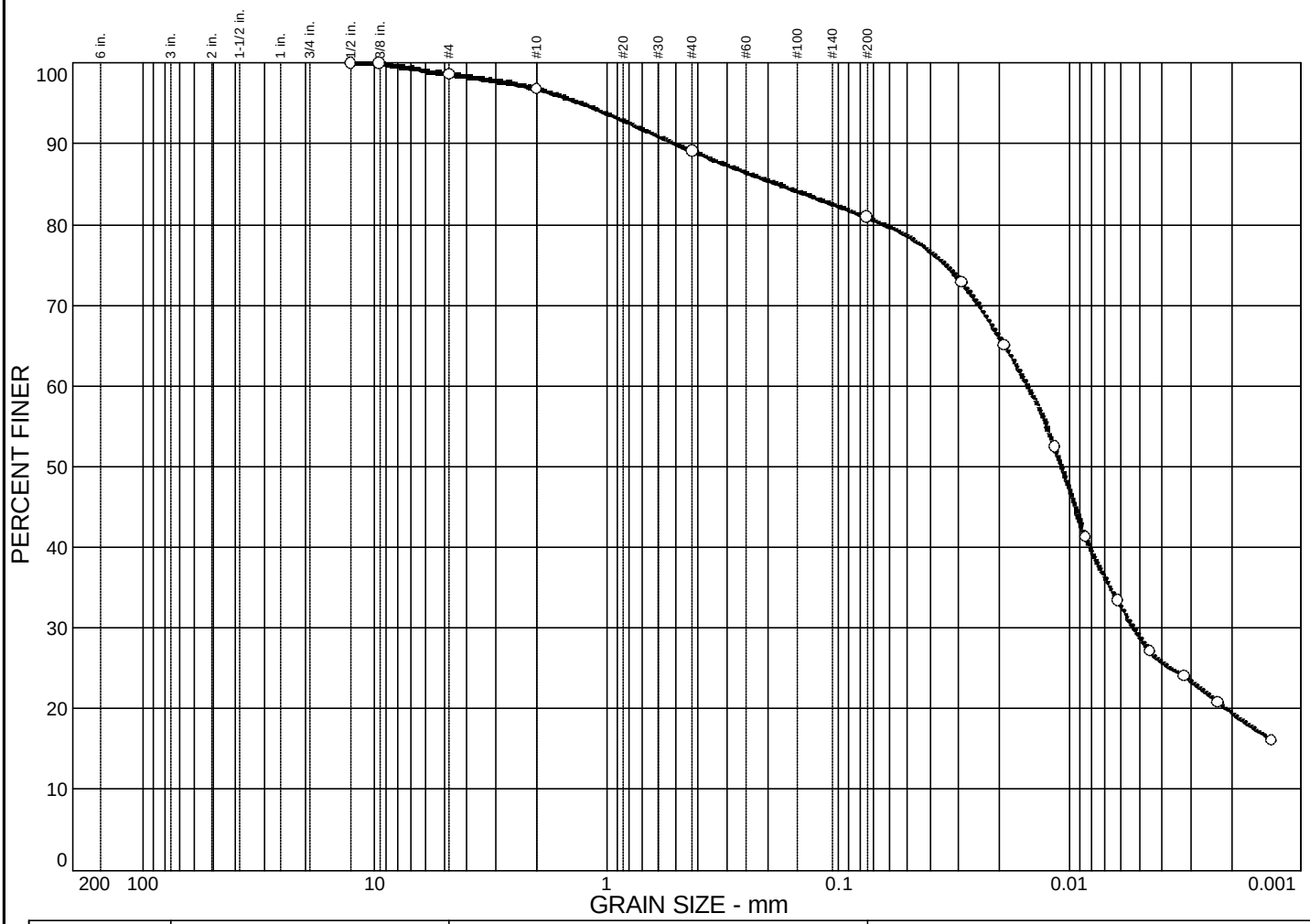
○

Particle Size Distribution Report

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-25,S-1

Particle Size Distribution Report



	% + 3"	% GRAVEL		% SAND			% FINES	
		CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.0	1.4	1.8	7.7	8.2	52.0	28.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	29	20	0.181	0.0151	0.0108	0.0053				

MATERIAL DESCRIPTION	USCS	AASHTO
○ BROWN CLAY	CL	A-4(6)

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

○ **Source:** BORING 6 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

Remarks:

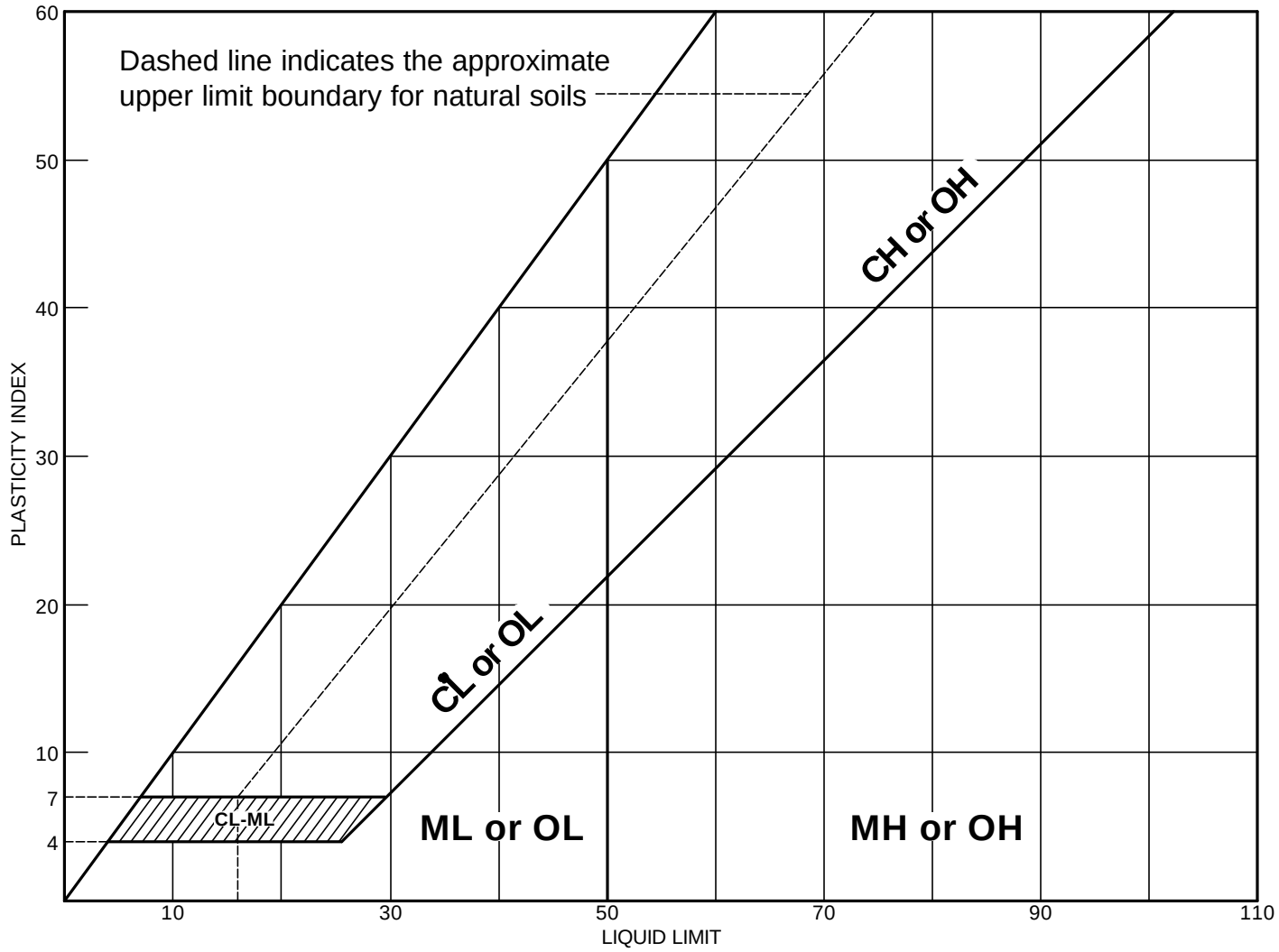
○

Particle Size Distribution Report

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-6,S-1

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SILTY CLAY	35	20	15	85.5	82.8	CL

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

● **Source:** BORING 19 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

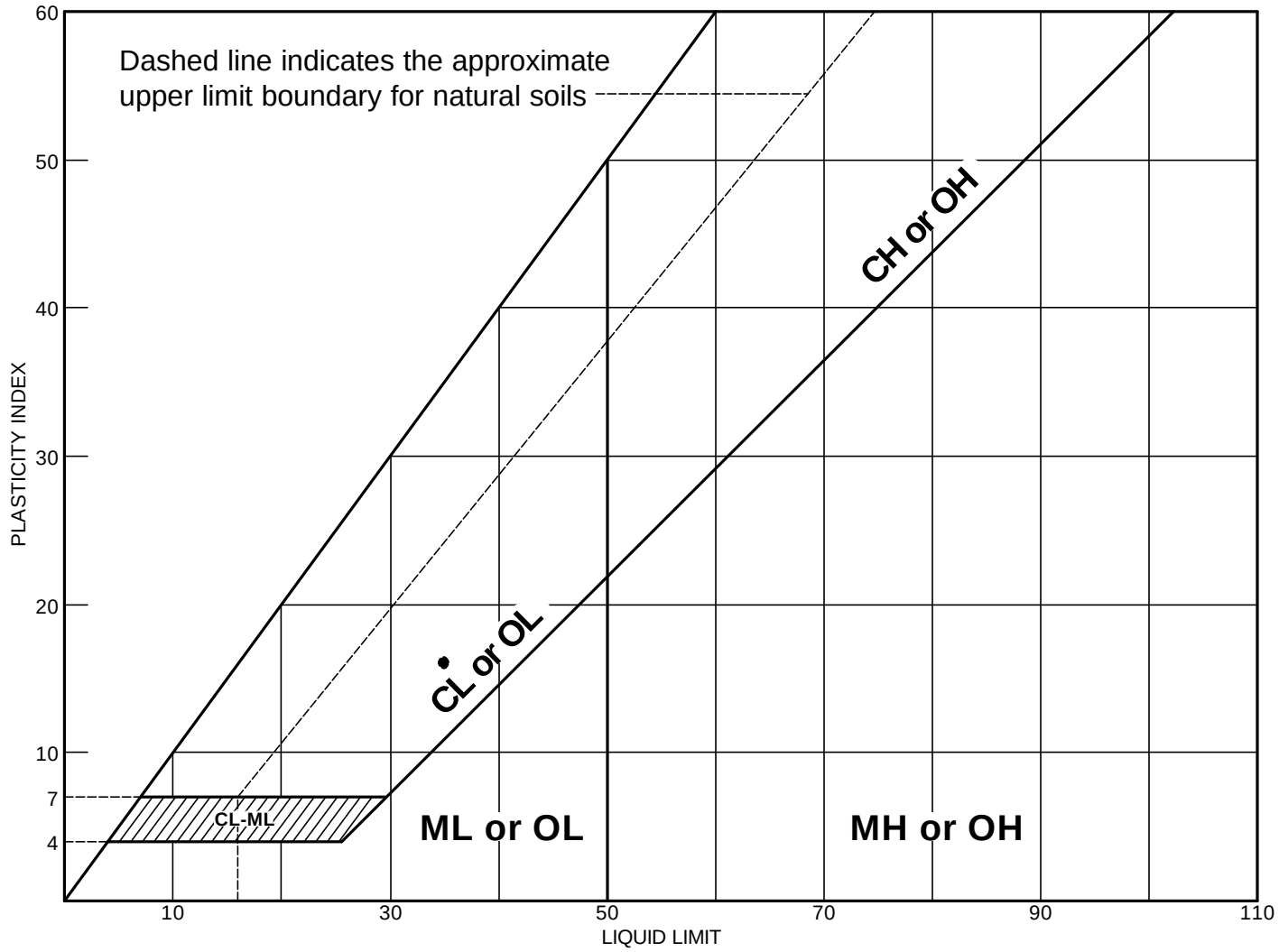
Remarks:

●

LIQUID AND PLASTIC LIMITS TEST REPORT
AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-19,S-1

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BRWON CLAYEY SILT	35	19	16	86.3	82.2	CL

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

● **Source:** BORING 19 **Sample No.:** S-2 **Elev./Depth:** 5.0'-10.0'

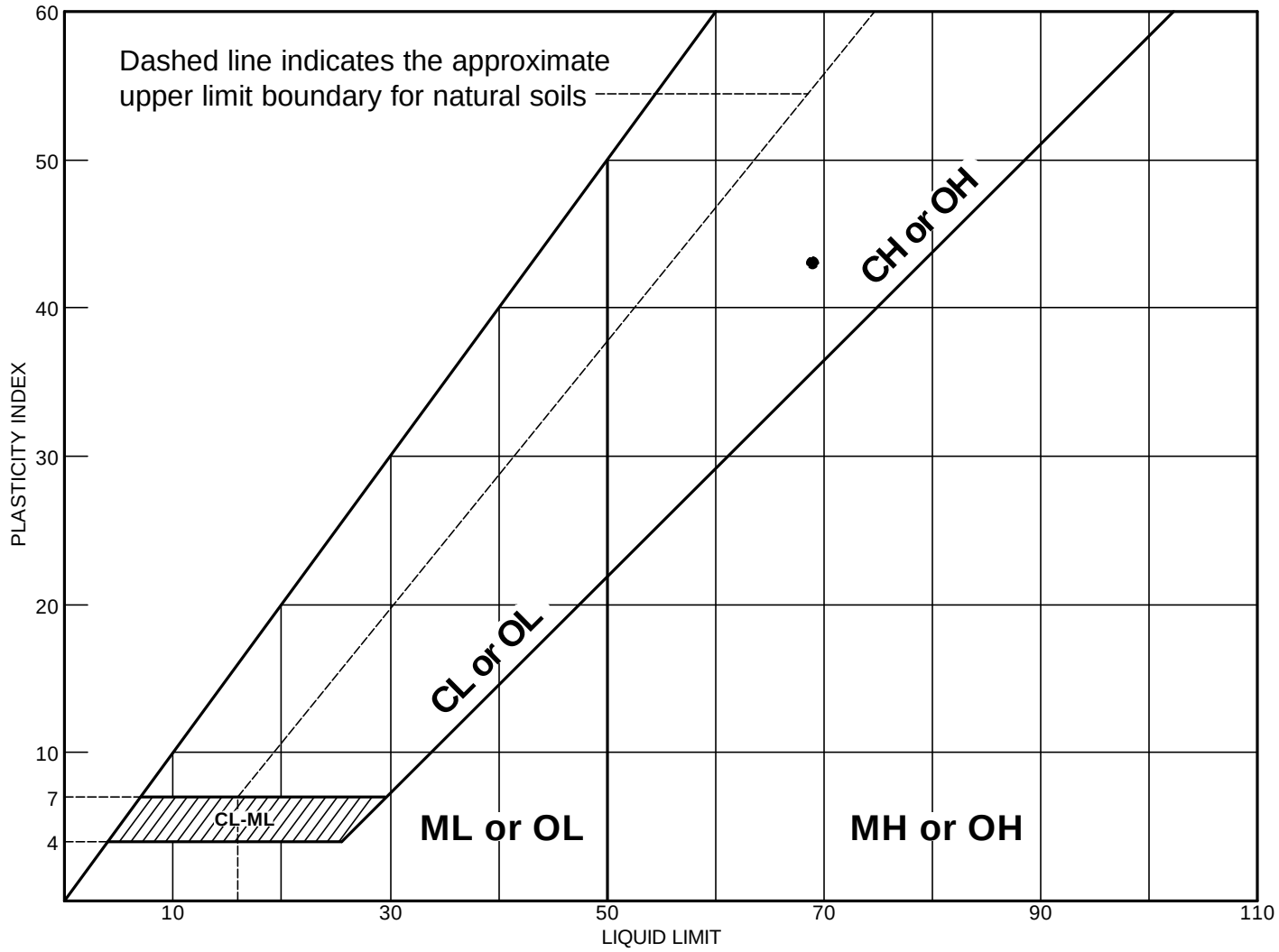
Remarks:

●

LIQUID AND PLASTIC LIMITS TEST REPORT
AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-19,S-2

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	REDDISH-BROWN SILTY CLAY	69	26	43	89.5	86.6	CH

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

● **Source:** BORING 2 **Sample No.:** S-1 **Elev./Depth:** 1.0'-5.0'

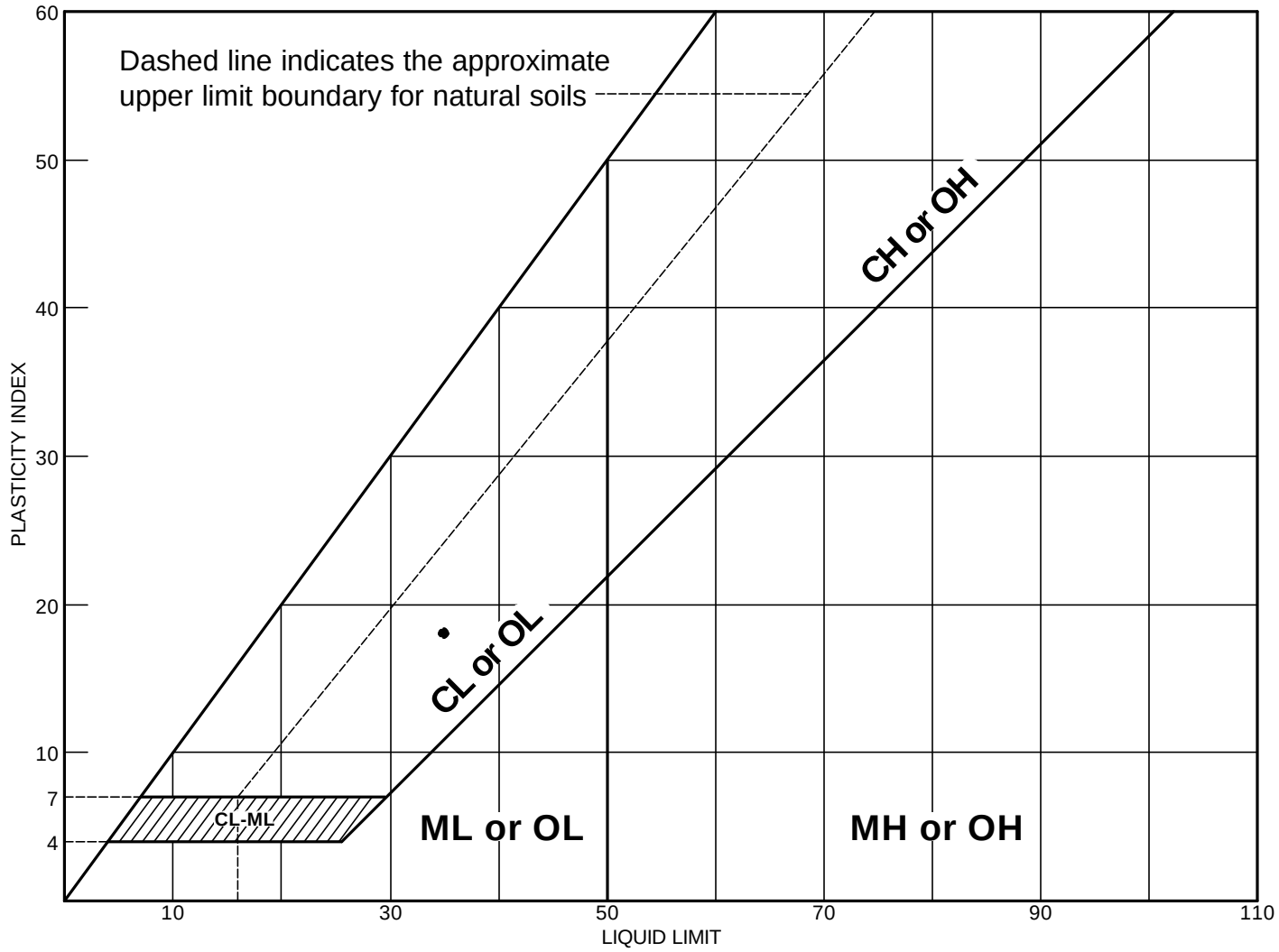
Remarks:

●

LIQUID AND PLASTIC LIMITS TEST REPORT
AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-2,S-1

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	REDDISH-BROWN SILTY CLAY	35	17	18	84.7	72.8	CL

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

● **Source:** BORING 25 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

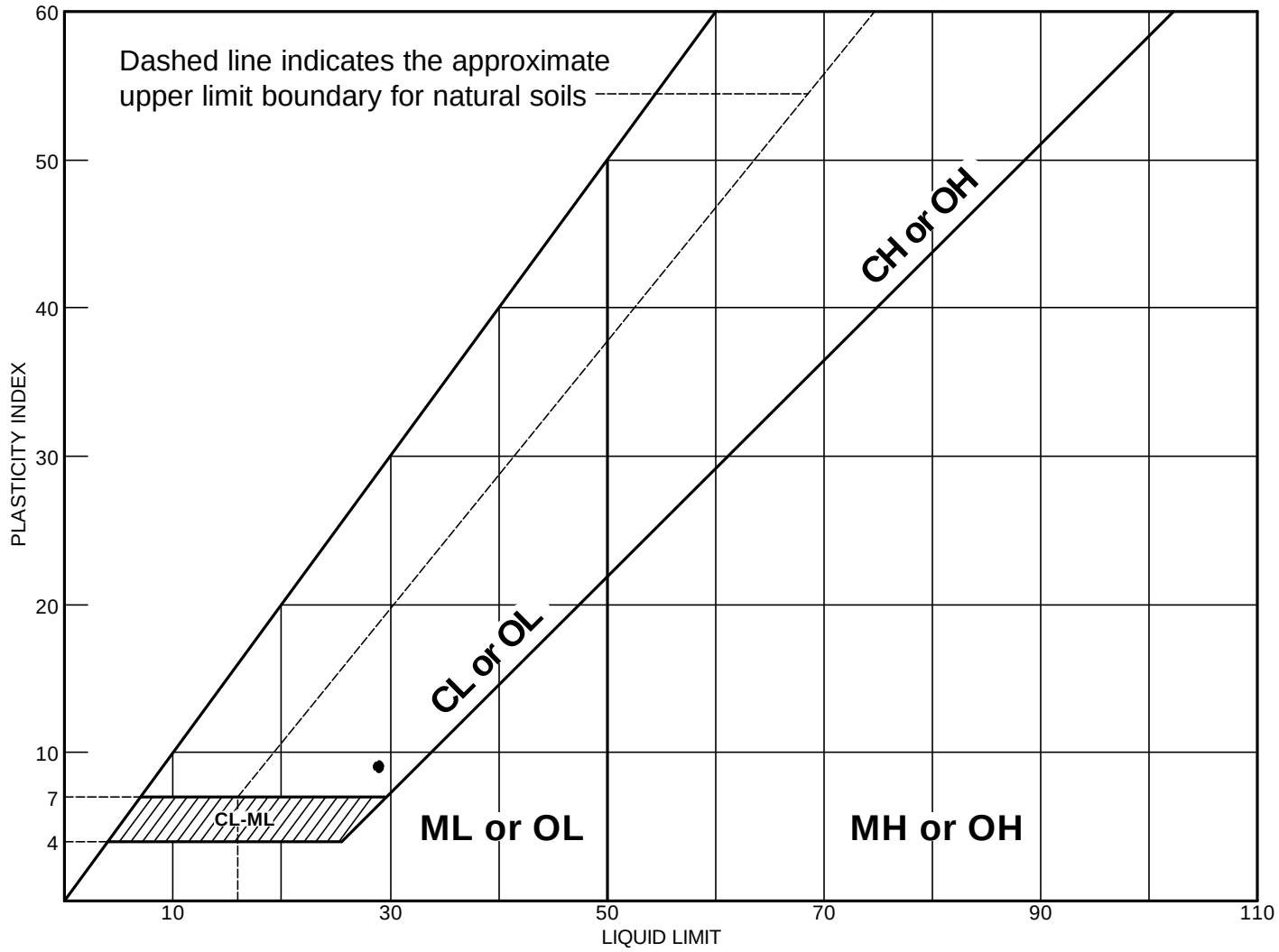
Remarks:

●

LIQUID AND PLASTIC LIMITS TEST REPORT
AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-25,S-1

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN CLAY	29	20	9	89.1	80.9	CL

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

● **Source:** BORING 6 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

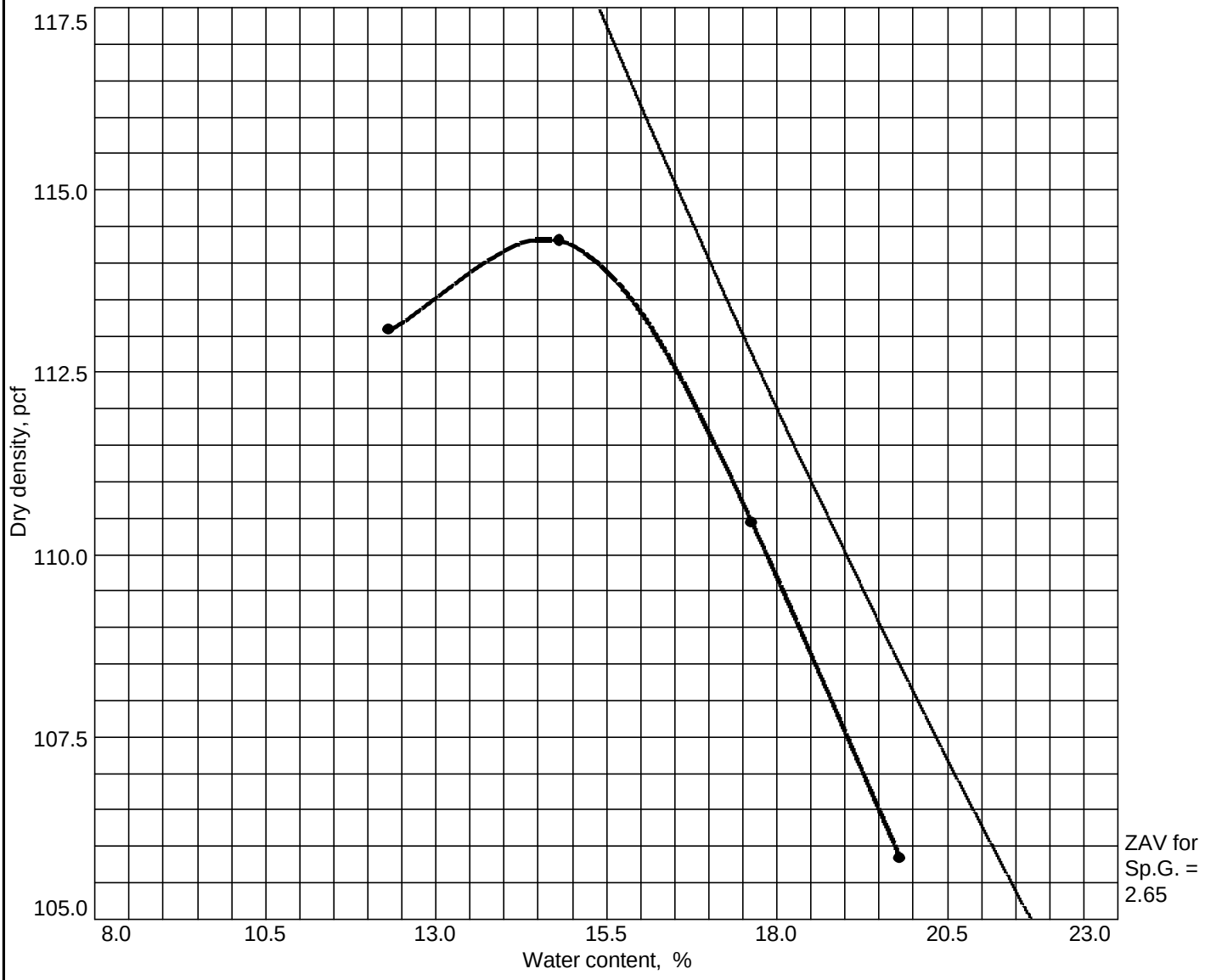
Remarks:

●

LIQUID AND PLASTIC LIMITS TEST REPORT
AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

FIGURE: B-6,S-1

MOISTURE-DENSITY RELATIONSHIP



Test specification: ASTM D 1557-91 Procedure A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
0.0'-5.0'	CL	A-6(12)			35	15	0.2	82.8

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 114.3 pcf Optimum moisture = 14.6 %	BROWN SILTY CLAY

Project No. 3-7590-0000 **Client:** naboo1
Project: RSP/FORT KNOX HOUSING/GEO

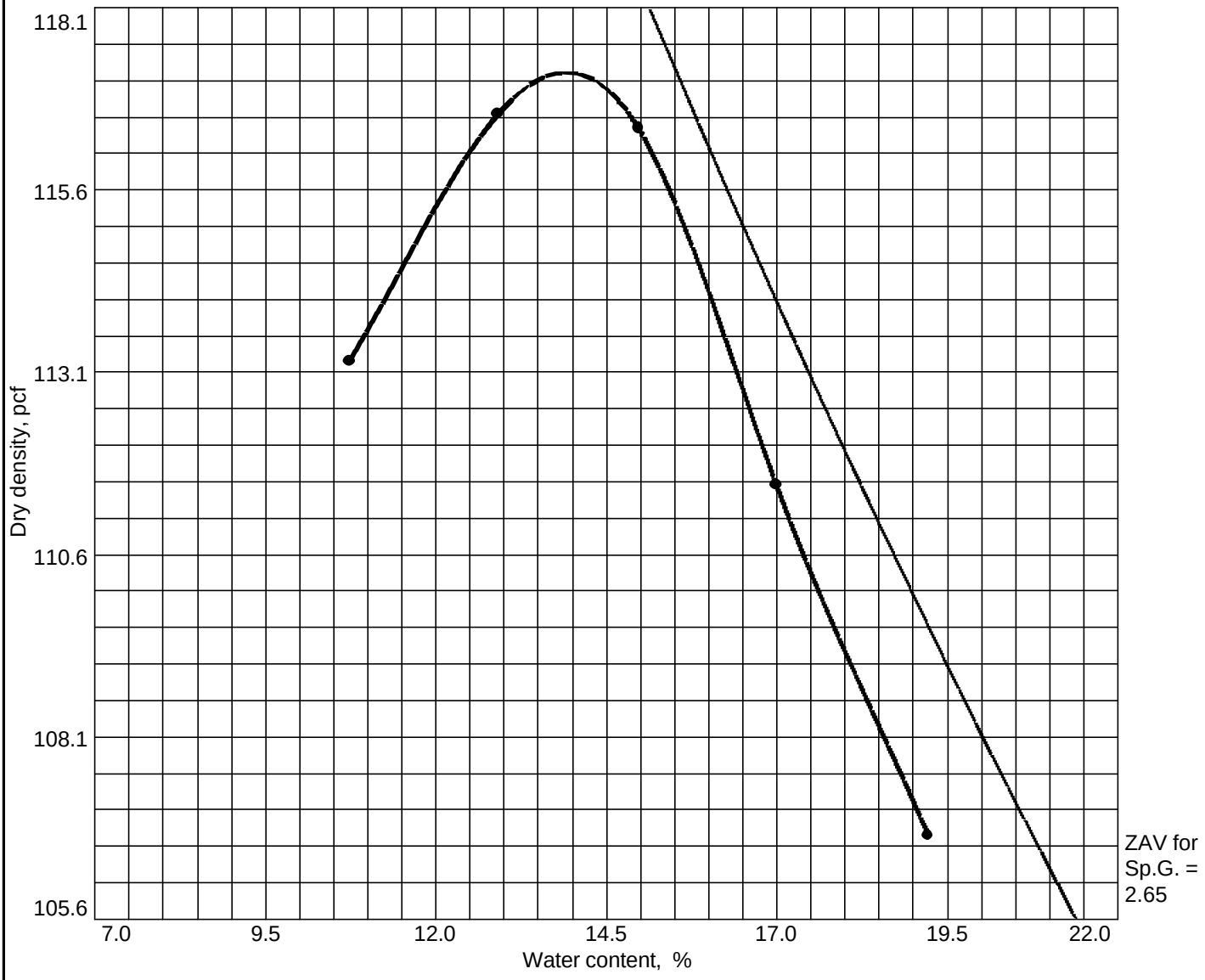
● **Source:** BORING 19 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

MOISTURE-DENSITY RELATIONSHIP
AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

Remarks:

FIGURE: B-19,S-1

MOISTURE-DENSITY RELATIONSHIP



Test specification: ASTM D 1557-91 Procedure A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
5.0'-10.0'	CL	A-6(12)			35	16	0.4	82.2

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 117.2 pcf Optimum moisture = 13.9 %	GRAY AND BRWON CLAYEY SILT

Project No. **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

● **Source:** BORING 19 **Sample No.:** S-2 **Elev./Depth:** 5.0'-10.0'

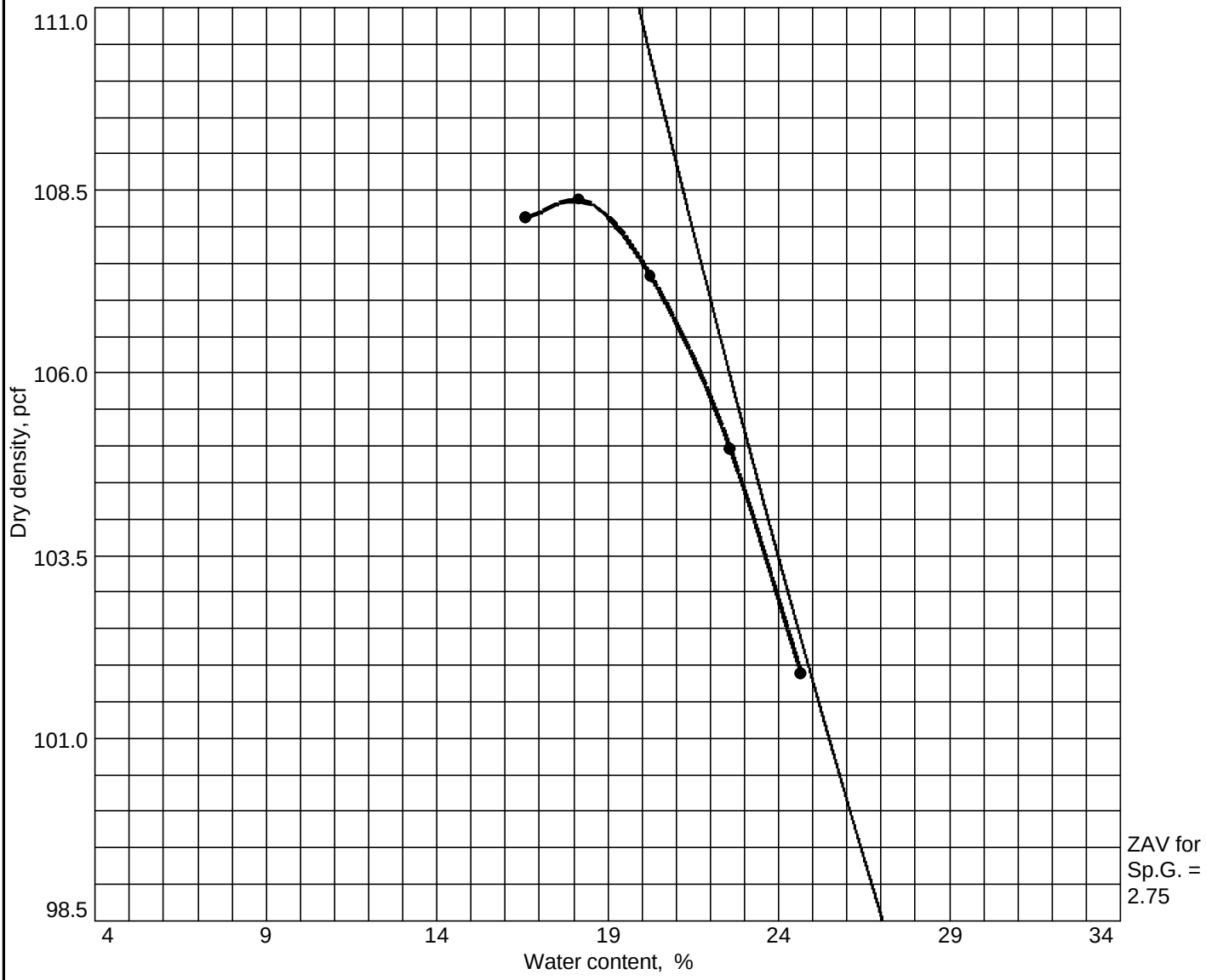
MOISTURE-DENSITY RELATIONSHIP

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

Remarks:

FIGURE: B-19,S-2

MOISTURE-DENSITY RELATIONSHIP



Test specification: ASTM D 1557-91 Procedure A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
1.0'-5.0'	CH	A-7-6(42)			69	43	0.5	86.6

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 108.4 pcf Optimum moisture = 18.0 %	REDDISH-BROWN SILTY CLAY

Project No. 3-7590-0000 **Client:** naboo1
Project: RSP/FORT KNOX HOUSING/GEO

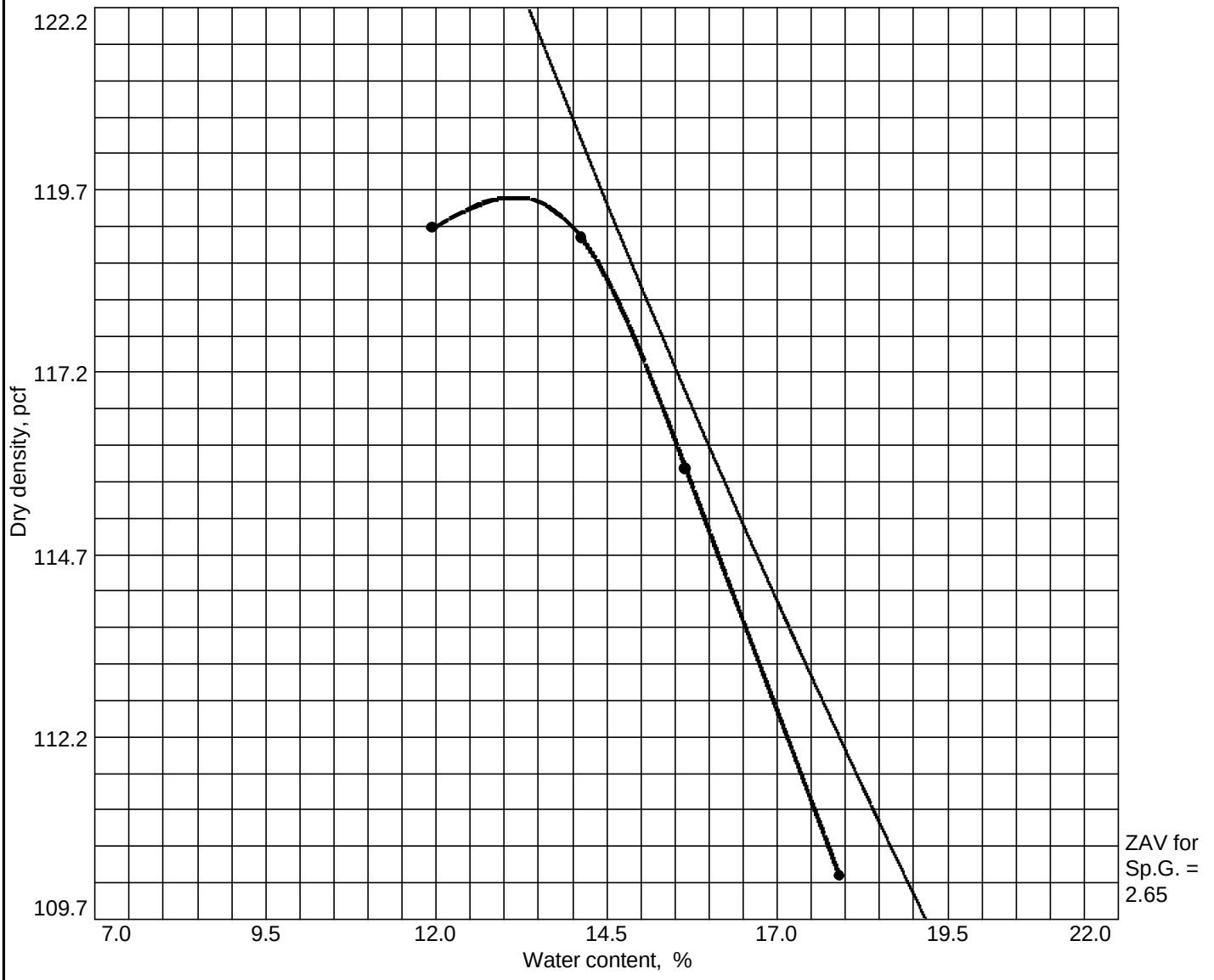
● **Source:** BORING 2 **Sample No.:** S-1 **Elev./Depth:** 1.0'-5.0'

MOISTURE-DENSITY RELATIONSHIP
AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

Remarks:

FIGURE: B-2,S-1

MOISTURE-DENSITY RELATIONSHIP



Test specification: ASTM D 1557-91 Procedure A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
0.0'-5.0'	CL	A-6(11)			35	18	7.3	72.8

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 119.6 pcf Optimum moisture = 13.1 %	REDDISH-BROWN SILTY CLAY

Project No. 3-7590-0000 **Client:** naboo1
Project: RSP/FORT KNOX HOUSING/GEO

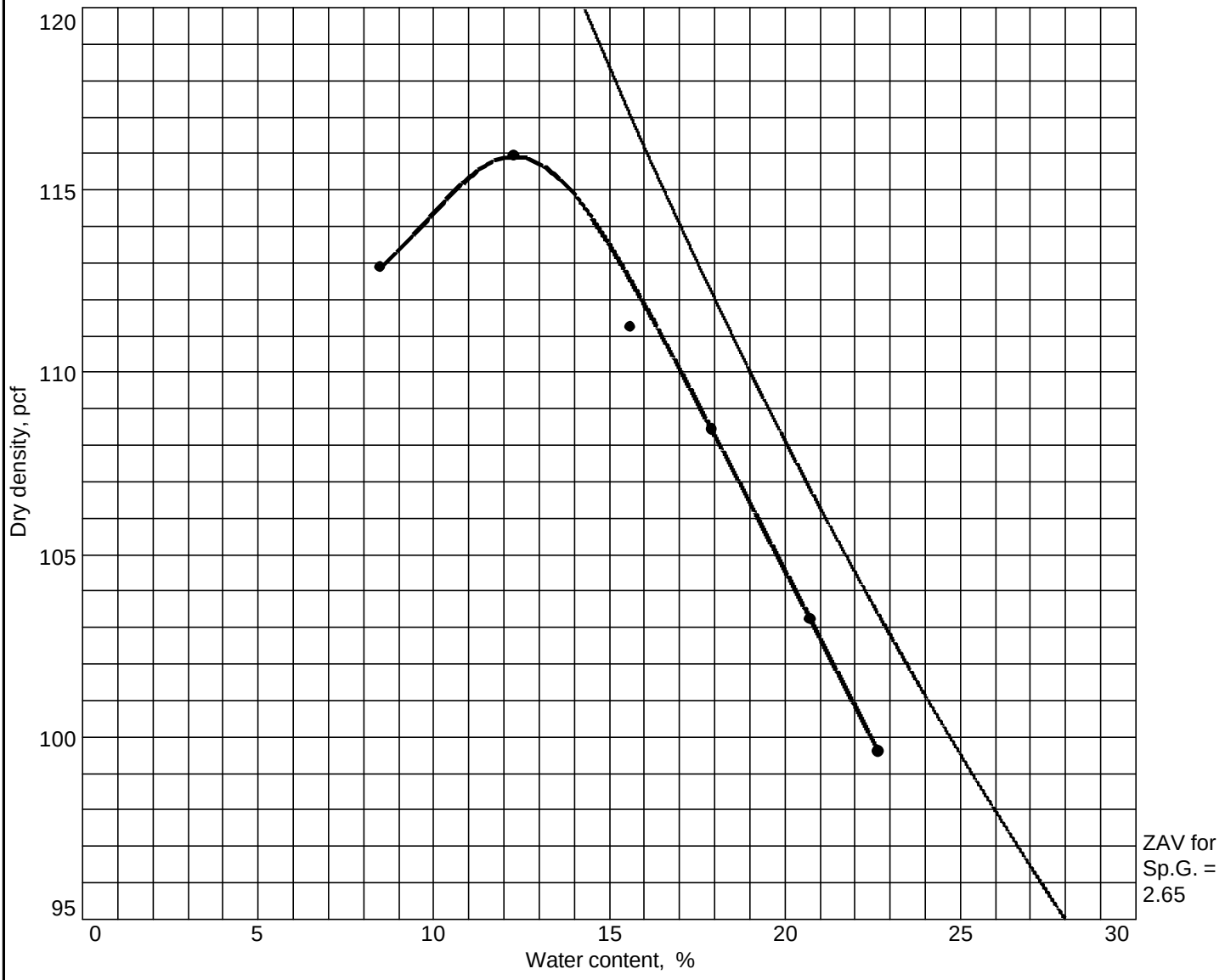
● **Source:** BORING 25 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

MOISTURE-DENSITY RELATIONSHIP
AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

Remarks:

FIGURE: B-25,S-1

MOISTURE-DENSITY RELATIONSHIP



Test specification: ASTM D 1557-91 Procedure A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
0.0'-5.0'	CL	A-4(6)			29	9	1.4	80.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 115.9 pcf Optimum moisture = 12.3 %	BROWN CLAY

Project No. 3-7590-0000 **Client:** naboo1

Project: RSP/FORT KNOX HOUSING/GEO

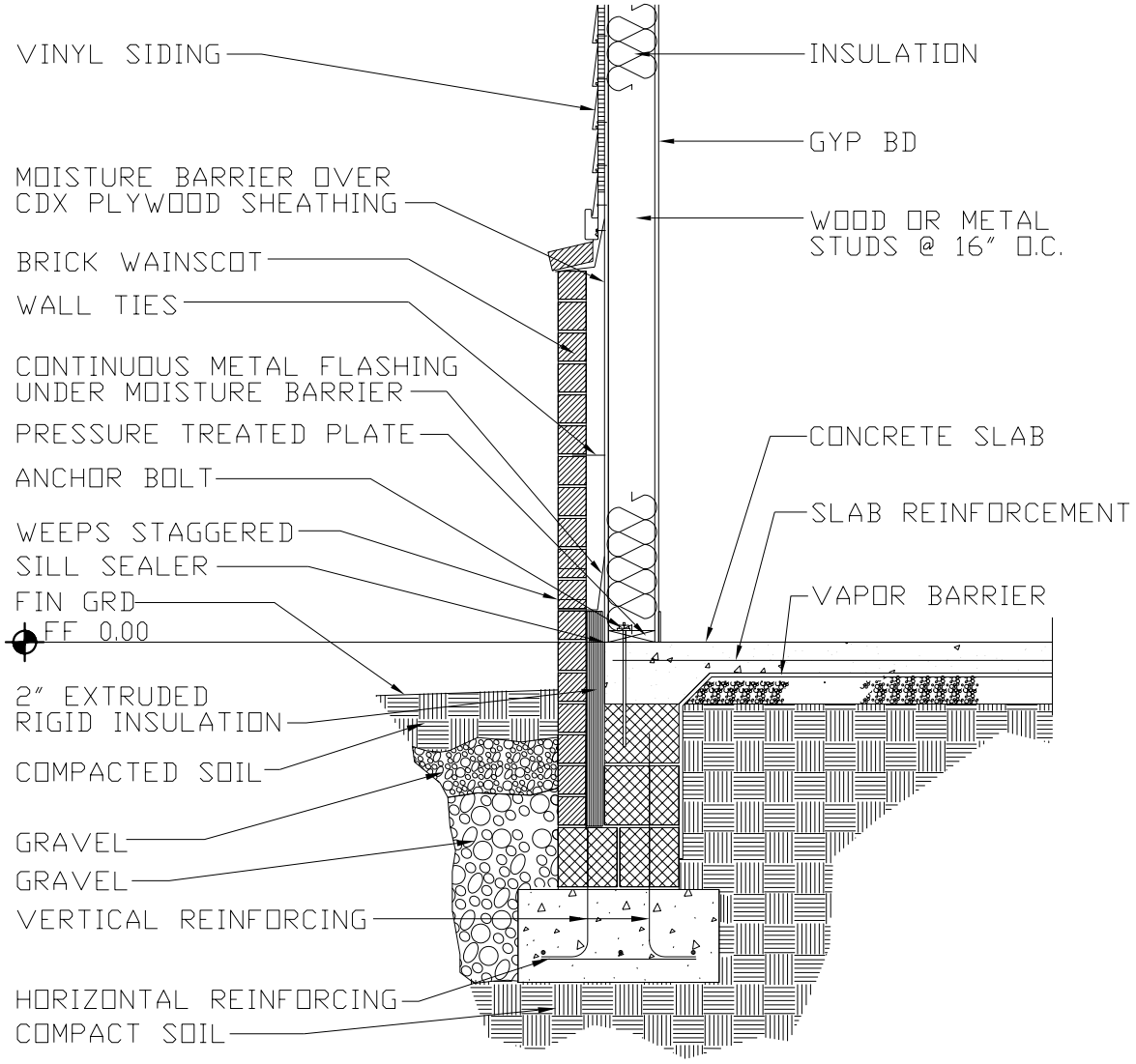
● **Source:** BORING 6 **Sample No.:** S-1 **Elev./Depth:** 0.0'-5.0'

MOISTURE-DENSITY RELATIONSHIP

AMEC GEOTECHNICAL AND CONSTRUCTION MATERIALS LABORATORY

Remarks:

FIGURE: B-6,S-1



WALL DETAIL - BRICK & SIDING

SECTION 01021L

DESIGN SUBMISSION REQUIREMENTS AFTER AWARD

07/02

PART 1 GENERAL

1.1 INTRODUCTION

This section contains information needed after the successful Offeror has been selected. This information is provided to all Offerors as an outline of the Design requirements to be anticipated after award.

The information contained in this section (01021L Design Submission Requirements After Award) applies to the design required for Whole Neighborhood Renewal, Fort Knox, KY.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CONTRACTOR DESIGN REQUIREMENTS AFTER AWARD

a. The Contractor must submit for Government Approval a Design Quality Control Plan in accordance with Section 01453, Paragraph 1.3, before design may proceed.

b. The Contractor shall design and detail a complete and useable facility in soft metric (inch-pound) units as outlined in this solicitation. The design phase of this project shall be in two parts.

PART I WILL INCLUDE:
* 100% Site and Foundation Design & 65% Building Design

PART II WILL INCLUDE:
* 100% Building Design

c. The submittals shall include specifications, drawings, Design Analysis, permit applications, confirmation notices, completed DD Form 1354, and submittal registers.

d. The design shall be completed in accordance with the codes and standards itemized in Statement of Work.

3.2 SUBMISSION OF DESIGN DOCUMENTS

a. The Contractor shall submit design documents with cover letter by overnight mail in accordance with the requirements of the Statement of Work. The letter shall indicate the project name, due date of comments, and

where to send the comments. All drawings shall be half-size. Specifications, submittal register, design analysis and other technical information shall be bound.

b. Formal Design Reviews will be held at Fort Knox, KY for the following milestone meetings:

* 100% Site & Foundation Design & 65% Building Design
* 100% Unchecked Building Design
* 100% Checked Building Design

c. Design Reviews shall not be taken as an approval and does not relieve the Contractor from responsibility for compliance with the RFP solicitation, Code Regulations, or betterments listed with the contractor's proposal or identified during proposal evaluation.

d. Construction may not proceed until the Government has received revised final documents which incorporate resolutions of all review comments. Section 00800, Para. 1.66, provides the instructions for how the Contractor will be notified when the design has been cleared for construction.

e. The Contractor shall allow a minimum of 28 days for each required Government Design Review.

3.3 GENERAL

a. The Contractor is required to independently prepare and submit for review a complete Design. The Contractor's Design Professionals shall independently confirm and be responsible for the technical accuracy and adequacy of all aspects of the project design.

b. The project design shall include the items listed in para 3.1.

c. The submission requirements outlined herein are the MINIMUM requirements necessary.

d. Document quantities and delivery addresses are specified at the end of this specification section. Quantities and addresses apply for each submittal.

e. Existing Documents: See Section 00800, paragraph 1.7.

f. Metric Requirements: All work shall be designed completely, including all drawings, specifications and design analysis in soft metric with english equivalents in parentheses. RFP site drawings are furnished in English units horizontally and metric units verically.and must be converted to soft metric (English) as part of the Design/Build contractor's work.

g. CADD Requirements

(1) All drawings shall be in AutoCad R2002. Only standard fonts provided by AutoCAD are allowed to be used in the creation of CADD

files. No fonts created by third parties or the designers are permitted. The Contractor shall use EM 1110-1-1807 Standards Manual for U.S. Army Corps of Engineers Computer-Aided Design and Drafting (CADD) Systems as guidance for standard details, cell libraries, title blocks, and layer/level assignments. The use of Xrefs during the design stage is at the discretion of the designers. All Xref files shall be removed at the submittal of the final construction documents.

(2) Provide a separate electronic drawing file for each project drawing. Each file shall contain all the data for one complete drawing, including the date and border. Each drawing file must be completely independent of any data in any other file. Drawing files with external references such as reference file attachments or special fonts will not be acceptable. All displayable graphic elements on all levels of the drawing file must be part of the project drawing image. The drawing file may not contain any graphic element that is not part of the drawing image.

(3) Provide a list of all drawings in the set of project drawings together with the name of the electronic file that contains the data for each drawing.

(4) Submitted hard copy drawings must be plotted directly from the electronic file.

h. Specifications and Reports

(1) Provide project specifications and reports in a single electronic document file in Microsoft Word (version 7.0), Windows 95 format. The complete document: including title sheet, table of contents, submittal checklist, and all specification sections; must be assembled into a single electronic document in Word format.

(2) Provide independent page numbering for each specification section. The page number shall incorporate the specification section number (e.g. - 15010-1).

(3) Submitted hard copy documents must be printed directly from the electronic file.

i. Electronic Data

(1) Electronic data of all design documents must be provided with the Certified Final Design Submittal. Data shall be on CD ROM 5-1/4 inch disc.

j. As-Built Documents: Provide as-build drawings and specifications in accordance with Section 00800, Para. 1.9.

k. Submittal Register: The contractor will be required to prepare a Submittal Register (Engineering Form 4288) identifying all construction submittals. Each submittal item shall be identified and coded in accordance with Section 01331. A completed Engineering Form 4288, approved by the Contracting Officer, will be required prior to commencement of

construction.

3.4 SUBMISSION REQUIREMENTS

3.4.1 Design Phase

a. Part 1 will consist of plans, specifications and design analysis for sitework, utilities, and foundations, 100% complete and architectural, structural, mechanical, electrical 65% complete.

b. Part 2 will consist of plans, specifications and design analysis for structural, architectural, mechanical and electrical 100% percent.

c. Review sets will be distributed, by the Contractor, as shown on the list at the end of this section. Written comments will be provided to the Contractor and a review meeting to discuss the comments and preliminary responses will be held at Fort Knox, KY for each part of the design. The Contractor will keep the minutes of the meetings and forward the minutes and annotated comments to all reviewers within 7 days of the meeting. The annotations will be detailed enough to indicate exactly what the Contractor will do to comply with the comments. The contractor shall assemble the comments received into a complete package. The complete package of comments and responses shall be transmitted to all offices that received the design submitted.

d. The Government's review is not to be considered a quality control review; the contractor shall provide his own internal quality control as required by contractor Design Quality Controls Plan 01331 before the design is submitted to the Government. It is very important the contractor's entire team agrees with the design before it is submitted to the Government. Each design submittal shall be stamped "approved" by the contractor, major constructors and by the design team prior to submission for review. The Government's review or approval does not relieve the contractor of his responsibility to provide a safe, functional project in accordance with the terms of the contract. All final drawings shall be signed and sealed by the Design Professional. Quality control procedures shall consist of design and/or checking by registered professionals and a review completed by a separate professional. Complete names of designers, checkers, and reviewers shall appear in the drawing title block.

e. The Government's review will likely result in a significant number of comments. The Contractor shall respond to each comment with a response that clearly indicates what action will be taken. Comments that, in the Contractor's opinion, require effort outside the scope of the contract will be clearly indicated as such by the Contractor. The Contractor shall not proceed with work outside the contract until a modification to the contract is properly executed.

f. The Contractor (including appropriate design representatives) will be required to participate in project progress meetings at Fort Knox, KY. Meeting requirements include the following:

Monthly Progress Meetings - At a minimum, the Construction Project Manager, Design Project Manager, and appropriate Design

Professionals shall attend.

Additional meetings may be required, if in the Government's opinion, they are required to facilitate the design process.

3.4.2 Construction Phase

a. Notice-to-Proceed for construction will precede any construction work.

b. A separate Notice-to-Proceed for the Part II Design will be issued upon completion and approval of that portion of the design.

c. As the first item of work during each approved construction phase, the Contractor shall furnish to the Government 15 half size sets and 5 full size sets of the approved drawings and 20 sets of the approved specifications for its use during construction.

d. No construction will be allowed on work for which the design has not been reviewed and approved.

e. The Contractor (including appropriate design representatives) will be required to participate in project progress meetings at Fort Knox, KY. Meeting requirements include the following:

- Weekly Coordination Meetings - At a minimum, the Construction Project Manager, Project Superintendent, and appropriate sub-contractors shall attend.

- Monthly Progress Meetings - At a minimum the Construction Project Manager and Design Project Manager shall attend.

- Quarterly Senior Advisory Meeting - At a minimum, the Senior Executive Manager for the construction and design team shall attend.

- Additional meetings may be required, if in the Government's opinion, they are required to facilitate the construction process.

f. The Design/Build design team shall be required to visit the site 24 times (independent of scheduled meetings) during design and construction. Site visits will be scheduled at the request of the Contractor. At least two (2) Design Professionals will be required for each visit.

g. The Designer of Record will be required to review and approve all project submittals.

3.4.3 PART 1 SUBMISSION REQUIREMENTS

a. Part 1 Design will consist of drawings, specifications and design analysis for sitework, utilities, and foundations (100% complete) and architectural, structural, mechanical, electrical (65% complete).

b. Drawings

(1) Submit drawings complete with all RFP requirements incorporated

into the documents to provide a complete 100% design for sitework, utilities, and foundations.

(2) Submit drawings complete with the RFP requirements incorporated into the documents to reflect a 65% complete design for architectural, structural, mechanical, and electrical work.

c. Design Analysis

(1) The Design Professional shall prepare an independent Design Analysis and calculations necessary to confirm and support all design documents submitted for review. At a minimum, the Design Analysis shall include site civil calculations, structural calculations, life safety and building code analysis, HVAC analysis and calculations, sprinkler system analysis, electrical load analysis and calculations, electrical short circuit and protective device coordination analysis and calculations.

(2) Analysis and calculations for the sitework, utilities, and building foundations shall be 100% complete. Analysis for architectural, structural, mechanical, and electrical work shall be 65% complete.

d. Specifications

(1) The specifications provided with this solicitation state the Government's minimum requirements. The Design Professional shall edit and expand the specifications to insure that all project design requirements, current code and regulatory requirements are met.

(2) Specifications for the sitework, utilities, and building foundations shall be 100% Complete. Specifications for architectural, structural, mechanical, and electrical work shall be 65% complete.

e. Structural Interior Design (SID)

(1)Interior Finishes Boards

Prepare and submit for approval two different interior building finishes schemes (Scheme A & B) of comparable quality. It is recommended the Contractor meet with and/or discuss the interior finishes with the Government prior to preparation of the individual schemes to be submitted for review and selection. Two (2) copies each of the Scheme A and Scheme B original building finishes boards shall be submitted.

At a minimum, Scheme A & B Building Finishes Color boards shall include original color samples of the following:

All wall finishes (paint, vinyl, tile, etc.). Provide information regarding tile patterns, etc. where applicable.
All flooring finishes (carpet, tile, vinyl composite tile, etc.). Provide information regarding tile patterns where applicable.
All ceiling finishes (acoustic tile, paint, etc.)
All millwork materials and finishes (cabinets, counter tops, etc).
All window blinds

Each item on the Finishes Boards shall be identified and keyed to the floor plans to provide a clear indication of how and where each item will be used.

At the conclusion of the 65% Design Phase (after comments have been incorporated in the design), the Government will select and direct the Contractor to proceed with one of the schemes presented.

(2) Exterior Finish Boards

Prepare and submit for approval two copies (boards) of the proposed exterior building materials.

At a minimum, the Exterior Building Materials Board shall include original color samples of the following:

Roofing Material
Brick or stone Samples
Siding
Glass
Exposed exterior metals
Window & door finishes
Specialty items

Each item on the Exterior Building Materials Board shall be identified and keyed to the building elevations to provide a clear indication of how and where each item will be used.

At the conclusion of the 65% Design Phase (after comments have been incorporated in the design), the Government will direct the Contractor to proceed with the exterior finishes.

f. Survey and geotechnical investigation report - the Contractor shall submit his 100% complete survey and geotechnical investigation report.

g. The preliminary life safety analysis shall be prepared using the form provided at the end of this Section, and provided with this submittal.

h. The Contractor shall submit his preliminary sustainability analysis, using the form provided as Attachment 14 to the Statement of Work.

i. The Contractor shall submit a statement confirming that, at a minimum, the significant trees which were identified to be preserved in his proposal are being preserved.

j. The Contractor shall obtain Nolin Rural Electrical Cooperative Corporation electrical service construction drawings, and submit them with this submittal.

k. The Contractor shall submit his GCHP drilling plan with this submittal.

3.4.4 PART 2 SUBMISSION REQUIREMENTS

a. Part 2 will consist of plans, specifications and design analysis for sitework, utilities, structures, architecture, mechanical and electrical (100% complete).

b. Drawings

(1) Submit drawings complete with all RFP requirements incorporated into the documents to provide a complete 100% design (Part 1 & Part 2) reflecting the requirements for Whole Neighborhood Renewal, Fort Knox, KY. All drawings submitted for the final 100% design will be considered an independent and complete design for this project Whole Neighborhood Renewal, Fort Knox, KY. All drawings submitted shall be designed and reviewed by or under the direct supervision of licensed professionals in the applicable area of expertise.

(2) All Final Design Part 1 & Part 2 Drawings (100%) shall bear the seal of the licensed professional responsible for the design.

c. Design Analysis:The Design Professional shall prepare an independent Design Analysis and calculations (Part 1 & Part 2) necessary to confirm and support all design documents submitted for approval. At a minimum the Design Analysis shall include Site civil calculations, structural calculations, life safety & building code analysis, HVAC analysis and calculations, sprinkler system analysis, electrical load analysis and calculations, electrical short circuit and protective device coordination analysis & calculations.

d. Specifications

(1) Specifications for the sitework, utilities, and building foundations shall be 100% Complete. Specifications for architectural, structural, mechanical, and electrical work shall be 100% complete.

e. Rendering and Rendering Photography

Contractor shall be required to provide a colorrendering, in tempra media, and photos of the building exterior as follows:

- 1 - 18" x 24" color original framed & matted behind glass
- 1 - 18" x 24" color copy framed & matted behind glass
- 3 - 8" x 10" color view graph slides
- 3 - 35mm color slides
- 3 - 35mm color negatives
- 5 - Framed 8" x 10" color photographs framed & matted behind glass

f. Architectural Photography: Within 6 months after building occupancy the Contractor shall provide photography of 4 exterior and 6 interior views as selected by the Government. Three sets of 8x10 color prints and 35mm color slides of each view shall be provided.

g. Submittal Register: The Contractor shall prepare the Submittal Register and submit it with his design (see Specification Section 01331).

All shop drawings and other construction submittals shall be reviewed and stamped as approved by the appropriate professional in the contractor's design team, before submitted to the Government.

h. Preparation of DD Form 1354 (Transfer of Real Property): This form itemizes the types, quantities and costs of various equipment and systems that comprise the project, for the purpose of transferring the new construction project from the Corps Construction Division to the Installation's inventory of real property. The Project Engineer will furnish the contractor a project specific DD Form 1354 checklist. This checklist will be used as a guide in preparation of the project draft DD1354. The contractor shall prepare the draft DD 1354, and submit it with the final design. Submit an updated or corrected checklist and draft DD 1354 with the certified final design. The Corps will use these documents to complete the final DD 1354 upon completion of construction.

i. Structural Interior Design (SID)

(1) Interior Finishes Boards

Prepare and submit two original copies of the interior building finishes approved at the 65% Design. Finishes boards shall incorporate all comments and changes approved at the 65% Design.

At a minimum, Finishes Color boards shall include original color samples of the following:

All wall finishes (paint, vinyl, tile, etc.). Provide information regarding tile patterns, etc. where applicable.

All flooring finishes (carpet, tile, vinyl composite tile, etc.). Provide information regarding tile patterns where applicable.

All ceiling finishes (acoustic tile, paint, etc.)

All millwork materials and finishes (cabinets, counter tops, etc).

All window blinds

Each item on the Finishes Boards shall be identified and keyed to the floor plans to provide a clear indication of how and where each item will be used.

(2) Exterior Finish Boards

Prepare and submit for approval two copies (boards) (8-1/2" x 11", 3-ring binder format) of the exterior building materials approved at the 65% Design. Exterior materials boards shall incorporate all comments and changes approved at the 65% Design.

At a minimum, the Exterior Building Materials Board shall include original color samples of the following:

Roofing Material
Brick or stone Samples

Siding
Glass
Exposed exterior metals
Window & door finishes
Specialty items

Each item on the Exterior Building Materials Board shall be identified and keyed to the building elevations to provide a clear indication of how and where each item will be used.

j. The final life safety analysis shall be prepared using the form provided at the end of this Section, and provided with this submittal.

k. The Contractor shall submit his final sustainability analysis, using the form provided as Attachment 14 to the Statement of Work.

l. The Contractor shall submit the survey, geotechnical investigation report, and electrical service construction drawings with this submittal.

m. The Contractor shall submit a statement reconfirming that, at a minimum, the significant trees which were identified to be preserved in his proposal are being preserved.

n. The Contractor shall prepare an accounting of the additional design and construction costs to obtain a Gold SPiRiT rating (minimum of 50 points) rather than a Bronze rating (minimum 25 points). To do so, Contractor shall identify those items from his project SPiRiT matrix (see 3.4.4.k above) which would not have been implemented if only a Bronze rating was required, and provide an individual design and construction implementation cost for each of them.

LIST OF ADDRESSES FOR REVIEWS COPIES

Tom Walker 8
ATTN: CELRL-ED-MA
Corps of Engineers, Louisville District
600 Dr. Martin Luther King, Jr. Place
Louisville, KY 40202-2230

James Cruz 1
Corps of Engineers, Louisville District
600 Dr. Martin Luther King, Jr. Place #972
Louisville, KY 40202-2230

Thomas C. McQuary, PE 2
Fort Knox Area Office
Building 122, Binter Street
Fort Knox, KY 40121-5000

David Blandford 10
DBOS (ATZK-OSP-M)
Building 1110
Fort Knox, KY 40121-5000

JR Cardin 1
DBOS
Building 1110 Basement, 6th Avenue
Fort Knox, KY 40121-5000

John Griffanti 2
Facilities Management-Housing Division
Bldg 1383 Vine Grove Road
Fort Knox, KY 40121

Terry Deglandfon 2
CENAO-TS-A/E
803 Front Street
Norfolk, VA 23510

Emma Watson 1
DBOS
Building 1110 Basement, 6th Avenue
Fort Knox, KY 40121-5000

FIRE PROTECTION/LIFE SAFETY CODE SUBMITTAL
Revised May 19, 2003

*Instructions: The information outlined in this document shall be used to provide the **minimum** requirement for development of Fire Protection and Life Safety Code submittals for all building projects. Additional and supplemental information may be used to further develop the code review. Insert N/A after criteria, which may be "not applicable".*

1. Project Name (insert name and location)

Applicable Codes and Standards

Unified Facilities Criteria (UFC): 1-200-01, General Building Requirements, 31 July 2002.

Unified Facilities Criteria (UFC): 3-600-01, Design: Fire Protection Engineering For Facilities, 17 April 2003

International Building Code (IBC) 2000 for fire resistance requirements, allowable floor area, building height limitations and building separation distance requirements, except as modified by UFC 3-600-01.

National Fire Protection Association (NFPA) 101 Life Safety Code (latest edition), for building egress and life safety and applicable criteria in UFC 3-660-01.

Uniform Federal Accessibility Standards (UFAS), August 1984 and the Americans with Disabilities Act Accessibilities Guidelines (ADAAG), as amended through January 1998, will be used, whichever is most stringent.

1. Occupancy Classification
IBC chapters 3 and 4

2. Construction Type
IBC chapter 6

3. Area Limitations
IBC chapter 5, table 503

Allowable floor areas
IBC section 503, 505

Allowable area increases
IBC section 506, 507
Maximum Height of Buildings
IBC section 504

Fire-resistive substitution

4. Occupancy Separations

IBC table 302.3.3

5. Fire Resistive Requirements IBC table 601, 602	Exterior Walls – ( ) hour rating Interior Bearing walls - ( ) hour rating Structural frame- ( ) hour rating Permanent partitions- ( ) hour rating Shaft enclosures- ( ) hour rating Floors & Floor-Ceilings- ( ) hour rating Roofs and Roof Ceilings – ( ) hour rating
6. Automatic Sprinklers and other Extinguishing Equipment UFC 3-600-01, chapters 4 and 6	Used to determine the need for automatic Extinguishing systems, foam systems, standpipe systems, wet chemical systems, etc. State which systems are required and to what criteria they will be designed.
UFC 3-600-01, Appendix B	Occupancy Classification– note the classification for each room. This may be accomplished by classifying the entire building and noting exceptions for rooms that differ. (Eg. The entire building is Light Hazard except boiler room and storage rooms are …, etc.)
UFC 3-600-01, Chapter 3	Sprinkler Design Density, Sprinkler Design Area, Water Demand for Hose Streams (supply pressure and source requirements).
UFC 3-600-01, Chapter 4	Coverage per sprinkler head
Available Water Supply	Provide the results of the water flow tests showing the available water supply static pressure and residual pressure at flow. Based on this data and the estimated flow and pressure required for the sprinkler system, determine the need for a fire pump.
7. **Portable Fire Extinguishers** NFPA 10	Fire classification and travel distance.
8. Enclosure Protection	Mechanical rooms, stairwells, storerooms, janitor (__ hour rating). IBC Table 302.1.1 Fire Blocks and Draft Stops MIL HDBK 1008C para. 2.2.1
9. Fire and Smoke Dampers NFPA 90A	Describe where fire dampers and smoke dampers are to be used. State whether isolation smoke dampers are required at the air handler.
10. Detection Alarm and Communication UFC 3-600-01, Chapter 5) NFPA 101 para. 3.4 (chapters 12-42)	

11. Interior Finishes (classification)
NFPA 101.10.2.3
NFPA 101.7.1.4

12. Means of Egress
NFPA 101 chapters 7 and 12- 42.

Separation of Means of Egress.
NFPA101.7.1.3

Occupant Load
NFPA101.7.3.1 and chapters 12-42.

Egress Capacity (stairs, corridors, ramps and doors)
NFPA101.7.3.3

Number of Means of Egress
NFPA101.7.4 and chapters 12-42.

Dead end limits and Common Path of Travel
NFPA 101.7.5.1.6 and chapters 12-42.

Accessible Means of Egress (for accessible buildings)
NFPA101.7.5.4

Measurement of Travel Distance to Exits
NFPA101.7.6 and chapters 12-42.

Discharge from Exits
NFPA101.7.7.2

Illumination of Means of Egress
NFPA101.7.8

Emergency Lighting
NFPA101.7.9

Marking of Means of Egress
NFPA101.7.10

13. Elevators
UFC 3-600-01, Chapter 6
IBC and ASME A17.1C – 1999
(Safety Code for Elevators and Escalators)

14. Accessibility Requirements
UFC 3-600-01, Chapter 1, UFAS and ADAAG

Certification of Fire Protection and Life Safety Code Requirements
(Note: Edit the Fire team membership if necessary)
Preparers of this document certify the accuracy and completeness of the Fire Protection and Life Safety features for this project.

SECTION 01312A

QUALITY CONTROL SYSTEM (QCS)
08/02

1.1 GENERAL

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

Administration
Finances
Quality Control
Submittal Monitoring
Scheduling
Import/Export of Data

1.2 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

1.3 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320A, PROJECT SCHEDULE, Section 01331, SUBMITTAL PROCEDURES FOR DESIGN/BUILD, and Section 01453A, CONTRACTOR QUALITY CONTROL FOR DESIGN/BUILD, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

1.4 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior

to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

1.5 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

Hardware

IBM-compatible PC with 500 MHz Pentium or higher processor

128+ MB RAM for workstation / 256+ MB RAM for server

1 GB hard drive disk space for sole use by the QCS system

3 1/2 inch high-density floppy drive

Compact disk (CD) Reader, 8x speed or higher

SVGA or higher resolution monitor (1024 x 768, 256 colors)

Mouse or other pointing devise

Windows compatible printer (Laser printer must have 4+ MB of RAM)

Connection to the Internet, minimum 56 BPS

Software

MS Windows 98, ME, NT, or 2000

Word Processing software compatible with MS Word 97 or newer

Latest version of : Netscape Navigator, Microsoft Internet Explorer, or other browser that supports HTML 4.0 or higher

Electronic mail (E-mail), MAPI compatible

Virus protection software that is regularly upgraded with all issued manufacturer's updates

1.6 RELATED INFORMATION

1.6.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a

CD-ROM containing these instructions.

1.6.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

1.7 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

1.8 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Weekly data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

1.8.1 Administration

1.8.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

1.8.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

1.8.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to

the Contractor will be prefixed with "C".

1.8.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

1.8.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

1.8.2 Finances

1.8.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

1.8.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

1.8.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01453A, CONTRACTOR QUALITY CONTROL FOR DESIGN/BUILD. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

1.8.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01453A, CONTRACTOR QUALITY CONTROL FOR DESIGN/BUILD. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

1.8.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

1.8.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

1.8.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

1.8.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

1.8.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work

progresses, and shall promptly provide this information to the Government via QCS.

1.8.4 Submittal Management

The Government will provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

1.8.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or Section 01320A, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320A PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

1.8.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

1.9 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

1.10 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

1.10.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of

running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

1.10.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

1.10.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

1.11 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

1.12 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

-- End of Section --

SECTION 01320L

PROJECT SCHEDULE
10/01

PART 1 GENERAL

1.1 REFERENCES

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

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES FOR DESIGN/BUILD:

SD-01 Preconstruction Submittals

Initial Project Schedule; G,ED.
Preliminary Project Schedule; G. .

Two copies of the schedules showing codes, values, categories, numbers, items, etc., as required.

Qualifications; G.

Documentation showing qualifications of personnel preparing schedule reports.

SD-05 Design Data

Narrative Report; G.
Schedule Reports; G.

Two copies of the reports showing numbers, descriptions, dates, float, starts, finishes, durations, sequences, etc., as required.

Periodic Schedule Updates; G.

Two copies of the schedules showing codes, values, categories, numbers, items, etc., as required.

1.3 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports, and who shall be located on the project site during the construction period. This person shall have previously created and reviewed computerized project schedules. Qualifications of this individual shall be submitted to the Contracting Officer for review with the Preliminary Project Schedule submission. The use of the individual proposed is predicated on acceptance by the Contracting Officer and this individual is subject to removal by the Contracting Officer at any time throughout the life of the project if their work becomes unsatisfactory.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The schedule must also conform to the applicable requirements of 01312 QUALITY CONTROL SYSTEM. The scheduling of construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the absence of an approved schedule, the Contracting Officer may withhold approval of requests for progress payments. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the

Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in the Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

The Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule:

3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days).

3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, and delivery.

3.3.2.3 Critical Activities

The following activities shall be listed as separate line activities on the Contractor's project schedule:

a. Submission and approval of mechanical/electrical layout drawings.

b. Submission and approval of O & M manuals.

c. Submission and approval of as-built drawings.

d. Submission and approval of 1354 data and installed equipment lists.

e. Submission and approval of testing and balancing of HVAC plus

commissioning plans and data.

f. Prefinal inspection.

g. Correction of punchlist from prefinal inspection.

h. Final inspection.

3.3.2.4 Government Activities

Government and other agency activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.2.5 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.6 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.7 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

3.3.2.8 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

3.3.2.9 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be

by the unique Phase of Work Code.

3.3.2.10 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.11 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to, a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from NTP to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Program features which calculate one of these parameters from the other shall be disabled.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contractor shall propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 20 calendar days after the NTP is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after NTP.

3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after NTP. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail. The Contractor shall participate in a review and evaluation of the proposed network diagrams and analysis by the Contracting Officer. Any revisions necessary as a result of this review shall be resubmitted for approval of the Contracting Officer within ten (10) calendar days after the conference. The approved schedule shall then be the schedule to be used by the Contractor for planning, organizing and directing the work and for reporting progress. If the Contractor thereafter desires to make changes in his method of operating and scheduling he shall notify the Contracting Officer in writing stating the reasons for the change. If the Contracting Officer considers these changes to be of a major nature, he may require the Contractor to revise and submit for approval, without additional cost to the Government, all or the affected portion of the detailed diagrams and mathematical analysis and the summary diagram to show the effect on the entire project. A change may be considered of major nature if the time estimated to be required or actually used for an activity or the logic of sequence of activities is varied from the original plan to a degree that there is a reasonable doubt as to the effect on the contract completion date or dates. Any change in schedule or execution of work which changes the relationship of any activities on the critical path or a near-critical path (path whose float is within 30 days of the float on the critical path) shall be considered a major change. Changes which affect activities with adequate slack time shall be considered as minor changes, except that an accumulation of minor changes may be considered a major change when their cumulative effect might affect the completion date.

3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgement of the Contracting Officer or authorized representative is necessary for verifying the

Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.4 Standard Activity Coding Dictionary

The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used.

3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project in addition to the requirements for submission of schedules and reports in paragraph 1.2 "SUBMITTALS".:

3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on 3.5 disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5. or 6.x, unless otherwise approved by the Contracting Officer.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the MS-DOS version used to format the disk.

3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with the preliminary, initial, and each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the

Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number on "J-NODE"/"I-NODE" as appropriate.

3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number. Preceeding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the NTP until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; and complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly schedule update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress,

revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. As a minimum, the Contractor shall address the following items on an activity by activity basis during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed .

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations shall be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule which does not represent the actual or planned prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, or any interim milestone date, the Contractor shall furnish the following for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract: justification, project schedule data, and supporting evidence as

the Contracting Officer may deem necessary. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

a. A list of affected activities, with their associated project schedule activity number.

b. A brief explanation of the causes of the change.

c. An analysis of the overall impact of the changes proposed.

d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions

furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

-- End of Section --

SECTION 01331

SUBMITTAL PROCEDURES FOR DESIGN/BUILD
06/02

PART 1 GENERAL
1.1 SUBMITTAL IDENTIFICATION

Submittals required are identified by SD numbers and titles as follows:

SD-01 Preconstruction Submittals

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

SD-02 Shop Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

SD-03 Product Data

Preprinted manufacturer material describing a product, system, or material, such as catalog cuts.

SD-04 Samples

Samples, including both fabricated and un-fabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-05 Design Data

Submittals, which provide calculations, descriptions, or documentation regarding the work.

SD-06 Test Reports

Reports of inspections, or tests, including analysis and interpretation of test results.

SD-07 Certificates

Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and

address, must name the project and location, and must list the specific requirements, which are being certified.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material; including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

SD-09 Manufacturer's Field Reports

Daily reports from specialty suppliers to the contractor that provide information, data, tests result for a product.

SD-10 Operation and Maintenance Data

Data, which forms a part of an operation and maintenance manual.

SD-11 Closeout Submittals

All data, documentations, information, and drawings to achieve contract closeout.

SD-12 Schedules

All data, documentations, information, and drawings to achieve contract closeout.

SD-13 Records

Documentation to record compliance with technical or administrative requirements.

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 Design Engineer of Record (EOR) Approved

EOR applies to individuals who have professional accountability and design responsibility for certain features of a project involving one or more engineering and design discipline, such as architectural, structural, mechanical, or electrical. EOR approval is required for all required project design submittals as identified in section 01021, extensions of design, critical materials, any deviations from the solicitation, the accepted proposal, or the completed design, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Included in this category of submittals are structural steel connections, critical fire protection and life safety items, and commissioning of HVAC equipment whose compatibility with the entire system must be checked. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," such submittals are considered to be "shop drawings". The Contractor shall provide the Government the number of copies, designated in paragraph "Submittal

Procedure", of all Designer of Record approved submittals. The Government may review any or all Designer of Record approved submittals for conformance to the Solicitation and Accepted Proposal. The Government will review all submittals designated as deviating from the RFP or accepted Proposal as descibed below.

1.2.2 Government Reviewed Design or Extension of Design

Administrative Contracting Officer review is required for all design. Government review will be for conformance with the technical requirements of the solicitation and shall take place on all design submittals. Section **01021** covers the design submittal and review process in detail. **(Feger)**

Government reviewed submittals (not to be confused with Government approved submittals) include structural connections, life safety/fire protection and other extension of design construction submittals, and HVAC equipment commissioning where additional detail is being provided to define contract conformity. Review is not required for submittals that offer no additional details beyond that which is already shown on the construction documents. Construction documents were already reviewed and accepted in accordance with Section 01021 DESIGN SUBMISSION REQUIREMENTS AFTER AWARD. Government review shall not remove or replace design EOR design responsibility.

1.2.3 Government Approved

Administrative Contracting Officer approval is required for any deviations from the Solicitation, accepted proposal, or the accepted final design and other items as designated by the Contracting Officer's Representative. Within the terms of the Contract clause entitled "Specifications and Drawings for Construction," these submittals are considered to be "shop drawings."

1.2.4 Information Only

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

1.3 CONTRACTOR RESPONSIBILITY FOR GOVERNMENT REVIEWED OR GOVERNMENT APPROVED SUBMITTALS

The Contracting Officer's Representative conformance review or approval of submittals shall not be construed as a complete check, but will indicate only that the design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal. Government Review or approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Design and Contractor's Quality Control (CQC) requirements of this contract is responsible for design, dimensions, all design extensions, such as the design of adequate connections and details, etc. and the satisfactory construction of all work. After submittals have been reviewed for conformance or approved, as applicable, by the Contracting Officer's Representative, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a

substitution is necessary.

1.4 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.5 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (Not used)

PART 3 EXECUTION

3.1 DESIGN SUBMITTALS

The Contractor shall provide design documents submittals in accordance with Section 01021 DESIGN SUBMISSION REQUIREMENTS AFTER AWARD.

3.1.1 SUBMITTAL REGISTER (ENG Form 4288)

The Designer of Record shall develop a complete list of submittals during design. The Designer of Record shall identify required submittals in the specifications, and use the list to prepare the Submittal Register. The list may not be all inclusive and additional submittals may be required by other parts of the contract. The Contractor is required to complete the submittal register and submit it to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. The submit dates and need dates used in the submittal register shall be coordinated with dates in the Contractor prepared progress schedule. Updates to the submittal register showing the Contractor action codes and actual dates with Government action codes and actual dates shall be submitted monthly or until all submittals have been satisfactorily completed. When the progress schedule is revised, the submittal register shall also be revised and both submitted for approval.

3.1.2 Draft 1354

The DD Form 1354 Data Sheets contain a summary of project information used to transfer the facility to the owner agency. The data sheet is divided into two parts; Facility and Features within the 1.524 meters (5 foot) line and Features outside the 1.524 meters (5 foot) line. The Contractor shall meet with Government representatives (Construction Office Representative and installation representative) at the start of design to get direction and example documents, on the format and content of the Draft DD Form 1354. The draft form will be prepared as part of the final design documents and

reviewed by the Government. The Contractor will then revise the form to reflect the comments received. At time of construction completion, the Draft DD Form 1354 will be updated by the Contractor to reflect as-constructed information. The final form is then submitted to the Government.

3.2 CONSTRUCTION SUBMITTALS

3.2.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer's Representative may require submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. See Section 00800, "AS-BUILT DOCUMENTS FOR DESIGN BUILD PROJECTS", for electronic submittal requirement for some shop drawings and other submittals. Prior to submittal, the Contractor's Quality Control (CQC) representative, and the Designer of Record, as applicable, shall check, approve and stamp, sign, and date each item, indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

3.2.2 Scheduling

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Except when approved in advance by the Contracting Officer, all submittal items within a specification section which can be prepared before construction of the related feature of work shall be submitted under a single transmittal. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 30 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

3.2.3 Transmittal Form (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached at the end of Section 00800 shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These blank forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank

spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.2.4 Submittal Procedure

Submittals shall be made as follows:

The Contractor shall submit to the Contracting Officer three (3) copies of all submittals of items requiring shop inspection and one (1) copy of all other submittals as called for under the various headings of these specifications.

3.2.4.1 Procedures

Detailed submittal procedures will be further discussed with the Contractor at the pre-construction conference.

3.2.4.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. As stated above, the Contractor's Designer of Record's approval is required for any proposed deviation. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.2.5 Control of Submittals

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register" so the material needed date is not threatened.

3.2.6 Government Conformance Review and Approved Submittals

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. One copy of the submittal will be retained by the Contracting Officer's Representative and two copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be so identified and returned, as described above.

3.2.7 Information Only Submittals

The Contractor is responsible for preparing and retaining two copies of all FIO submittals in a pair of "Government" files at the Contractor's field office. One copy of the FIO submittals will be used for historical record and transferred to the customer upon completion of the project. The second copy will be used for Quality Assurance reviews, but may be retained at the Government's field office at the discretion of the Quality Assurance

Representative. Both files shall be maintained in good order and filed by specification section.

A minimum of 30 days in advance of the Approval Needed By date (Submittal Register, ENG Form 4288, Contractor Schedule Dates, Item "t") the contractor shall submit only the transmittal form (ENG Form 4025-R) to the Government. The required submittal information shall be complete and available for review at the Contractor's field office. Government personnel will perform discretionary Quality Assurance reviews of the submittals as necessary to satisfy the Government that the Contractor's Quality Control system is providing the specified level of quality. Submittals that contain both Government Approval and Information Only items shall be processed as Government Approved Submittals. Submittals that do not meet the contract requirements will be assigned an "FX" action code by the Contracting Officer, and the submittal deficiencies will be forwarded to the Contractor. The Contractor shall resubmit for Government Approval and in accordance with Paragraph 1.4.

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.

3.2.8 STAMPS

Stamps used by the Contractor's Designer of Record and the Contractor's designated Quality Control person on the submittal data to certify that the submittal meets contract requirements shall be similar to the following (use two stamps for submittals reviewed by both):

CONTRACTOR
(Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or sheet(s).
SIGNATURE: _____
TITLE: (DESIGNER OF RECORD)_____
DATE: _____

-- End of Section --

-- End of Section --

SECTION 01356A

STORM WATER POLLUTION PREVENTION MEASURES
08/96

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4439	(1997) Standard Terminology for Geosynthetics
ASTM D 4491	(1996) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1996)) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1995) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(1995) Identification, Storage, and Handling of Geosynthetic Rolls

1.2 GENERAL

The Contractor shall implement the storm water pollution prevention measures specified in this section in a manner which will meet the requirements of Section 01410 ENVIRONMENT PROTECTION.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-07 Certificates

Mill Certificate or Affidavit;

Certificate attesting that the Contractor has met all specified

requirements.

1.4 EROSION AND SEDIMENT CONTROLS

The Contractor's designers shall develop an Erosion And Sediment Control Plan in compliance with NPDES requirements and Best Management practices. The plan shall include preparation and filing of Notice of Intent and Notice of Termination with the State of Kentucky.

The controls and measures which may be required by the Contractor Plan are described below.

1.4.1 Stabilization Practices

The stabilization practices to be implemented may include temporary seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, erosion control matts, protection of trees, preservation of mature vegetation, etc. On his daily CQC Report, the Contractor shall record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.4.1.1 Unsuitable Conditions

Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases is precluded by unsuitable conditions caused by the weather, stabilization practices shall be initiated as soon as practicable after conditions become suitable.

1.4.1.2 No Activity for Less Than 21 Days

Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.

1.4.2 Structural Practices

Structural practices shall be implemented as required to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices may include the following devices.

a. Silt fences.
b. Straw bales.
c. Diversion dikes.

d. Drainage swales.
e. Check dams.
f. Subsurface drains.
g. Pipe Slope drains.
h. Level spreaders.
i. Storm drain inlet protection.
j. Rock outlet protection.
k. Sediment traps.
l. Reinforced soil retaining systems.
m. Gabions.
n. Sediment basins.

1.4.2.1 Permit

A permit under Section 404 of the Clean Water Act may be required for certain structural practices.

1.4.2.2 Common Drainage Locations

For common drainage locations that serve a disturbed area of 4 or more hectares (10 or more acres) at one time, a temporary or permanent detention basin providing 252 cubic meters of storage per hectare (3,600 cubic feet of storage per acre) drained, or equivalent control measures, shall be provided where attainable until stabilization of the site. The 252 cubic meters of storage per hectare (3,600 cubic feet of storage per acre) drained does not apply to flows from offsite areas and flows from onsite areas that are either undisturbed or have undergone final stabilization where such flows are diverted around the sediment basin. For drainage locations which serve a disturbed area of 4 or more hectares (10 or more acres) at one time and where a temporary sediment basin providing 252 cubic meters of storage per hectare (3,600 cubic feet of storage per acre) drained, or equivalent sediment controls, is not attainable, sediment controls are required for all sideslope and downslope boundaries of the construction area.

1.4.2.3 Other Drainage Locations

For drainage locations serving less than 4 hectares (10 acres), sediment traps, silt fences, or equivalent sediment controls are required for all sideslope and downslope boundaries of the construction area unless a sediment basin providing storage for 252 cubic meters of storage per hectare (3,600 cubic feet of storage per acre) drained is provided.

1.4.2.4 Removal of Total Sediment Solids

A goal of 80 percent removal of total suspended solids from these flows which exceed predevelopment levels should be used in designing and installing storm water management controls (where practicable). Where this goal is not met, the permittee shall provide justification for rejecting each practice listed above based on site conditions.

1.4.2.5 Velocity Dissipation Devices

Velocity dissipation devices shall be placed at discharge locations and

along the length of any outfall channel as necessary to provide a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected.

1.4.2.6 Silt Fences

The Contractor shall provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading). Silt fences shall be installed in the locations indicated on the drawings. Final removal of silt fence barriers shall be upon approval by the Contracting Officer.

1.4.2.7 Straw Bales

The Contractor shall provide bales of straw as a temporary structural practice to minimize erosion and sediment runoff. Bales shall be properly placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in a area between a ridge and drain, bales shall be placed as work progresses, bales shall be removed/replaced/relocated as needed for work to progress in the drainage area). Areas where straw bales are to be used are shown on the drawings. Final removal of straw bale barriers shall be upon approval by the Contracting Officer. Rows of bales of straw shall be provided as follows:

a. Along the downhill perimeter edge of all areas disturbed.

b. Along the top of the slope or top bank of drainage ditches, channels, swales, etc. that traverse disturbed areas.

c. Along the toe of all cut slopes and fill slopes of the construction areas.

d. Perpendicular to the flow in the bottom of existing drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Rows shall be spaced a maximum of 60 meters (200 feet) apart.

e. Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales. Rows shall be spaced a maximum of 60 m (200 feet) apart.

f. At the entrance to culverts that receive runoff from disturbed areas.

1.4.2.8 Diversion Dikes

Diversion dikes shall have a maximum channel slope of 2 percent and shall be adequately compacted to prevent failure. The minimum height measured from the top of the dike to the bottom of the channel shall be 0.5 m (18 inches). The minimum base width shall be 1.8 m (6 feet) and the minimum top width shall be 0.6 m. (2 feet). The Contractor shall ensure that the diversion dikes are not damaged by construction operations or traffic.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of -18 to 49 degrees C (0 to 120 degrees F). The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile	ASTM D 4632	445 N min.
Elongation (%)		30 % max.
Trapezoid Tear	ASTM D 4533	245 N min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile	ASTM D 4632	100 lbs. min.
Elongation (%)		30 % max.
Trapezoid Tear	ASTM D 4533	55 lbs. min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction, shall have a minimum cross section of 50 mm by 50 mm (2 inches by 2 inches) when oak is used and 100 mm by 100 mm (4 inches by 4 inches) when pine is used, and shall have a minimum length of 1.5 m (5 feet). Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum mass of 1.98 kg per linear meter weight of (1.33 pounds per linear foot) and a minimum length of 1.5 m 5 feet.

2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

2.2 COMPONENTS FOR STRAW BALES

The straw in the bales shall be stalks from oats, wheat, rye, barley, rice, or from grasses such as byhalia, bermuda, etc., furnished in air dry condition. The bales shall have a standard cross section of 350 mm by 450 mm (14 inches by 18 inches). All bales shall be either wire-bound or string-tied. The Contractor may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose, shall have a minimum dimensions of 50 mm by 50 mm (2 inches x 2 inches) in cross section and shall have a minimum length of 1 m 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum mass of 1.98 kg per linear meter weight of (1.33 pounds per linear foot) and a minimum length of 1 m (3 feet).

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Silt fences shall extend a minimum of 400 mm (16 inches) above the ground surface and shall not exceed 860 mm (34 inches) above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 150 mm (6 inch) overlap, and securely sealed. A trench shall be excavated approximately 100 mm (4 inches) wide and 100 mm (4 inches) deep on the upslope side of the location of the silt fence. The 100 mm by 100 mm (4-inch by 4-inch) trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3.2 INSTALLATION OF STRAW BALES

Straw bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 100 mm. (4 inches). After the bales are staked and chinked (gaps filled by wedging with straw), the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 100 mm (4 inches) against the uphill side of the barrier. Loose straw shall be scattered over the area immediately uphill from a straw bale barrier to increase barrier efficiency. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake or steel post in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or steel pickets shall be driven a minimum 450 mm (18 inches) deep into the ground to securely anchor the bales.

3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

3.3.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade.

3.3.2 Straw Bale Maintenance

Straw bale barriers shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales. Necessary repairs to barriers or replacement of bales shall be accomplished promptly. Sediment deposits shall be removed when deposits reach one-half of the height of the barrier. Bale rows used to retain sediment shall be turned uphill at each end of each row. When a straw bale barrier is no longer required, it shall be removed. The immediate area occupied by the bales and any sediment deposits shall be shaped to an acceptable grade.

3.3.3 Diversion Dike Maintenance

Diversion dikes shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged diversion dikes and necessary repairs shall be accomplished promptly. When diversion dikes are no longer required, they shall be shaped to an acceptable grade.

3.4 INSPECTIONS

3.4.1 General

The Contractor shall inspect disturbed areas of the construction site, areas used for storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 13 mm (0.5 inches) or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

3.4.2 Inspections Details

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of offsite sediment tracking.

3.4.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

-- End of Section --

SECTION 01410

ENVIRONMENT PROTECTION
10/98

PART 1 GENERAL

1.1 SUMMARY

The site for the Whole Neighborhood Renewal, Fort Knox, KY, includes part of the Anderson Golf Course, the family housing area currently known as Binter Court housing, and adjacent undeveloped land. The total site covers approximately 38.8 hectares (96 acres). The site includes the Binter Court Housing and infrastructure to be demolished, several golf holes, and a playground area. Large mature trees exist on the site, and some known sinkholes exist, providing groundwater recharge areas. The Contractor shall conduct his construction activities on the site in a manner to protect the natural features of the site. This includes but is not limited to the proper installation of sediment control features, tree and mature vegetation protection measures, control of nuisance dust, proper storage and handling of waste, the prohibition of burning, and noise control.

1.1.1 Contaminated Soils

Fort Knox has conducted tests to identify contaminated soils on the golf course area of the site, and will remove those contaminated soils before the Design/Build contract is awarded. Should the Contractor encounter soils with evidence of contamination, work in the area shall be stopped immediately, and the Contractor shall notify the Contracting Officer and await his direction.

1.1.2 Demolition

Prior to, or concurrent with starting construction the Contractor is responsible for the demolition and removal of all existing improvements on the designated site. The improvements to be demolished include Golf Cart Storage Building/Old Club House (Building 7955) at Anderson Golf Course and the Binter Street Housing Development. Demolition and removal shall include but is not limited to all structures, associated utilities, paving, curb and gutter, landscaping and other site amenities.

1.1.3 Hazardous Materials

The Government will remove hazardous materials from the Binter Court Housing and Building 7955 prior to Contractor demolition of the buildings, and will provide a certification that the buildings are free of hazardous materials, except for lead-based paint in quantities that will allow disposal without special provisions. Should suspected asbestos-containing

materials be encountered, work in the area shall be stopped immediately, and the Contractor shall notify the Contracting Officer and await his direction.

1.1.4 Fuel Spills

The Contractor shall address any fuel spills in accordance with the provisions of the Fort Knox Pollution Prevention Envirionmental Handbook, July, 2002.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES FOR DESIGN/BUILD:

SD-01 Preconstruction Submittals

Environmental Protection Program; G RE.

Within 10 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall submit in writing his detailed proposal for implementing requirements for environmental pollution control specified herein.

Within 10 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall:

(1) Submit in writing his detailed proposal for implementing the requirements for environmental pollution control specified herein.

(2) Meet the representatives of the Contracting Officer to review and alter his proposal as needed for compliance with the environmental pollution control program.

Preconstruction Survey

Prior to start of any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey, after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs, and grassed areas immediately adjacent to the site of the work and adjacent to his assigned storage area and access routes(s) as applicable. This report will be signed by both the Contracting Officer and Contractor upon mutual agreement as to its accuracy and completeness.

Waste Disposal Scheme

As part of his proposed implementation under Paragraph 3.2, and prior to onsite construction, the Contractor shall submit a description of his

scheme for disposing of waste materials resulting from the work under this contract. If any waste material is dumped in unauthorized area, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed areas.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall perform all work in such manner as to minimize the pollution of air, water, or land, and shall, within reasonable limits, control noise and the disposal of solid waste materials, as well as other pollutants. The Contractor shall address any fuel spills in compliance with the provisions of the Fort Knox Pollution Prevention Environmental Handbook, July, 2002.

3.2 IMPLEMENTATION

Within 10 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall meet the representatives of the Contracting Officer to review and alter his proposal as needed for compliance with the environmental pollution control program.

3.3 PROTECTION OF LAND AREAS

Except for any work on storage areas and access routes specifically assigned for the use of the Contractor under this contract, the land areas outside the limits of permanent work performed under this contract shall, in accordance with CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURE, UTILITIES AND IMPROVEMENTS, be preserved in their present condition. Contractor shall confine his construction activities to areas defined for work on the plans or specifically assigned for his use. In accordance with CONTRACT CLAUSE: OPERATIONS AND STORAGE AREAS, storage and related areas and access routes required temporarily by the Contractor in the performance of the work will be assigned by the Contracting Officer. No other areas on Government premises shall be used by the Contractor without written consent of the Contractor Officer.

3.4 PROTECTION OF TREES AND SHRUBS

CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES AND IMPROVEMENTS, is hereby supplemented as follows: The Contractor shall not deface, injure or destroy trees or shrubs, nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage.

3.4.1 Tree Protective Structures

Where, in the opinion of the Contracting Officer, trees may possibly be defaced, bruised, injured or otherwise damaged by the Contractor's equipment or by his other operations, he may direct the Contractor to provide temporary protection of such trees by placing boards, planks, or

poles around them.

3.4.2 Restoration of Damaged Trees

Any tree scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. All scars made on trees not designated on the plans to be removed by construction operations shall be coated as soon as possible with an approved tree wound dressing. If any of the significant trees identified for preservation are damaged by the Contractor so as to be beyond saving in the opinion of the Contracting Officer, the Contractor will be subject to liquidated damages as noted in Section 00800, paragraph 1.4.

3.5 PROTECTION OF WATER RESOURCES

The Contractor shall control the disposal of fuels, oils, bitumens, calcium chloride, acids, or harmful materials, both on and off the Government premises, and shall comply with applicable Federal, State, County and Municipal laws concerning pollution of rivers and streams while performing work under this contract. Special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, herbicides and insecticides from entering public waters. Water used in onsite material processing, concrete curing, foundation and concrete cleanup, and other waste waters shall not be allowed to reenter a stream if an increase in the turbidity of the stream could result therefrom.

3.6 ACTIVITY ENVIRONMENTAL ANALYSIS

Before starting any major phase of the work, an Activity Environmental Analysis shall be developed by the contractor and reviewed with the Government Representative. A major phase of the work is defined as an operation involving a type of work not previously experienced which presents possible sources of adverse environmental effects. This analysis will evaluate potential environmental consequences of the activity and the techniques which will be utilized to accomplish the work in an acceptable manner. This analysis included: (1) the phase or activity or work; (2) the potential environmental consequences of the activity; (3) precautionary actions to prevent adverse environmental impacts; (4) actions in the event of an environmental incident; and (5) the appropriate reference to Federal, State, or Local standards, regulations, or laws.

3.7 BURNING

Air pollution restrictions applicable to this project are as follows. Materials shall not be burned on the Government premises. If the Contractor elects to dispose of waste materials off the Government premises, by burning, he shall make his own arrangements for such burning area and shall, as specified in CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES, conform to all local regulations.

3.8 DUST CONTROL

The Contractor shall maintain all excavations, stockpiles, access roads, waste areas, and all other work free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to the Using Service or to others. Approved temporary methods consisting of sprinkling, chemical treatment, or similar methods will be permitted to control dust. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

3.9 EROSION CONTROL

Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall be graded to control erosion within acceptable limits. Temporary control measures shall be provided and maintained until permanent drainage facilities are completed and operative. The area of bare soil exposed at any one time by construction operations, should be held to a minimum.

Contractor shall apply for a Kentucky Stormwater Discharge Permit for Construction Activity; compliance with the permit will require Contractor to prepare a Stormwater Best Management Practices Plan.

3.10 NOT USED

3.11 CORRECTIVE ACTION

The Contractor shall, upon receipt of a notice in writing of any noncompliance with the foregoing provisions, take immediate corrective action. 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 any such stop orders shall be made the subject of a claim for extension of time or for excess costs of damages by the Contractor unless it was later determined that the Contractor was in compliance.

3.12 POST-CONSTRUCTION CLEANUP OR OBLITERATION

In accordance with CONTRACT CLAUSE: CLEANING UP, the Contractor shall, unless other wise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed areas shall be graded and filled and the entire area seeded.

3.13 PAYMENT

No separate payment or direct payment will be made for the cost of the work covered under this section, and such work will be considered as a subsidiary obligation of the Contractor except as noted in the paragraph PENALTY FOR FAILURE TO PROTECT EXISTING SIGNIFICANT TREES below.

3.13.1 PENALTY FOR FAILURE TO PROTECT EXISTING SIGNIFICANT TREES

Should the Contractor fail to protect and preserve any of the significant trees identified and designated for preservation in the Tree Preservation Plan of the Contractor's Proposal, the Contractor Officer will issue an equitable adjustment to the contract. The penalty amount included in the equitable adjustment shall be the amount shown in the table at the end of this Section, corresponding the tree listed which was designated for preservation but was damaged by Contractor operations.

-- End of Section --

-- End of Section --

SIGNIFICANT TREE INVENTORY AND VALUE SCHEDULE

TREE TYPE:	TREE SIZE	UNIT VALUE
CONIFEROUS	8' - 16-	$50 /foot
(height from grade)	16-24	$85/foot
	24 >	$100 /foot
DECIDUOUS	6" - 18"	$75/Per Inch
(diameter at breast-height)	18 - 24	$100/Per Inch
	24 - 36	$150/Per Inch
	36>	$175/Per Inch

NO.	SPECIES	CALIPER IN.	CONDITION	VALUE / INCH	VALUE
1	Black Oak	36	Good	175	$6,300.0
2	White Oak	26	Good	150	$3,900.0
3	White Oak	38	Fair	175	$6,650.0
4	White Oak	36	Good	175	$6,300.0
5	Pin Oak	21	Good	100	$2,100.0
6	Eastern Red Cedar	17	Fair	85	$1,445.0
7	Swamp White Oak	28	Good	150	$4,200.0
8	Bitternut Hickory	20	Good	100	$2,000.0
9	White Oak	26	Good	150	$3,900.0
10	White Oak	32	Fair	150	$4,800.0
11	White Oak	30	Good	150	$4,500.0
12	White Oak	30	Good	150	$4,500.0
13	Black Oak	26	Good	150	$3,900.0
14	Red Oak	33	Good	150	$4,950.0
15	White Oak	30	Good	150	$4,500.0
16	White Oak	23	Good	100	$2,300.0
17	White Oak	35	Good	150	$5,250.0
18	Red Oak	21	Good	100	$2,100.0
19	Red Oak	22	Good	100	$2,200.0
20	White Oak	21	Fair	100	$2,100.0
21	Black Oak	20	Good	100	$2,000.0
22	Black Oak	18	Good	100	$1,800.0
23	Sugar Maple	19	V-Good	100	$1,900.0
24	White Oak	29	Good	150	$4,350.0
25	White Oak	25	Good	100	$2,500.0
26	Black Cherry	19	V-Good	100	$1,900.0
27	Black Cherry	21	Good	100	$2,100.0
28	American Black Walnut	21	V-Good	100	$2,100.0
29	American Black Walnut	19	Good	100	$1,900.0
30	Black Oak	19	Good	100	$1,900.0
31	Black Oak	25	Good	150	$3,750.0
32	Black Oak	22	Good	100	$2,200.0
33	Red Oak	23	Good	100	$2,300.0

SIGNIFICANT TREE INVENTORY AND VALUE SCHEDULE

34	Red Oak	26	Good	150	$3,900.0
35	Yellow Poplar	27	Good	150	$4,050.0
36	Black Cherry	19	Good	100	$1,900.0
37	Black Cherry	24	Good	150	$3,600.0
38	Yellow Poplar	18	Good	100	$1,800.0
39	Not in development area				
40	Not in development area				
41	Not in development area				
42	Not in development area				
43	Not in development area				
44	Not in development area				
45	Not in development area				
46	Not in development area				
47	Not in development area				
48	Not in development area				
49	Not in development area				
50	Not in development area				
51	Not in development area				
52	Not in development area				
53	Not in development area				
54	Not in development area				
55	Sycamore	40	V-Good	175	$7,000.0
56	Eastern Red Cedar	26	Good	100	$2,600.0
57	Red Oak	23	Good	100	$2,300.0
58	Red Oak	42	V-Good	175	$7,350.0
59	Red Oak	38	Good	175	$6,650.0
60	Eastern Red Cedar	23	Good	85	$1,955.0
61	Yellow Poplar	26	Good	150	$3,900.0
62	Yellow Poplar	22	Good	100	$2,200.0
63	Red Oak	34	Good	150	$5,100.0
64	American Black Walnut	19	Good	100	$1,900.0
65	Eastern Red Cedar	22	Good	85	$1,870.0
66	Eastern Red Cedar	30	Good	100	$3,000.0

SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS
09/01

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number. The designations "AOK" and "LOK" are for administrative purposes and should not be used when ordering publications.

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Fax: 248-848-3701
Internet: www.aci-int.org
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ACOUSTICAL SOCIETY OF AMERICA (ASA)
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Fax: 516-576-2377
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Internet: www.asa.aip.org

To order ASA Standards, contact:
Standards and Publications Fulfillment Center
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Fax: 703-528-3816
E-mail: ari@ari.org
Internet: www.ari.org
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AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)
2800 Shirlington Road, Suite 300
Arlington, VA 22206
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FAX: 703-575-4449
Internet: www.acca.org
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AIR DIFFUSION COUNCIL (ADC)
104 So. Michigan Ave., No. 1500
Chicago, IL 60603
Ph: 312-201-0101
Fax: 312-201-0214
Internet: www.flexibleduct.org
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AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)
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Arlington Heights, IL 60004-1893
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Fax: 847-253-0088
Internet: www.amca.org
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Fax: 972-506-7682
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e-mail: info@concrete-pipe.org
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BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
355 Lexington Ave.
17th floor
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Ph: 212-297-2122
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Internet: www.buildershardware.com
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BUILDING OFFICIALS & CODE ADMINISTRATORS INTERNATIONAL (BOCA)
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Country Club Hills, IL 60478
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Fax: 423-892-0817
Internet: www.cispi.org
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CEILINGS & INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION (CISCA)
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St. Charles, IL 60174
Ph: 630-584-1919
Fax: 630-584-2003
Internet: www.cisca.org
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FAX: 216-241-0105
www.cagi.org/welcome.htm
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COMPRESSED GAS ASSOCIATION (CGA)
1725 Jefferson Davis Highway, Suite 1004
Arlington, VA 22202-4102
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SECTION 01452A

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1.5 SPECIAL INSPECTION

1.5.1 Continuous Special Inspection

1.5.2 Perodic Special Inspection

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3.1 PERFORMANCE OF INSPECTIONS

3.1.1 Reinforcing Steel

3.1.2 Structural Concrete

3.1.3 Structural Masonry

3.1.4 Structural Steel

3.1.5 Structural Wood

3.1.6 Cold-Formed Steel Framing

3.1.7 Architectural Components

3.1.8 Mechanical and Electrical Components

3.2 TESTING

3.3 REPORTING AND COMPLIANCE PROCEDURES

-- End of Section --

SECTION 01453L

CONTRACTOR QUALITY CONTROL FOR DESIGN/BUILD
7/02

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(2001) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2000b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

1.3 SUBMITTALS

SD-01 Preconstruction Submittals

Design Quality Control Plan; G, ED

Construction Quality Control Plan; G, RE

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all design and construction operations, both onsite and

offsite, and shall be keyed to the proposed construction sequence. The site project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.

3.2 DESIGN QUALITY CONTROL PLAN (DQCP)

All documents shall be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product shall not perform the independent technical review (ITR). The plan must identify the Independent Technical Review Team and their qualifications. The Contractor shall correct errors and deficiencies in the design documents prior to submitting them to the Government.

The Contractor shall include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. The schedule shall include review and correction periods associated with each item. This should reflect calendar days and not dates for each activity. If the schedule is changed, the Contractor shall submit a revised schedule reflecting the change within 7 calendar days. The Contractor shall include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal.

The Contractor shall furnish for review by the government, not later than 10 days after Notice to Proceed, the Contractor Design Quality Control Plan for the design portion of the contract. The professional quality, technical accuracy and the coordination of all design documents and other services to be provided by the prime Contractor and subcontractor/consultants is of major importance. A logical and functional quality control program requiring technical and interdisciplinary reviews to eliminate errors and deficiencies in the design documents is required. As a minimum, the DQCP will address the following elements:

Management Approach - Define the specific management-methodology to be followed during the design phase of the work including the relationship between prime contractor and subcontractors/consultants. Address coordination, quality control, communications and lines of responsibility. The DQCP must also cover the process of review and approval of construction submittals as specified in Section 01331.

Management Structure - Delineate the organizational structure and interrelationship of management and the design team including all subcontractor and consultants. Identify the key design and review team members showing their specific responsibilities. Either the designer or the reviewer must be a registered professional for the Architectural,

Civil, Structural, Mechanical and Electrical disciplines.

List submittals required, dates for submittal, dates for completion of Government review and products required to be submitted. Allow a minimum of 28 days for Government Design review periods Technical review comments provided by the ITR Team must be submitted with each design submittals. The approved complete checklists shall be submitted at each design phase as part of the project documentation.

Designer or Engineer of Record (EOR) - The registered professional ultimately responsible and liable for adequacy and safety of the design. EOR review is required on all submittals and EOR approval is required on all submittals of extensions of design and submittals of critical materials. See Section 01331 for definitions of these type submittals.

3.2.1 Acceptance of Plan

Acceptance of the Contractor's Quality Control Plan for Design is required prior to the start of design. Acceptance is conditional and will be predicated on satisfactory performance during the preparation of design documents. The Government reserves the right to require the Contractor to make changes in his CQ Plan for Design, and operations including removal of personnel, as necessary, to obtain the quality specified.

3.3 CONSTRUCTION QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.3.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01331 SUBMITTAL PROCEDURES FOR DESIGN/BUILD.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.) The Contractor will enter into the RMS databse all appropriate fields of data appearing in the QC requirement's screen, concerning the tests and generate a report of the same. reference **SCVR 46 IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM (RMS)**

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation. The Contractor will populate the RMS schedule data fields for each feature of work through importation of data from the approved schedule. In cases where the schedule submittal is reviewed concurrently with the CQC Plan submittal, the schedule data may be incorporated in a resubmittal after interm approval of the plan. Note that the approved schedule must have a specified format for importation into the RMS database. That informationwill be supplied to the Contractor by the Contracting Officer's Representative.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.(See Paragraph 3.10.1) These procedures shall also incorporate the "QC Comments" feature of RMS.

h. Reporting procedures, including proposed reporting formats. Reporting procedures, including proposed reporting formats. all reports shall be preformed using RMS in all cases where the apllicable report is available in RMS.

i. A list of the definable features of work, in the form of the "Features of Work" report from the RMS. The contractor shall enter all features of work into the RMS database. A definable feature of work is a task which is separate and distinct from other tasks,

has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting. Should the Contracting Officer determine that the Contractor's list of definable features of work was prepared in insufficient detail, as evidenced by the Contractor's frequent request s tro perform a partial phase of control, the Contracting Officer may direct the list to be revised to reflect features of work with a smaller, more manageable scope of construction.

j. Procedures for involvement of Contractor's designers in quality control during the construction of the project, including review of shop drawings, periodic construction inspection visits, and participation in pre-final inspections and commissioning.

3.3.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.3.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.4 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 30 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4.1 Subcontractor CQC Orientation

Before a Subcontractor begins work on the job site, the CQC System Manager will train the Subcontractor by showing the video tape entitled "CQC - A Bridge (or Pathway) to Success" and answering any questions pertaining to quality control operations. This requirement is waived only if a Subcontractor attended the initial coordination meeting described above. A copy of this video can be borrowed from the Contracting Officer. A record of the orientation shall be documented in the QC Report.

3.5 QUALITY CONTROL ORGANIZATION

3.5.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization.The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, show drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.5.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate of a four year college or university program accredited in engineering, architecture, or construction management, with a minimum of 5 years experience as a construction quality engineer, architect or manager on construction similar to this contract. The CQC system shall be proficient in preperation of coherent written documentation of CQC activities. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties including any listed in 3.5.3 below. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.5.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: electrical, mechanical, civil, architectural, geotechnical, and

submittals clerk . These individuals, except for geotechnical, shall be directly employed by the prime Contractor and may not be employed by a supplier or sub-contractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals shall have no other duties other than quality control. Each discipline's work is deemed to begin with review of the first submittal concerning work in that discipline. The word "graduate" indicates an individual pocessing a four year college degree in a accredited program for the discipline.

Experience Matrix

	Area	Qualifications
a.	Civil	Graduate Civil Engineer with 2 years experience in the type of work being performed on this project or technician with 5 yrs related experience
b.	Mechanical	Graduate Mechanical Engineer with 2 yrs experience or person with 5 yrs related experience
c.	Electrical	Graduate Electrical Engineer with 2 yrs related experience or person with 5 yrs related experience
d.	Architectural	Graduate Architect with 2 yrs experience or person with 5 yrs related experience
e.	Submittals	Submittal Clerk with 1 yr experience
f.	Geotechnical (subcontractor)	Graduate Civil Engineer with emphasis on geotechnical with 2 years experience or person with 5 years related experience.

3.5.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have passed, within the last five years or within 3 months after contract award, the course entitled "Construction Quality Management For Contractors". This course is periodically offered by the Associated Builders and Constructors, Inc., or Associated General Contractors, Inc.

3.5.5 Full Staffing

The Contractor shall maintain his CQC staff as required to perform all requirements of the CQC System. As a minimum, the CQCSM shall be employed continuosly at all times through the duration of the contract and shall be on site at all times through the duration of the contract and shall be on the site anytime work is taking place, unlesss the Alternate CQCSM is present on the job site. The Alternate CQCSM shall be employed continuously throughout the duration of the contract, but may be assigned as another member of the CQC staff.

Persons listed in CQC Additional Personnel shall be employed contiuously from the time the first construction submittal is prepared in their respective disciplines and shall remain employed continuously until final acceptance by the Government of the last feature or work falling within their respective disciplines. Each of the CQC Additional Personnel (except the RMS Clerk) shall participate in the review of the submittals falling within their respective disciplines. The RMS Clerk shall be employed continuously from the Notice To Proceed and remain employed and on the job site at all times until the completion of the contract.

3.5.6 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.6 SUBMITTALS AND DELIVERABLES

Submittals, if needed, shall be made as specified in Section 01331 SUBMITTAL PROCEDURES FOR DESIGN/BUILD. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 15950A HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS; 15951A DIRECT DIGITAL CONTROL FOR HVAC; 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS; or 15995A COMMISSIONING OF HVAC SYSTEMS are included in the contract, the submittals required by those sections shall be coordinated with Section 01331 SUBMITTAL PROCEDURES FOR DESIGN/BUILD to ensure adequate time is allowed for each type of submittal required.

3.7 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers,

complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

3.7.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved. The Contractor may initiate a feature of work prior to completion of all required submittal actions (receipt of Government approved submittals, or transmittals of FIO submittals a minimum 30 days in advance) ONLY with the express written consent of the Contracting Officer. Willful violation of this restriction shall be considered cause for removal of the offending supervisor/manager/CQC personnel.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Resolve all differences.

k. Discussion of the initial control phase.

l. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The meeting shall include a word for word detailed review of the contract specifications and a detail for detail review of all applicable drawings. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager, incorporated into the appropriate fields of the RMS database, and attached to the daily CQC report. After the conclusion of the Preparatory, but prior to the actual start of work,the Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.7.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 46 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.7.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to

the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

3.7.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.8 TESTS

3.8.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers validated testing laboratory or establish a validated testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.8.2 Testing Laboratories

3.8.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.8.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $1,375.00 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.8.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

Commander and Director
Engineer Research and Development Center
ATTN: CEERD-GG-S
3909 Halls Ferry Road, Waterways Experience Station
Vicksburg, MS 39180-6199

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.9 COMPLETION INSPECTION

3.9.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the Special Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.9.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.9.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, construction, base operations support, fire, safety, housing, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.10 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control

phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.

g. Offsite surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

k. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.11 SAMPLE FORMS (Generated By RMS)

Sample forms for Deficiency List are enclosed at the end of Section 00800 as well as other forms the Contractor may utilize during this project.

3.12 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages

by the Contractor. The Contractor CQC staff shall also record any nonconformances to the foregoing requirements. Such nonconformances shall be recorded in any case where it cannot be corrected within 24 hours. The Contractor shall maintain a log of all such construction nonconformances and submit the current log with each monthly progress payment request.

-- End of Section --

SECTION 01500A

TEMPORARY CONSTRUCTION FACILITIES
02/97

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 Payment for Utility Services

The Government will make all reasonably required amounts of electricity and water available to the Contractor. The amount of water consumed will be billed to the Contractor by the Government at "B" rates. Temporary electrical service will be provided by Nolin Electrical, and the cost for temporary service installation and removal will be included in the price that Nolin provides the Offeror for the proposal. The Contractor will be invoiced by Nolin for the power used.

1.2.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide meters) required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection.

1.2.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $500.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

1.2.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. The Contractor shall then remove all the temporary distribution lines, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

1.2.5 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.2.6 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.3.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 915 by 1220 mm (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. The bulletin board shall be located at the project site in a

conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.3.2 Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the drawings. The signs shall be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall 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 and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

1.4.1 Haul Roads

The Contractor shall, at its own expense, construct on-site access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

Whenever practical, one-way haul roads shall be used on this contract. Haul roads built and maintained for this work shall comply with the following:

a. One-way haul roads for off-the road equipment; e.g., belly dumps, scrapers, and off-the-road trucks shall have a minimum usable width of 25

ft. One-way haul roads for over-the-road haulage equipment only (e.g., dump trucks, etc.) may be reduced to a usable width of 15 ft. When the Contracting Officer determines that it is impractical to obtain the required width for one-way haul roads (e.g., a road on top of a levee), a usable width of not less than 10 ft. may be approved by the Contracting Officer, provided a positive means of traffic control is implemented. Such positive means shall be signs, signals, and/or signalman and an effective means of speed control.

b. Two-way haul roads for off-the-road haulage equipment shall have a usable width of 60 ft. Two-way haul roads for over-the-road haulage equipment only may be reduced to a usable width of 30 ft.

c. Haul roads shall be graded and otherwise maintained to keep the surface free from potholes, ruts, and similar conditions that could result in unsafe operation.

d. Grades and curves shall allow a minimum sight distance of 200 ft. for one-way roads and 300 ft. for two-way roads. Sight distance is defined as the centerline distance an equipment operator (4.5 ft. above the road surface) can see an object 4.5 ft. above the road surface. When conditions make it impractical to obtain the required sight distance (e.g., ramps over levees), a positive means of traffic control shall be implemented.

e. Dust abatement shall permit observation of objects on the roadway at a minimum distance of 300 ft.

f. Haul roads shall have the edges of the usable portion marked with posts at intervals of 50 ft. on curves and 200 ft. maximum elsewhere. Such markers shall extend 6 ft. above the road surface and, for nighttime haulage, be provided with reflectors in both directions.

1.4.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required 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 shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.5 CONTRACTOR'S TEMPORARY FACILITIES

1.5.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

1.5.2 Storage Area

The Contractor shall construct a temporary 1.8 m (6 foot) high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored green, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

1.5.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

1.5.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

1.5.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.5.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 3.6 m (12 feet) in width, 5 m (16 feet) in length and have a minimum of 2.1 m (7 feet) headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and

the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 11 degrees C (20 degrees F) below the outside temperature when the outside temperature is 35 degrees C (95 degrees F), shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

1.5.7 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

1.6 GOVERNMENT FIELD OFFICE - NOT USED

1.7 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 shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available for use by Government personnel.

1.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 1.1 m (42 inches) high, supported and tightly secured to steel posts located on maximum 3 m (10 foot) centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

1.9 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.10 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01525

SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS
6/30/03 Revisions

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)

ANSI Z359.1	(1999) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

ASME INTERNATIONAL (ASME)

ASME B30.5	(2000) Mobile and Locomotive Cranes
ASME B30.8	(2000) Floating Cranes and Floating Derricks
ASME B30.22	(2000) Articulating Boom Cranes

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

29 CFR 1910	Safety and Health Regulation in General Industry
29 CFR 1910.94	Ventilation
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
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 1926.62	Lead in Construction
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.450	Scaffolds
29 CFR 1926.500	Fall Protection
29 CFR 1926.1101	Asbestos

U. S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (1996) Safety and Health Requirements Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (1998) Portable Fire Extinguishers

NFPA 70 (2002) National Electrical Code

NFPA 241 (2000) Safeguarding Construction, Alteration, and Demolition Operations

1.2 SUBMITTALS

Government approval/ acceptance is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

SSHO Qualifications, and Letter of Authority; G

Accident Prevention Plan (APP); G

Crane Critical Lift Plan; G

SD-06 Test Reports

Reports

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

Accident Reports

Monthly Exposure Reports

Regulatory Citations and Violations

Crane Reports

SD-07 Certificates

Confined Space Entry Permit

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

1.3 DEFINITIONS

a. Associate Safety Professional (ASP). An individual who is currently certified by the Board of Certified Safety Professionals.

b. Certified Construction Health & Safety Technician (CHST). An individual who is currently certified by the Board of Certified Safety Professionals.]

c. Certified Industrial Hygienist (CIH). An individual who is currently certified by the American Board of Industrial Hygiene.]

d. Certified Safety Professional (CSP). An individual who is currently certified by the Board of Certified Safety Professionals.]

e. Certified Safety Trained Supervisor (STS). An individual who is currently certified by the Board of Certified Safety Professionals.]

f. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

g. Low-slope roof. A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

h. 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.

i. Multi-Employer Work Site (MEWS). A multi-employer work site, as defined by OSHA, is one in which many employers occupy the same site. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors.

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

k. 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;

(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.

l. Site Safety and Health Officer (SSHO). The qualified or competent person who is responsible for the on-site safety and health required for the project. The Contractor quality control (CQC) person or

superintendent shall be in addition to the SSHO. Either the CQC person or the superintendent shall be equally qualified as the SSHO and shall be capable of performing the full duties of the SSHO during any brief period of work when the SSHO is absent.

m. Steep roof. A roof having a slope greater than 4 in 12 (vertical to horizontal).

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

o. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six 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; and collision, including unplanned contact between the load, crane, and/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.).]

1.4 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, 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 shall apply.

1.5 DRUG PREVENTION PROGRAM

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employee uses illegal drugs or consumes alcohol during work hours. Ensure there are no employees under the influence of drugs or alcohol during work hours. After accidents, collect blood, urine, or saliva specimens and test the injured and involved employees for the influence of drugs and alcohol. A copy of the test shall be made available to the Contracting Officer upon request.

1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The SSHO shall be responsible for the overall safety on the project and shall receive their delegated authority directly from an authorized official of the firm; the SSHO shall have the authority to stop work which is not in

compliance with the USACE EM 385-1-1. Letter of authority, personnel qualifications of the SSHO will be submitted to the Government. The SSHO shall have the following experience requirements:

(1) minimum of 5 years safety work on similar projects,
(2) 30-hour OSHA construction safety class or equivalent within the past 5 years,
(3) attended at least 24 hours of formal safety training each year for the past 5 years, and
(4) competent person training as needed.

To make sure there is a SSHO present at all times, the Contractor shall designate an alternate to perform the safety requirements stated herein to cover any extended period when the SSHO can not be present, such as during absences for vacations, or when there are multiple shifts that requires additional coverage. The alternate shall have the same training as the SSHO.

1.6.1.2 Not used
1.6.1.3 Not used

1.6.1.4 Competent Person for Confined Space Entry

Provide a competent person meeting the requirements of USACE EM 385-1-1 who is assigned in writing by the Designated Authority to assess confined spaces and who possesses demonstrated knowledge, skill and ability to:

a. Identify the structure, location, and designation of confined and permit-required confined spaces where work is done;

b. Calibrate and use testing equipment including but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;

c. Perform all required tests and inspections specified in 29 CFR 1910.146 and 29 CFR 1915 Subpart B;

d. Assess hazardous conditions including atmospheric hazards in confined space and adjacent spaces and specify the necessary protection and precautions to be taken;

e. Determine ventilation requirements for confined space entries and operations;

f. Assess hazards associated with hot work in confined and adjacent space and determine fire watch requirements; and,

g. Maintain records required.

1.6.1.5 Competent Person for the Health Hazard Control and Respiratory Protection Program

Provide a competent person meeting the requirements of USACE EM 385-1-1 who is:

a. Capable by education, specialized training and/or experience of anticipating, recognizing, and evaluating employee exposure to hazardous chemical, physical and biological agents in accordance with USACE EM 385-1-1, Section 6.

b. Capable of specifying necessary controls and protective actions to ensure worker health.

1.6.1.6 Not used

1.6.2 Personnel Duties

1.6.2.1 Site Safety and Health Officer (SSHO)

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. Safety inspection logs shall be attached 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 safety conference, preparatory, initial and follow-up control meetings, monthly supervisory and weekly toolbox safety meetings, and periodic in-progress meetings.

e. Prepare, implement and enforce APPS and AHAs.

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

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

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

1.6.2.2 Not used

1.6.3 Meetings

1.6.3.1 Prework Safety Conference

a. The Contractor will be informed of the date of the prework safety conference. The purpose of the conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the

administration of the overall project's APP before the initiation of work.

b. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the conference. This includes the project system manager, 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 AHAs and special plans, program and procedures associated with it).

c. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated activity hazard analyses (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, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

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

1.6.3.2 Weekly Safety Meetings

Conduct weekly safety meetings at the project site for all employees. The Contracting Officer will be informed of the meeting in advance and be allowed attendance. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report.

1.6.3.3 Work Phase Meetings

The appropriate AHA shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up phases of quality control inspection. The analysis should be used during daily inspections to ensure the implementation and effectiveness of safety and health controls.

1.7 TRAINING

1.7.1 New Employee Indoctrination

New employees (prime and sub-contractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

1.7.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

1.7.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

1.8 ACCIDENT PREVENTION PLAN (APP)

The Contractor shall 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 Preparation of Accident Prevention Plan". Where a paragraph or subparagraph element is not applicable to the work to be performed indicate "Not Applicable" next to the heading. Specific requirements for some of the APP elements are described below at paragraph 1.8.1. The APP shall be job-specific and shall 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. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included 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, and the designated site safety and health officer.

Submit the APP to the Contracting Officer’s Representative prior to the date of the prework safety conference for acceptance. Work cannot proceed without an accepted APP. The Contracting Officer reviews and comments on the Contractor's submitted APP and accepts it when it meets the requirements of the contract provisions.

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 unforeseen hazard become evident during the performance of work, the project superintendent shall inform the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment.

Copies of the accepted plan will be maintained at the job site.
The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

1.8.1 EM 385-1-1 Contents

In addition to the requirements outlines 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. The duties of each position shall be specified.

b. Qualifications of competent and of qualified persons. As a minimum, competent persons shall be designated and qualifications submitted 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 space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, 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. Health Hazard Control Program. The Contractor shall designate a competent and qualified person to establish and oversee a Health Hazard Control Program in accordance with USACE EM 385-1-1, Section 6. The program shall ensure that employees, on-site Government representatives, and others, are not adversely exposed to chemical, physical and biological agents and that necessary controls and protective actions are instituted to ensure health.

e. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of crane hoist's maximum load limit; lifts involving more than one crane or hoist; lifts of personnel; and technically difficult lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks in accordance with USACE EM 385-1-1, paragraph 16.c.18. and submit 15 calendar days prior to on-site work.

f. Alcohol and Drug Abuse Plan

(1) Describe plan for random checks and testing with pre-employment screening in accordance with the DFAR Clause subpart 252.223-7004, "Drug Free Work Force."

(2) Description of the on-site prevention program

g. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. It shall 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 shall prepare and sign the plan. The plan shall include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, rescue and escape equipment and operations, training requirements, and monitoring methods. Fall Protection and Prevention Plan shall be revised reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. The accepted Fall Protection and Prevention Plan shall be kept and maintained at the job site for the duration of the project.

h. Not Used

i. Not Used

j. Not Used

k. Not Used.

l. Not Used

m. Not Used

n. Not Used.

o. Training Records and Requirements. List of mandatory training and certifications which are applicable to this project (e.g. explosive actuated tools, confined space entry, fall protection, crane operation, vehicle operator, forklift operators, personal protective equipment); list of requirements for periodic retraining/certification; outline requirements for supervisory and employee safety meetings.

1.9 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1, as modified by the Louisville District, using CELRL Form 1259, 1 November 2001, and is attached at the end of this section. Submit the AHA for review at least 2 calendar days prior to the start of each phase. An AHA will be developed by the Contractor for every operation involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform work. The analysis must identify and evaluate hazards and outline the proposed methods and techniques for the safe completion of each phase of work. At a minimum, define activity being performed, sequence of work, specific safety and health hazards anticipated, control measures (to include personal protective equipment) to eliminate or reduce each hazard to acceptable levels, equipment to be used, inspection requirements, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards associated with scaffold erection and removal, identify the appropriate fall arrest systems. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include requirements for safeguarding excavations. An activity requiring an

AHA shall not proceed until the AHA has been accepted by the Contracting Officer's representative and a meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activity, including on-site Government representatives. The Contractor shall document meeting attendance at the preparatory, initial, and follow-up phases of quality control inspection. The AHA shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations. 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.

Activity hazard analyses shall be updated as necessary to provide an effective response to changing work conditions and activities. The on-site superintendent, site safety and health officer and competent persons used to develop the AHAs, including updates, shall sign and date the AHAs before they are implemented.

1.10 DISPLAY OF SAFETY INFORMATION

Prior to commencement of work, erect a safety bulletin board at the job site. The following shall be displayed on the safety bulletin board in clear view of the on-site construction personnel, maintained current, and protected against the elements and unauthorized removal:

a. Map denoting the route to the nearest emergency care facility.

b. Emergency phone numbers.

c. Copy of the most up-to-date APP.

d. AHA(s).

e. OSHA 300A Form.

f. Confined space entry permit.

g. OSHA Safety and Health Protection-On-The-Job Poster.

1.11 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.

1.12 EMERGENCY MEDICAL TREATMENT

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

1.13 REPORTS

1.13.1 Accident Reports

a. For recordable injuries and illnesses, and property damage accidents resulting in at least $2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 1 calendar day of the accident. The Contracting Officer will provide copies of any required or special forms.

1.13.2 Accident Notification

Notify the Contracting Officer's Representative 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 involving a overturned crane, collapsed boom, or any other major damage to the crane or adjacent property. Information shall 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.

1.13.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

1.13.4 Regulatory Citations and Violations

Contact the Contracting Officer immediately of any OSHA or other regulatory agency inspection or visit, and provide the Contracting Officer with a copy of each citation, report, and contractor response. Correct violations and citations promptly and provide written corrective actions to the Contracting Officer.

1.13.5 Crane Reports

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

1.13.6 Not Used

1.14 HOT WORK

Prior to performing "Hot Work" (welding, etc.) or operating other flame-producing devices, a written permit shall be requested from the Fire Department. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will 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.

a. Oil painting materials (paint, brushes, empty paint cans, etc.), and all flammable liquids shall be removed from the facility at quitting time. All painting materials and flammable liquids shall be stored outside in a suitable metal locker or box and will require re-submittal with non-hazardous materials.

b. Accumulation of trays, paper, shavings, sawdust, boxes and other packing materials shall be removed from the facility at the close of each workday and such material disposed of in the proper containers located away from the facility.

c. The storage of combustible supplies shall be a safe distance from structures.

d. Area outside the facility undergoing work shall be cleaned of trash, paper, or other discarded combustibles at the close of each workday.

e. All portable electric devices (saws, sanders, compressors, extension chord, lights, etc.) shall be disconnected at the close of each workday. When possible, the main electric switch in the facility shall be deactivated.

f. When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Department phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED IMMEDIATELY.

PART 2 PRODUCTS

2.1 Not used

2.2 CONFINED SPACE SIGNAGE

The Contractor shall 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

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, and other related submittals and activity fire and safety regulations.

3.1.1 Hazardous Material Use

Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site. Approval by the Contracting Officer of protective measures and storage area is required prior to the start of the work.

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.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If additional 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. 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

Contractors are required to apply for utility outages at least 17 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, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer’s Representative and the Base Utilities Department 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 FALL HAZARD PROTECTION AND PREVENTION

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall 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 escape procedures.

3.3.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

3.3.2 Fall Protection Equipment

The Contractor shall enforce use of the fall protection equipment designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is on a surface 6 feet or more above lower levels. Fall protection systems such as guardrails, personnel fall arrest system, safety nets, etc., are required when working within 6 feet of any leading edge. 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 05.I. and 05.J. 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 may be required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. Fall protection must comply with 29 CFR 1926.500, Subpart M and USACE EM 385-1-1.

3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest 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 carabineers 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 shall always be taken into consideration when attaching a person to a fall arrest system.

3.3.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:
   (1) For work within 6 feet of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets. [A safety monitoring system is not adequate fall protection and is not authorized.]

(2) For work greater than 6 feet from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

3.3.4 Safety Nets

If safety nets are used as the selected fall protection system on the project, they shall be provided at unguarded workplaces, over water, machinery, dangerous operations and leading edge work. Safety nets shall be tested immediately after installation with a drop test of 400 pounds and every six months thereafter.

3.3.5 Existing Anchorage

Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person in accordance with ANSI Z359.1.

3.3.6 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person as part of a complete fall arrest system (29 CFR 1926.500).

3.5 SCAFFOLDING

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access to scaffold platforms greater than 20 feet in height shall be accessed by use of a scaffold stair system. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 20 feet in height. The use of an adequate gate is required. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Special care shall be given to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

The competent person in charge of erection of the scaffolding shall provide proof of competency such as formal training. The competent person shall be present during erection and during any changes. The scaffolding and/or stairs shall be inspected daily by the competent person prior to use and shall bear a green tag with a log showing the initials and date that it was inspected. At any time when the scaffolding is incomplete the scaffolding shall bear a red tag with a warning that it is not to be used.

3.6 EQUIPMENT

3.6.1 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.

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

3.6.2 Weight Handling Equipment

a. Cranes must be equipped with:

(1) Load indicating devices (LIDS) and a boom angle or radius indicator,

(2) or load moment indicating devices (LMIs).

(3) Anti-two block prevention devices.

(4) Boom hoist hydraulic relief valve, disconnect, or shutoff (stops hoist when boom reaches a predetermined high angle).

(5) Boom length indicator (for telescoping booms).

(6) Device to prevent uncontrolled lowering of a telescoping hydraulic boom.

(7) Device to prevent uncontrolled retraction of a telescoping hydraulic boom.

b. The Contractor shall 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. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes and ASME B30.8 for floating cranes and floating derricks.

e. The presence of Government personnel does not relieve the Contractor of an obligation to comply with all applicable safety regulations. The Government will investigate all complaints of unsafe or unhealthful

working conditions received in writing from contractor employees, federal civilian employees, or military personnel.

f. Each load shall be rigged/attached independently to the hook/master-link in such a fashion that the load cannot slide or otherwise become detached. Christmas-tree lifting (multiple rigged materials) is not allowed.

g. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.

h. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.

i. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

j. A fire extinguisher having a minimum rating of 10BC and a minimum nominal capacity of 5lb of extinguishing agent shall be available at all operator stations or crane cabs. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

k. All employees shall be kept clear of loads about to be lifted and of suspended loads.

l. A weight handling equipment operator shall not leave his position at the controls while a load is suspended.

m. Only Contractor crane operators who have met the requirements of 29 CFR 1910.94, 29 CFR 1910.120, 29 CFR 1926.65, 29 CFR 1926.500, USACE EM 385-1-1, ASME B30.5, and ASME B30.22 and other local and state requirements shall be authorized to operate the crane.

n. The Contractor shall use cribbing when performing lifts on outriggers.

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

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

q. A substantial and durable rating chart containing legible letters and figures shall be provided with each crane and securely mounted onto the crane cab in a location allowing easy reading by the operator while seated in the control station.

r. 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.

s. 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.

t. The Contractor shall certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

3.6.3 Equipment and Mechanized Equipment

a. Equipment shall be operated by designated qualified operators. Proof of qualifications shall be kept on the project site for review.

b. Manufacture 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. Such additional safety precautions or requirements shall be incorporated into the AHAs.

c. Equipment and mechanized equipment shall be inspected in accordance with manufacturer's recommendations for safe operation by a competent person prior to being placed into use.

d. Daily checks or tests shall be conducted and documented on equipment and mechanized equipment by designated competent persons.

3.7 EXCAVATIONS

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect, and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly.

3.7.1 Utility Locations

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service 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.

3.7.2 Utility Location Verification

The Contractor must physically verify underground utility locations 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. Digging within 2 feet of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 100 feet if parallel within 5 feet of the excavation.

3.7.3 Utilities with Concrete Slabs

Utilities located within concrete slabs or pier decks, bridges, and the like are extremely difficult to identify. The location must be coordinated with station utility departments in addition to a private locating service. Outages on system utilities shall be used in circumstances where concrete chipping, saw cutting, or core drilling is required and utilities are unable to be completely identified.

3.7.4 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.7.5 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.8 ELECTRICAL

3.8.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific job and as delineated in the Contractor's AHA.

3.8.2 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

3.9 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1 and OSHA 29 CFR 1910.146. 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 06.I.05 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. Ensure the use of rescue and retrieval devices in confined spaces greater than 1.5 m (5 feet) in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of USACE EM 385-1-1.

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

e. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 06.I.06 of USACE EM 385-1-1.

f. Daily Entry Permit. Post the permit in a conspicuous place close to the confined space entrance.

3.10 CRYSTALLINE SILICA

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and USACE EM 385-1-1, Appendix C. The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.11 HOUSEKEEPING

3.11.1 Clean-Up

All debris in work areas shall be cleaned up daily or more frequently if necessary. Construction debris may be temporarily located in an approved location; however garbage accumulation must be removed each day.

3.11.2 Dust Control

In addition to the dust control measures required elsewhere in the contract documents, dry cutting of brick or masonry shall be prohibited. The Contracting Officer, upon written request by the Contractor, may Consider exceptions to this prohibition on a case-by-case basis. Wet Cutting must address control of water run off.

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy):

Project: Job:

Prepared By: Reviewed By:

Risk Assessment Code (RAC):

Recommended Protective Clothing & Equipment:

E = Extremely High Risk
H = High Risk
M = Moderate Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy):

Project: Job:

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy):

Project: Job:

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy):

Project: Job:

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy):

Project: Job:

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS

SECTION 01670A

RECYCLED / RECOVERED MATERIALS

9/01

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 basic designation only.

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

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Material

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. The Contractor shall 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.

-- End of Section --

SECTION 01800

EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS
08/96

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 General Requirements

The Contractor shall provide 6 complete copies of the Equipment Operating, Maintenance, and Repair Manuals. Separate manuals shall be provided for each utility system as defined hereinafter. Operations and Maintenance manuals shall be submitted and approved before field training or 90 days before substantial completion (whichever occurs earlier), and as specified in Special Contract Requirement 10. An amount of $10,000 shall be withheld until submittal and approval of O&M manuals is complete.

1.2.1 Definitions

1.2.2 Equipment

A single piece of equipment operating alone or in conjunction with other equipment to accomplish a system function.

1.2.3 System

A combination of one or more pieces of equipment which function together to accomplish an intended purpose (i.e. HVAC system is composed of many individual pieces of equipment such as fans, motors, compressors, valves, sensors, relays, etc.)

1.2.4 Hard Cover Binders

The manuals shall be hard cover with posts, or 3-ring binders, so sheets may be substituted easily. The following identification shall be printed on the cover: the words "EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUALS," the project name, building number, and an indication of utility or systems covered, the name of the Contractor, and the Contract number. Manuals shall be approximately 8-1/2 by 11-inches with large sheets folded in and capable of being easily pulled out for reference. All manuals for the project must be similar in appearance, and be of professional quality.

1.2.5 Warning Page

A warning page shall be provided to warn of potential dangers (if they exist, such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, high pressures, etc.). The warning page shall be placed inside the front cover and in front of the title page. Also, any necessary Material Safety Data Sheets (MDSD) shall be included here.

1.2.6 Title Page

The title page shall include the same information shown on the cover and show the name of the preparing firm and the date of publication.

1.2.7 Table of Contents

Each volume of the set of manuals for this project shall include a table of contents, for the entire set, broken down by volume.

PART 2 PRODUCTS (Not Used.)

PART 3 EXECUTION

3.1 GENERAL

Manuals shall be organized according to the following format, and will include information for each item of equipment (NOTE: This includes any equipment which may have been omitted from the items listed in Paragraph 3.2, System/Equipment Requirements.) A draft outline and table of contents shall be submitted for approval at 50% contract completion.

TABLE OF CONTENTS

PART I. Introduction.

(a) Equipment Description.
(b) Functional Description.
(c) Installation Description.

PART II. Operating Principles.

PART III. Safety.

PART IV. Preventive Maintenance

(a) Preventive Maintenance Checklist. Lubrication
(b) Charts and Diagrams.

PART V. Spare Parts Lists

(a) Troubleshooting Guide
(b) Adjustments
(c) Common Repairs and Parts Replacement

PART VI. Illustrations

3.1.1 Part I-Introduction

Part I shall provide an introduction, equipment or system description, functional description and theory of operation, and installation instructions

for each piece of equipment. Complete instructions for uncrating, assembly, connection to the power source and pre-operating lubrication shall be included in the installation instructions as applicable. Illustrations, including wiring and cabling diagrams, are required as appropriate in this section. Halftone pictures of the equipment should be included in the introduction and equipment description, as well as system layout drawings with each item of equipment located and marked. Copies of previously submitted shop drawings shall not be used in these manuals.

3.1.2 Part II-Operating Principles

Part II shall provide complete instructions for operating the system, and each piece of equipment. Illustrations, halftone pictures, tables, charts, procedures, and diagrams are required when applicable. This will include step-by-step procedures for start-up and shutdown of both the system and each component piece of equipments, as well as adjustments required to obtain optimum equipment performance, and corrective actions for malfunctions. Performance sheets and graphs showing capacity data, efficiencies, electrical characteristics, pressure drops, and flow rates shall be shown here, also. Marked-up catalogs or catalog pages do not satisfy this requirements. Performance information shall be presented as concisely as possible and contain only data pertaining to equipment actually installed. Actual test data collected for Contractor performance shall be included here.

3.1.3 Part III-Safety

Part III shall contain the general and specific safety requirements peculiar to each item of equipment. Safety information should be repeated as notes cautions, and warnings in other sections where appropriate to operations described.

3.1.4 Part IV-Preventive Maintenance

Part IV shall contain a troubleshooting guide, including detailed instructions for all common adjustments and alignment procedures, including a detailed maintenance schedule. Also, include a diagnostic chart showing symptoms and solutions to problems. Include test hookups to determine the cause, special tools and test equipment, and methods for returning the equipment to operating conditions. Information may be in chart form or in tabular format with appropriate headings. Instructions shall be included for the removal, disassembly, repair, reassembly, and replacement of parts and assemblies where applicable and the task is not obvious.

3.1.5 Part V-Spare Parts List

Part V shall contain a tabulation of description data and parts location illustrations for all mechanical and electrical parts. The heading of the parts list shall clearly identify the supplier, purchase order number, and equipment. The unit price for each part shall be included, also. Parts shall be listed by major assemblies, and the listing shall be arranged in columnar form. Also, names and addresses of the nearest manufacturer's representatives will be included, as well as any special warranty

information. A list of spare parts that are recommended to be kept in stock by the Government installation shall be provided.

3.1.6 Part VI-Illustrations

Part VI shall contain assembly drawings for the complete equipment or system and for all major components. Complete wiring diagrams and schematics shall be included. Other illustrations, such as exploded views, block diagrams, and cutaway drawings, are required as appropriate.

3.1.7 Framed Instructions

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, including equipment, ductwork, piping valves, dampers, and control sequence, shall be posted at a location near the equipment described. Condensed operating instructions explaining preventive maintenance procedures methods of checking the system for normal safe operation, valve schedule and procedures for safely starting and stopping the system shall be prepared in type form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting. The framed instructions shall be posted before field training.

3.1.8 Field Training

Contractor shall conduct a training course for the operating staff for each particular system. The training period, a total of 8 hours of normal working time, shall start after the system is functionally completed. The field instructions shall cover all of the items contained in the Equipment Operating, Maintenance and Repair Manuals. The training will include both classroom and "hands-on" training. The Contractor shall submit a lesson plan outlining the information to be discussed during training periods. This lesson plan will be submitted 90 days before contract completion and approved before the field training occurs. Training shall be videotaped on one-half inch VHS cassettes and shall be furnished to the Government within ten (10) days following training. Training shall be documented by the Contractor and a list of attendees shall be furnished to the Government.

3.1.9 SYSTEM/EQUIPMENT REQUIREMENTS

3.1.10 Facility Heating System

Information shall be provided on the following equipment: heat exchangers, pumps, air handling units (both heating only and heating and cooling), and valves (associated with heating systems).

3.1.11 Air-Conditioning Systems

Provide information on pumps, compressors, air handling units, and valves (associated with air-conditioning systems).

3.1.12 Temperature Control and HVAC Distribution Systems

Provide all information described for the following equipment: valves, fans, air handling units, pumps, converters and heat exchangers, and control components (sensors, controllers, adapters and actuators).

3.1.13 Fire Protection Systems

Information shall be provided on the following equipment: range hood fire suppression.

3.1.14 Plumbing Systems

Information shall be provided on the following equipment: water heaters, valves, backflow preventors, piping materials, and plumbing fixtures.

3.1.15 Miscellaneous Systems

Information shall be provided on the following: disposal, and other similar type special systems not otherwise specified.

3.2 PRICING OF CONTRACTOR-FURNISHED AND INSTALLED PROPERTY AND GOVERNMENT-FURNISHED CONTRACTOR-INSTALLED PROPERTY

The Contractor shall promptly furnish and shall cause any sub-contractor or supplier to furnish, in like manner, unit prices and descriptive data required by the Government for Property Record purposes of fixtures and equipment furnished and/or installed by the Contractor or sub-contractor, except prices do not need to be provided for Government-Furnished Property. This information shall be listed in the RMS CQC Module furnished by the Government. See example forms at the end of the Special Contractor Requirements.

-- End of Section --

STATEMENT OF WORK

STATEMENT OF WORK

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STATEMENT OF WORK

1. DESIGN OBJECTIVES.

1-1 The design and construction shall comply with the specifications and requirements contained in this Request for Proposals (RFP). The design and technical criteria contained and cited in this RFP establish minimum standards for design and construction quality. All housing units constructed in accordance with these standards are "Energy Star Homes".

The Contractor shall incorporate sustainable design techniques as they relate to site design, site engineering, unit design, and unit engineering. The Contractor shall use the US Army Corps of Engineers' Sustainable Project Rating Tool (SPiRiT) as a guide to obtain a minimum of 50 points in order to achieve a Gold Rating. See Chapter 13 Sustainable Design Considerations and Attachment 13 Sample Sustainability Matrix for additional information.

1-1.1 This project implements the Whole Neighborhood Replacement of Military Family Housing at Fort Knox, Kentucky. The objective is to construct 178 family housing units comparable to new construction standards in the private sector, within the funds available. The units will be located in a new neighborhood constructed on a site currently occupied by Binter Court subdivision and the Anderson Golf Course. See Section 00800, Paragraph 1.3 for project schedule information.

Fort Knox intends to privatize military family housing in the future, under the Residential Communities Initiative (RCI). Future military family housing developments at Fort Knox will be designed, constructed and managed by the private sector under a contract with the Government. This project is intended to set the standard for such future RCI projects, and may be privatized under RCI when completed.

1-1.2 Primary Consideration. The PRIMARY CONSIDERATION of this solicitation process is to provide the entire number of housing units identified in this statement of work. All proposals received MUST include the total number of units required to be considered for evaluation and award. In no case will a smaller number of units be accepted to allow inclusion of betterments or enhancements. Options, betterments and enhancements will not be considered unless the proposal includes ALL units required. Offerors are encouraged to review the statement of work to familiarize themselves with all of the available options included herein.

1-1.3 Option Items – The Government has identified Option Items that they wish included in the project. The Option Items are shown individually on the Bid Form, and described below.

All Offerors should provide a design proposal and price proposal as a best value offering to the Government within the construction cost limit (CCL). In addition, the Offerors are required to provide proposals and prices for Options that may be purchased by and contracted for by the Government at the Government's discretion. Offerors shall provide sufficient information on options for the Government to determine quality.

Option A – Provide a walking path to the swimming pool complex (Buildings 7956 through 7958). Construct path to the specifications for the jogging track, and connect the path to the other site pedestrian circulation elements.

Option B – Provide rapidly renewable hardwood flooring, such as bamboo, in lieu of the specified hardwood flooring for the housing units. Provide flooring of a grade suitable for heavy residential use.

Option C – Provide a grass volleyball court, with net, as a part of the recreational facilities for the housing development. Locate near one of the picnic shelters.

Option D – Provide 180 additional trees as a part of the landscaping plan, distributed throughout the units and common areas. Provide trees to the specifications in this Statement of Work.

Option E – Provide all trees in the landscape plan with a minimum caliper of 2 ½ inches, rather than the 1 7/8-

inch caliper specified in this Statement of Work.

Option F – Provide raised panel interior doors throughout the housing units. Interior doors shall be 2050mm (6 feet-8 inches) in height by 35mm (1 3/8-inch) thick, solid core wood, raised panel doors. Wood doors shall be primed and painted. Pocket doors are prohibited. Design consideration should be given to the use of stain as the door finish (with stain grade wood) in lieu of providing a painted finish and/ for the use of Stewardship Council certified wood products for wood doors.

Option G - Additional Phone Outlets. Provide an additional duplex jack outlet for a total of two duplex jack outlets in dining room, family room, living room and all bedrooms.

Option H - Additional CATV Outlets. Provide an additional cable TV outlet for a total of two cable TV outlets in dining room, family room, living room and all bedrooms.

Option I – Provide a recessed soap/shampoo shelves. Recessed soap/shampoo shelves shall be designed and built within the tub/shower area and surfaced with a solid polymer to match the surround. A minimum of three shelves shall be provided with minimum dimension (height, width and length) to provide space for two bars of soap, and four bottles of shampoo.

Option J – Extended roof to cover the unit patio. The patio roof shall be integral with the roof of the structure. Roof overhangs shall be a minimum of 457mm (18 inches) beyond the length and width of the patio. Soffits of overhangs shall be perforated vinyl or aluminum. The roof shall also be linked to the unit's gutter and downspout drainage system.

Option K – Provide full-height brick on the front façade on 25% of the units to diversify the look of unit facades within the streetscape. Brick shall conform to ASTM C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale). Provide brick cap and flashing for all offset brick veneer. For grade beam design, the brick shall run a minimum of one course below the finished floor and shall be flashed at that level.

Option L – Provide full-height cultured stone on the front façade on 25% of the units to diversify the look of unit facades within the streetscape. Cultured stone shall conform to ASTM C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

Option M – Provide chair rail in the living room, dining room, and family room. Chair rail shall be paint or stain grade wood and located 914mm (36 inches) above the finished floor. Railing shall be firmly secured at a minimum every 610mm (2 feet). All interior trim shall have solid wood paint grade trim as a minimum. Caulking of trim and wall joints shall be provided.

Option N – Provide full height brick exterior finish to all elevations on all one-story units.

Option O - Provide a street with street lighting from the housing development to MacDonald School to the west, as shown on the conceptual sketch which is Attachment 10 to the Statement of Work. Provide chain link fencing between street and school as shown on sketch. Design street and lighting to same criteria as streets and lighting for housing development. On school grounds, provide speed bumps in street every 300 feet.

1-1.4 Betterments - Betterments are features, materials or systems that exceed the requirements of the RFP. Betterments must be included in the Base Bid price. Proposals that include and identify betterments will be given additional consideration if all other RFP requirements are met. Offerors shall provide sufficient information on betterments in their proposal for the Government to determine quantity and quality. Some Government-suggested betterments are listed below and mentioned in the RFP as items to which “design consideration” should be given. Offerors are also encouraged to propose additional betterments they believe will add to the quality of life for the residents.

a. Simple programmable thermostats
b. 2 additional picnic shelters
c. Avoid building on slopes between 15 and 25%
d. Upgraded unit lighting fixtures
e. Upgraded window blinds
f. Open wood stair railings
g. Decorative columns
h. Kitchen island
i. Cathedral ceilings
j. Higher gauge metal shelving
k. Save 95% of significant trees

1-2. Work Scope. The objective of this solicitation is to obtain housing complete and adequate for assignment as quarters for military personnel and their families. This contract shall consist of the demolition of Building 7955 and Binter Street housing units and the design and construction of a total of 178 housing units on Government-owned land at Fort Knox, Kentucky, which comply with the requirements of this RFP. This work shall also include sitework (utilities, streets, recreation areas, etc.) and landscaping, plumbing, mechanical, electrical, and incidental related work. All of the units shall be detached houses. Work shall consist of the following:

1-2.1 Housing Units. The Whole Neighborhood Renewal project consists of the construction of 178 Senior Non-commissioned Officer military family housing units; 118 three-bedroom units and 60 four-bedroom units and associated neighborhood infrastructure. All units shall have attached single-car garage. All units shall be single family detached dwelling units, as shown in Table 1-1 below:

TABLE 1-1– HOUSING TYPE

Housing Type	Number of Units
Single Family Detached	178
Total	**178**

All housing unit construction shall be wood or steel frame, slab on grade or foundation walls and footings, and one or two stories in height. Exterior wall structure may be of cast-in-place concrete, precast concrete panels, insulating concrete forms, or concrete masonry units, providing that all other requirements of this RFP are met, including requirements for insulation value for the exterior wall, and requirements for interior and exterior finishes for the exterior wall. All housing units shall provide, at a minimum, ample living space, a patio or balcony, one car garage, exterior and interior storage, individual central heating systems, energy conservation systems and central air conditioning. The garbage disposal, dishwasher, range hood, water heater, carbon monoxide alarms, and smoke detectors shall be Contractor-furnished/Contractor-installed (CF/CI). The range (30-inch width) and refrigerator (36-inch width) shall be Government-furnished and Contractor-installed. Exterior finishes include brick and vinyl siding. Housing units shall be a mix of three- and four-bedroom housing units as shown in Table 1-2:

TABLE 1-2– HOUSING UNITS

Pay Grade	Number of Bedrooms	Number of Units
E-7 through E-9 (SNCO)	5	0
	4	60
	3	118
	2	0

1-2.2 Accessible units. No less than five (5) percent of each unit type at each site shall be single-story ground floor housing units. These housing units shall be designed and built in such a way that they may be easily and readily modified to accommodate physically challenged occupants at time of occupancy. See Chapter 5 Unit Design – Architecture, Paragraph 5-1.3. Design of accessible housing units shall conform to the Uniform Federal Accessibility Standards (UFAS) and American Disabilities Act Accessibility Guidelines (ADA-AG). Accessible housing units shall be well dispersed throughout the development and shall not be grouped or clustered so as to create segregated pockets within the housing community. The requirement to have an additional two (2) percent of housing units equipped with warning devices for the hearing impaired will be met by the Government at the time the unit is assigned to an occupant needing this equipment.

1-2.3 Site area and density.

1-2.3.1 Site area. The site/s is/are described on the RFP drawings included as part of this solicitation; the preferred housing development area includes approximately 34.8 hectares (86 acres). The total housing development area includes approximately 38.8 hectares (96 acres). Additional consideration will be given to proposals that use only the preferred housing development area. Site work includes all design and construction of the site design to include grading, storm drainage, erosion control, pedestrian and vehicular circulation, utility systems, outdoor lighting, play lots, and neighborhood parks.

1-2.3.2 Site density. This project consists of 178 housing units on approximately 86 to 96 acres of land area. The project site is approved for LOW DENSITY siting. Site development shall comply with the minimum requirements for LOW DENSITY siting. Siting and construction of housing and infrastructure shall not disturb portions of development area with slopes exceeding 25%; additional consideration will be given to proposals in which siting and construction of housing and infrastructure do not disturb all or most portions of development area with slopes exceeding 15%.

1-2.3.3 The Contractor's site plan shall provide for 183 housing sites, to provide five spare sites in the event that some housing sites prove to have soil or underground conditions which are not conducive to construction.

1-2.3.4 In addition to the housing development area described above, an additional area has been designated for construction of a soccer field to serve the housing development and Fort Knox. Only the soccer field and associated amenities may be constructed in this area; no housing is permitted.

1-2.3.5 Known sinkholes and significant trees on the site are identified on the RFP drawings. The Contractor is required to provide a buffer area of 75 feet around sinkholes, and to preserve 85% of the significant trees.

1-2.4 Special utilities and supplementary construction.

1-2.4.1 Electrical distribution on Fort Knox has been privatized under a contract with Nolin Rural Electrical Cooperative Corporation (Nolin RECC). Nolin RECC will provide design and construction of electrical power and distribution as described in Paragraph 4-8 of this Statement of Work. Nolin RECC will design and construct their work in compliance with their contract with the Government. The Contractor is responsible for coordination of Nolin RECC design and construction with the other portions of Contractor's design and construction.

1-2.4.2 If necessitated by the Offeror's site and utility layout, sanitary sewer pump station(s) will be required.

1-2.4.3 Buildings 7956 through 7963 house a Guest House, swimming pool complex, and Club House/Lounge. These facilities are not a part of the project, and will remain in operation throughout the construction of the housing development. Maintenance of utility services and unobstructed vehicle and pedestrian access to these buildings is required; short interruptions in service and access for necessary construction operation will be allowed, but must be scheduled through the Contracting Officer 14 days in advance of their occurrence.

1-2.4.4 This RFP requires the use of geothermal air conditioning/heat pump systems for unit HVAC. See Paragraph 10 of this Statement of Work for additional information.

1-2.5 Demolition

The Contractor is responsible for the demolition and removal of all existing improvements on the designated site prior to the start of construction. The units and improvements to be demolished include the Golf Cart Storage Building/Old Club House (Building 7955) at Anderson Golf Course and the Binter Street Housing Development. Demolition and removal shall include, but is not limited to, all structures, associated utilities, paving, curb and gutter, landscaping and other site amenities. All buildings will be vacated prior to starting demolition. All unused utilities lines (gas, potable water, irrigation, sanitary sewer and electrical) shall be disconnected and capped at the point of connection nearest the main utility line.

1-2.5.1 Golf Cart Storage/Old Club House (Building 7955) at Anderson Golf Course.

The Golf Cart Storage/Old Club House (Building 7955) is a warehouse type building combined with a finished lounge/retail type building for the Club House. Demolish the building structure completely, including the concrete floor slabs and footings and remove entirely from the site. Remove concrete stoops completely. Demolish all associated site improvements, such as lead walks, foundation plants, etc. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall use methods to avoid free fall and shall prevent ground impact and dust generation.

Gas and water main piping entering the building shall be removed to the perimeter of the site and capped. Sanitary Piping shall be removed to outside the building perimeter.

The Contractor shall field verify all existing conditions and verify the quantity of the above items prior to starting demolition.

The Government will remove hazardous materials from Building 7955 prior to the start of any contractor demolition work, and will provide a certification that the buildings are free of hazardous materials, except for lead-based paint in quantities that will allow disposal without special provisions. Any suspected asbestos containing material (ACM) encountered by the Contractor shall be reported immediately to the Contracting Officer.

1-2.5.2 Binter Street Housing Development

Demolition of the Binter Street Housing development involves the complete demolition and removal of 52 housing units. The Contractor shall demolish the building structures completely, including the concrete floor slabs, footers and remove all debris entirely from the site. Remove concrete stoops completely. Demolish all associated site improvements, such as lead walks, foundation plants, etc. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall use methods to avoid free fall and shall prevent ground impact and dust generation.

Gas and water main piping entering building shall be removed to the perimeter of the site and capped. Sanitary Piping shall be removed to outside the building perimeter.

The Contractor shall verify the quantity of the above items prior to starting demolition. All material is to be salvaged or disposed in accordance with existing installation procedures and specific instructions provided by the Contracting Officer.

The Government will remove hazardous materials from the Binter Court Housing prior to Contractor demolition of the buildings, and will provide a certification that the buildings are free of hazardous materials, except for lead-based paint in quantities that will allow disposal without special provisions. Any asbestos containing material (ACM) encountered by the Contractor shall be reported immediately to the Contracting Officer.

1-2.5.3 Demolished materials become the property of the Contractor and shall be disposed of off of Fort Knox, except as noted below, and in compliance with all applicable laws and regulations. Recycling of demolished materials is encouraged and may contribute to obtaining the required sustainability rating for the project.

1-2.5.3.1 Fort Knox has a construction landfill site which accepts only inert solid material; see location map in Attachment 6 of this Statement of Work. No soil may be disposed of at this site, or anywhere on Fort Knox. Contractor is responsible for segregating any debris taken to this site to comply with Fort Knox requirements. Operating hours are 0800 through 1630, Monday through Friday. Contractor shall haul to the route by taking Wilson Road north to Baker Road, and then proceeding west on Baker Road to the landfill site.

1-2.5.3.2 Fort Knox has a facility that makes firewood available for various uses; see location map in Attachment 6 of this Statement of Work. Contractor shall deliver all cut timber two inches or larger in diameter to this location, in lengths of at least sixteen inches and not to exceed eight feet.

1-2.6 Survey and geotechnical investigation – Site existing condition drawings and a preliminary geotechnical investigation report are provided in this RFP for information only pursuant to Offerors' preparation of proposals. After contract award, the Contractor shall prepare his own site survey and geotechnical investigation on which the Contractor's final design shall be based. Site survey shall be tied to the Fort Knox coordinate system. See Paragraph 4-1 of this Statement of Work for geotechnical investigation requirements.

1-3 Energy Star Homes Program Requirements: The Contractor, at the direction of the USACE Contracting Officer's Representative, shall be required to submit to the EPA the necessary information and certifications to register the units constructed in this project as Energy Star Homes. The Contractor constructing housing units in accordance with this Statement of Work is not required to be a registered Energy Star Contractor. The required information can be submitted to EPA in several methods:

1-3.1 Through the Internet by clicking on the *certificate automation system* icon at the World Wide Website http://yosemite.epa.gov/appd/eshomes/eshomes.nsf and following the instructions

1-3.2 By e-mailing to certificates@epa.gov

1-3.3 By mailing to the EPA Customer Service Manager. Contact information is provided below in Paragraph 1-3.5)

The information for each home may be submitted *individually* (each home individually tested/rated) or in a "*batch*" (for batches of homes, particular unit types). The following data shall be provided for each home (note: this can be in the form of a spreadsheet, database, word processing file or e-mail; if the format changes in the future EPA will inform the Contractor of the changes):

Contractor company name (ex. Jones Construction Co.)
Contractor telephone number (ex. 703-123-4567)
Name of company/organization performing testing/rating (ex. Jones Construction Co.)
Telephone number of company/organization performing testing/rating (ex. 703-123-4567)
Street address of home being submitted, including city, state & zip code (ex. 123 Smith St., City, State 12345)
Type of verification:

"**FEP**" --- if this particular home underwent infiltration testing (and possibly duct leakage testing). Please list the tested infiltration value in ACH/nat (natural air changes per hour) and if tested, the duct leakage to nonconditioned spaces in cfm and % of air handler flow at a pressure of 25 pascals.

SEP" --- if this particular home did *not* undergo infiltration and/or duct leakage testing, but was a member of a batch out of which at least 15% DID; if so, then the address of a home that was a tested member of this batch should also be identified as the tested member of the batch.

1-3.4 The following statement: "This home qualifies as an EPA Energy Star Home by conforming to the residential energy efficiency specifications and quality control confirmation of U.S. Army Corps of Engineers TI 801-02, Family Housing, 01-11-02, which has been determined by the EPA and USACE to be an ***Equivalent Program*** to the EPA Energy Star Homes Program." In addition, the "checklist" of home specifications that the USACE Contracting Officer's Representative uses to ascertain if the TI 801-02 specifications and testing results were met should be submitted. The statement and checklist should have the USACE Contracting Officer's Representative's signature affixed.

The year the house was built (ex. 2003)
The year the house was submitted for Energy Star certification (ex. 2003)

The name and title/rank, mailing address, e-mail address, telephone number and fax number of the USACE Contracting Officer's Representative overseeing the Contractor's adherence to construction specifications, quality control of construction and testing/rating activities.

1-3.5 The Contractor shall make arrangements with the EPA for receipt of the "Energy Star Homes" certificates and unit plaques and shall provide the certificates to the USACE Contracting Officer's Representative and include in the project the installation of the plaques on each of the housing units. Coordination point with the EPA regarding Energy Star certification and plaques shall be as follows:

United States Environmental Protection Agency
Climate Protection Division
US EPA 6202J
Washington DC 20460
ENERGY STAR Homes Customer Service Manager
ATTN: Mr. Brian Ng, Ng.Brian@epa.gov, 202-564-9162, fax: 202-565-2079
http://www.energystar.gov/homes

Technical questions on the Energy Star Homes Program in general can be addressed to:

ENERGY STAR Homes Technical Coordinator
ATTN: Mr. Glenn T. Chinery, Chinery.Glenn@epa.gov, 202-564-9784,
fax: 202-565-2079

1-4 Design Freedom. Requirements stated in this RFP are minimums. Innovative, creative, or cost-saving proposals which meet or exceed these requirements are encouraged and will receive additional consideration in the evaluation process provided that all required units are included in the proposal. Existing housing plans or modifications thereof that meet the design and construction criteria specified herein, which an Offeror has previously constructed and priced, may be submitted. They may include designs incorporating factory fabricated components or modules. Deviations from space and adjacency requirements are discouraged unless the changes result in improvement to the facilities.

1-5 Housing Units. Site-built, factory-built, and manufactured-housing units are acceptable options for this project.

1-6 Definition of Housing Unit Types. Terms for housing unit types used in these criteria are defined as follows:

1-6.1 Site-built housing. A residential building or housing unit wholly or substantially constructed at the site.

1-6.2 Factory-built housing. Construction consisting of components, sub-assemblies such as modules, panelized walls, roof trusses, floor joists, and other factory-assembled components, which are transported to the construction site and further assembled into completed housing units. All interior and exterior walls, regardless of whether they are structural (load bearing) or not, are plant fabricated (panelized). Panels must be fabricated to the extent that the structure of the panel or truss is factory-assembled. Finishes such as interior wallboard may be site applied.

1-6.3 Manufactured housing. As defined in Public Law 93-383, Title 24, Chapter XX amended (1977, 1978, 1979, and 1980), a manufactured home is "a structure, transportable in one (1) or more sections which in the traveling mode is eight body feet or more in width, or forty body feet or more in length, or, when erected on site, is built on a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning and electrical systems contained therein."

1-6.4 Apartment buildings. Prohibited, therefore not used.

1-6.5 Garden apartments. Prohibited, therefore not used.

1-6.6 Duplex. Prohibited, therefore not used.

1-6.7 Townhouses. Prohibited, therefore not used.

1-6.8 Detached house. A single-family, free standing, housing unit which is not attached to another housing unit.

1-7 Design Quality. The objectives are to obtain housing structures and complimentary site development, within funds available, and to optimize livability. The housing development should reflect comparable private-sector housing communities. Design quality is achieved through the optimization of interior planning, integration of housing structures to the site, and balancing architectural attractiveness, variety, function, and design for low-cost maintenance and operation. Offerors should consider sustainable design applications in developing proposals, see Section 13.

The design of housing units including the selection and specifying of exterior and interior finishes, equipment, appliances, and systems shall include consideration of maintenance ease and cost. Avoid products that require continuing maintenance at high cost.

1-8 Not used.

1-9 Energy and Resources Conserving Features. Public Law 102-486, Executive Order 13123, and Federal Regulations 10 CFR 435, require Federal buildings to be designed and constructed to reduce energy consumption in a life-cycle, cost-effective manner using renewable energy sources when economical. Products designed to conserve energy and resources by controlling the amounts of consumed energy or by operating at increased efficiencies should be considered. Offerors are required to provide Energy and Resource conserving improvements that at least insure compliance with the Energy Star Homes Program parameters.

1-10 Prototype Housing Units. The purpose of the prototype housing unit is to verify the details of the approved design and material selections, and to establish the quality level against which the remaining work will be judged. At the plant, construction connection details shall be exposed for study by authorized Government inspectors for a period of time agreed to by the Contractor and the Contracting Officer. The housing unit or units at the plant and/or the prototype at the site are subject to Contracting Officer's approval. At the site, the complete prototype shall be constructed for each housing unit floor plan. Each stage of work shall be completed and accepted on the prototype prior to starting work on the same stage for similar housing units in the project. The stages of work for the prototypes shall be:

a. Foundation, slab and under-slab rough-ins complete
b. Framing, exterior wall sheathing, roof sheathing, and rough-ins complete
c. Housing unit complete

1-10.1 "Site-Built." One prototype housing unit shall be required for each housing unit floor plan. The construction of the prototypes shall be coordinated with the Contracting Officer so that several stages of completion can be reviewed as the units are built.

1-10.1.1 One prototype unit shall be left in the “rough in” stage (no interior finishes) so that the utility systems and framing construction is exposed. Exteriors of the prototype shall be completely finished. When the last new units are constructed, the “rough in” stage prototype unit shall be completed and turned over to the Government with the last turnover group.

1-10.1.2 Perform blower door test on each prototype housing unit in accordance with SOW Paragraph 7-3.2. Blower door test is not required for prototype unit remaining in the “rough in” state.

1-10.2 "Manufactured" or "Factory-Built." A prototype housing unit shall be required for each housing unit type of each run fabricated at the plant for manufactured or factory-built homes.

1-10.2.1 Manufactured. If the housing units are classified as manufactured housing, all interior and exterior systems that form integral parts of the transportable module shall be constructed and assembled for inspection by the Government. This shall include, as a minimum, wall and ceiling construction, interior finishes, utility piping, wiring, and ductwork fastening and assembling of adjacent modules, connection details to sinks, installed kitchen cabinets and countertops. Portions of the work shall be left unfinished or exposed to demonstrate interior construction details.

1-10.2.2 Factory-Built. If the housing units are classified as factory-built housing, all wall panels that are fabricated in the plant for shipment to the site shall have prototype units constructed and assembled for in-plant inspection by the Government. This shall include, as a minimum, wall framing, roof and ceiling framing, connection details, utility piping, wiring and ductwork, interior and exterior wall finishes which form part of the factory-built wall. In addition, the Contractor shall construct as part of the factory-built prototype, installed samples of wall insulation, finished siding (if not part of wall assembly), sample installed bathtub and sink and installed kitchen sink and cabinets to demonstrate proper installation and wall connections. Portions of the work shall be left unfinished or exposed to demonstrate interior construction details.

1-10.2.2.1 One Floor Prototype. If only one floor of the prototype is manufactured or factory-built, factory assembly of the manufactured or factory-built portion of the prototype is required. In all cases, the factory prototype shall consist of one of each building type. The factory prototype shall be assembled to verify assembly connections, details, construction, and transportation of the finished housing unit.

1-11 Structural Integrity. Manufactured and factory-built homes shall be of individual housing units attached to one another in a manner which shall provide a finished structural assembly having an appearance and structural integrity comparable to a site-built single or multi-family residence built to applicable codes.

1-12 Construction Tolerances. Assembled housing units shall be true and plumb and all within specified construction tolerances for all alignments represented on the drawings. Adjacent walls shall be attached at roof and floor levels in such a manner as to preclude placing any wood member in cross-grain bending or cross-grain tension, and to avoid putting nails in withdrawal.

1-13 Force Protection & Anti-TerrorismConsiderations. Not required therefore not used.

1-14 Prototype Kitchen – The Contractor shall construct a complete prototype kitchen in a building on Fort Knox. This prototype kitchen shall reflect the kitchen design of one of the four-bedroom units, and shall be complete in every way, except for the installation of plumbing piping. The prototype kitchen shall remain in place until the construction of the final units in the housing development, or until the Government decides it can be disassembled, at which time the Contractor shall remove the kitchen and restore the Government space to its original condition. The Contractor may not use the kitchen components in the construction of units to be occupied, and shall dispose of them in compliance with the requirements of the RFP. The Government will provide the range and refrigerator for the prototype kitchen; the Contractor shall pick the appliances up at a warehouse on Fort Knox, transport them to the prototype kitchen site and install them, and shall return them to the warehouse when the kitchen disassembly is complete.

2. CRITERIA REFERENCES.

2-1 Criteria to be used for design and construction shall be taken from the most current references at the date of issue of the RFP. Administrative, contractual, and procedural features of the contract shall be as described in other sections of the RFP. Referenced codes and standards herein and those listed below are minimum acceptable criteria.

2-2 Local and State Codes or Standards. The following specifications, standards, bulletins, and handbooks form a part of this document to the extent specified herein. The edition of the code or standard current as of the day of contract award shall be used.

2-2.1 Local. – Not used.

2-2.2 State. Water and sanitary sewer service shall comply with the regulations of the Kentucky Department of Natural Resources.

Kentucky State Building Code
Kentucky Transportation Cabinet (KYTC)Highway Design Manual

2-2.3 National.

2-2.3.1 Design and construction shallcomply with the requirements of the following codes, unless other criteria in this RFP have more stringent requirements. In such cases the more stringent requirement shall govern.

International Residential Code
International Building Code
International Plumbing Code
International Mechanical Code

2-3 Federal Laws. The Federal laws and regulations listed in Table 2-1 form a part of this document. They are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20401-9325 (202) 512 – 1800.

TABLE 2-1 – FEDERAL LAWS & REGULATIONS

CFR/USC No.	Description
7 CFR 17xx	U.S. Department of Agriculture (USDA) Rural Utilities Service (RUS) Electric Program Regulations
10 CFR 430	National Appliance Energy Conservation Act (NAECA)
10 CFR 435	Voluntary Performance Standards for New Commercial and Multi-Family High Rise Residential Buildings; Mandatory for Federal Buildings.
16 CFR 1630	Standard for Surface Flammability of Carpet and Rugs
40 CFR 247.12	Comprehensive Procurement Guideline for Products Containing Recovered Materials, Construction Products
41 CFR 101	Uniform Federal Accessibility Standards (UFAS)
49 CFR 192	Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards
42 USC 4321-4361	National Environmental Policy Act (NEPA)
Army Regulation 200-1	Environmental Protection and Enhancement, May 1990
E.O. 13123	Energy Efficiency and Water Conservation in Federal Facilities

Note: 7 CFR 17xx denotes all applicable part 1700 as required by USDA Rural Utilities Service (RUS) Electric Program Regulations.

2-4 Other Government Documents and Publications. The following Government documents and publications form a part of this document to the extent specified herein:

2-4.1 Americans With Disabilities Act Accessibility Guidelines (ADA-AG), are available from U.S. Architectural and Transportation Barriers Compliance Board, 1331 F Street, N.W., Washington, D.C. 20004-1111

2-4.2 Environmental Protection Agency, Ariel Rios Building, 1200 Pennsylvania Avenue, N.W., Mail Code 3213A, Washington, DC 20460, (202) 260-2090. 833R92001 Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices; Summary Guidance available from: http://www.epa.gov/clariton/clhtml/pubtitle.html

2-4.3 “Recommended Standards for Sewage Works”, 1990, Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (also identified as the 10-State Standards).

2-4.4 Uniform Federal Accessibility Standards (UFAS) http://www.access-board.gov/indexes/accessindex.htm

2-4.5 Department of the Army, U.S. Army Corps of Engineers, Washington, D.C., 20314-1000: Sustainable Design

for Military Facilities (TL 1110-3-491) http://www.usace.army.mil/inet/usace-docs/eng-tech-ltrs/

2-4.6 Military Handbook 1008C, Fire Protection for Facilities Engineering Design and Construction

2-4.7 Federal Emergency Management Agency; Building Seismic Safety Council, National Earthquake Hazards Reduction Program (NEHRP) Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, 1997 Edition; Part 1: Provisions (FEMA 302)

2-4.8 Federal Manufactured Housing Construction and Safety Standards Act (FMHCSS) USC Title 42.

2-4.9 Not used.

2-4.10 U.S. Army Corps of Engineers Sustainable Project Rating Tool (SPiRiT), version 1.4.1, June 2002. Available from: http://www.usace.army.mil/inet/usace-docs/eng-tech-ltrs/etl1110-3-491/a-c.pdf

2-4.11 Handbook for Public Playground Safety, Consumer Product Safety Commission of the United States, 4330 East-West Highway, Bethesda, Maryland, 20814-4408; Tel: 301-504-6816, Fax: 301 504-0124 or 0025; www.cpsc.gov.

2-4.12 Manual on Uniform Traffic Control Devices, Office of Transportation Operations, Federal Highway Administration, Room 3416, 400 Seventh Street SW, Washington D.C. 20590.

2-4.13 Sign Standards Manual, EM 1130-2-322, Army Corps of Engineers, www.mvp.usace.army.mil/cxm/sign_standards_prog/Ch1singmansamp.pdf

2-5 Non-Government Publications. The following publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are Department of Defense (DoD) adopted are those listed in the Department of Defense Index of Specifications and Standards (DODISS).

2-5.1 Air-Conditioning and Refrigeration Institute (ARI). Information listed below is available from ARI, 4301 Fairfax Dr., Suite 425, ATTN: Pubs Dept., Arlington, VA 22203, Ph: 703-524-8800, Fax: 703-528-3816, Internet E-Mail: ari@dgsys.com, Directory of Certified Unitary Air Conditioners, Unitary Heat Pumps and Sound Rated Outdoor Unitary Equipment; ARI 210/240, Unitary Air Conditioning and Air-Source Heat Pump Equipment http://www.ari.org/

2-5.2 Air Movement and Control Association (AMCA), AMCA 210, Laboratory Methods of Testing Fans For Rating, is available from AMCA, 30 West University Drive, Arlington Heights, IL 60004, (312) 394-0150: http://www.amca.org/

2-5.3 American Architectural Manufacturers Association (AAMA). AAMA specifications are available from AAMA, 1540 East Dundee Rd., Suite 310, Palatine, IL 60067-8321,Ph: 708-202-1350,Fax: 708-202-1480 2700 River Road, Suite 118, Des Plaines, IL 60018, (312) 699-7310. AAMA 1002.10 “Voluntary Specifications for Aluminum Insulating Storm Products for Windows and Sliding Glass Doors”.

2-5.4 Air Conditioning Contractors of America (ACCA). Manual S, Residential Equipment Selection. Publication for sale at: ACCA, 2800 Shirlington Road, Suite 300, Arlington, VA 22206. Ph: 1-888-290-2220.

2-5.5 American Concrete Institute International (ACI). Publications for sale at: http://www.concrete.org/BOOKSTORE/BKSTR.HTMor ACI International, Member/Customer Services, P.O. Box 9094, Farmington Hills, MI 48333-9094, (248) 848-3801. ACI 318 Building Code Requirements for Structural Concrete and Commentary.

2-5.6 American Society of Civil Engineers (ASCE). 1801 Alexander Bell Drive, Reston, VA 20191-4400, (800) 548-

2723. http://www.asce.org ASCE 7 Minimum Design Loads for Buildings and Other Structures.

2-5.7 American National Standards Institute, Inc. (ANSI). Copies of the standards listed in Table 2-2 are available from ANSI, 11 West 42nd St., New York, NY 10036, Ph: 212-642-4900, Fax: 212-302-1286: http://www.ansi.org/

TABLE 2-2– AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS

Std. No.	Std. Description
A112.19.1	Enameled Cast Iron Plumbing Fixtures
A112.19.2	Vitreous China Plumbing Fixtures (DoD Adopted)
A112.19.3	Stainless Steel Plumbing Fixtures (Designed for Residential Use)
A112.19.4	Porcelain Enameled Formed Steel Plumbing Fixtures (DoD Adopted)
A112.19.5	Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards) (DoD Adopted)
A161.1	Recommended Construction and Performance Standards for Kitchen and Vanity Cabinets
B16.5	Steel Pipe Flanges and Flanged Fittings (DoD Adopted)
B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings (DoD Adopted)
B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes (DoD Adopted)
B31.8	Gas Transmission and Distribution Piping Systems
C2	National Electrical Safety Code
ANSI C105 AWWA A21.5	Polyethylene Encasement for Ductile-Iron Pipe Systems
Z21.10.1	Water Heaters, Gas, Volume I, Storage Type, 75,000 BTUH Input or Less
Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
Z60.1	American Standard for Nursery Stock
Z124.1	Plastic Bathtub Units
Z124.2	Plastic Shower Receptors and Shower Stalls

2-5.8 American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) documents, listed in Table 2-3, are available from ASHRAE,1791 Tullie Cir., NE, Atlanta, GA 30329-2305, Ph: 404-636-8400 Fax: 404-321-5478 1791 Tullie Circle, N.E., Atlanta, GA 30329, (404) 636-8400: http://www.ashrae.org/

TABLE 2-3 – AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR-CONDITIONING ENGINEERS (ASHRAE)

No.	Description
ASHRAE	Handbook of Fundamentals
ASHRAE	Residential Cooling Load Calculations
ASHRAE 62	Ventilation for Acceptable Indoor Air Quality
ASHRAE 52	Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter
ASHRAE 55	Thermal Environmental Conditions for Human Occupancy, Addenda 1995
ASHRAE 90.2	Energy Efficient Design Residential Buildings
ASHRAE 111	Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air Conditioning, and Refrigeration Systems
ASHRAE 129	Measuring Air-Change Effectiveness

2-5.9 American Society of Mechanical Engineers (ASME). ASME B16.11, Forged Fittings, Socket-Welding and Threaded, and ASME B31.8, Gas Transmission and Distribution Systems, are available from ASME, 22 Law Dr., Box 2300, Fairfield, NJ 07007-2900, Ph: 800-843-2763, Fax: 201-882-1717:
http://www.asme.org/

2-5.10 American Society of Safety Engineers (ASSE). ASSE 1008. Publication available from: ASSE, 1800 East Oakton Street, Des Plaines, IL 60018. Ph: (847) 699-2929.

2-5.11 American Society for Testing and Materials (ASTM). ASTM specifications listed in Table 2-4 are available from ASTM, AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1916 Race St., Philadelphia, PA 19103, Ph: 215-299-5585, Fax: 215-977-9679: http://www.astm.org/

TABLE 2-4– AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) SPECIFICATIONS

Spec. No.	Spec. Description
A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A526	Specification for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality (DoD Adopted)
B117	Method of Salt Spray (Fog) Testing (DoD Adopted)
C90	Specification for Hollow Load-Bearing Concrete Masonry Units (DoD Adopted)
C216	Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) (DoD Adopted)
D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft 2700kN-m/m)
D1785	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 (DoD Adopted)
D2513	Standard Specification for Thermoplastic Gas Pressure Piping (DoD Adopted)
D2683	Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing (DoD Adopted)
D2846	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot and Cold-Water Distribution Systems (DoD Adopted)
D3018	Specification for Class A Asphalt Shingles Surfaced with Mineral Granules (DoD Adopted)
D3679	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding
E84	Standard Test Method for Surface Burning Characteristics of Building Materials (DoD Adopted)
E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions (DoD Adopted))
E108	Standard Methods of Fire Tests of Roof Coverings
E119	Standard Methods of Fire Tests of Building Construction and Materials
E162	Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source (DoD Adopted)

TABLE 2-4– AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) SPECIFICATIONS

Spec. No.	Spec. Description
E283	Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors
E330	Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
E336	Standard Test Method for Measurement of Airborne Sound Insulation in Buildings
E408	Standard Test Methods for Total Normal Emission of Surfaces Using Inspection-Meter Techniques
E547	Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential
E648	Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source
E779	Measuring Air Leakage by the Pressurization Method
E1007	Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures
E1465	Standard Guide for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings
F1292	Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment
E1423	Standard Practice for Determining the Steady State Thermal Transmittance of Fenestration Systems
E 1554	Determining External Air Leakage of Air Distribution Systems by Fan Pressurization.
F 1066	Standard Specification for Sheet Vinyl Composition Floor Covering
F1487-98	Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
G90	Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight

2-5.12 American Water Works Association, Inc. (AWWA). Specifications listed below are available from AWWA, 6666 West Quincy, Denver, CO 80235, Ph: 800-926-7337, Fax: 303-795-1989, AWWA C500, Gate Valves for Water and Sewerage Systems (DoD adopted); AWWA C502, Dry-Barrel Fire Hydrants; and AWWA C503, Wet-Barrel Fire Hydrants: http://www.awwa.org/

2-5.13 National Association of Corrosion Engineers (NACE). NACE RP-0286, The Electrical Isolation of Cathodically Protected Pipelines, is available from NACE, P.O. Box 218340, Houston, TX 77218: http://www.nace.org/

2-5.14 American Association of Textile Chemists and Colorists (AATCC). AATCC 134, Electrostatic Propensity of Carpets, is available from AATCC, P.O. Box 12215, Research Triangle Park, NC 27709, (919) 549-8141.: http://www.aatcc.org/

2-5.15 Builders Hardware Manufacturers Association, Inc. (BHMA). Specifications shown in Table 2-5 are available from the Builders Hardware Manufacturers Association, Inc. (BHMA), 355 Lexington Ave., New York, NY 10017, Ph: 212-661-4261, FAX: 212-370-9047.

TABLE 2-5 – BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA) SPECIFICATIONS

No.	Description (Specs. are DoD Adopted)
BHMA-01	Directory of Certified Locks & Latches.
BHMA-02	Directory of Certified Door Closers.
BHMA 156.1	Butts and Hinges
BHMA 156.2	Auxiliary Locks and Associated Products Bored & Preassembled Locks & Latches
BHMA 156.4	Door Controls - Closers
BHMA 156.5	Auxiliary Locks & Associated Products
BHMA 156.7	Template Hinge Dimensions
BHMA 156.9	Bored and Preassembled Locks and Latches Cabinet Hardware
BHMA 156.13	Mortise Locks and Latches
BHMA 156.16	Auxiliary Hardware
BHMA 156.18	Auxiliary Hardware Materials and Finishes
BHMA 156.21	Thresholds

2-5.16 International Code Council (ICC). The International Residential Code One (1) and Two (2) Family Dwelling Code, the International Building Code (IBC), the International Mechanical Code, and the International Plumbing Code are available from the International Code Council, Inc. (ICC), 5203 Leesburg Pike, Suite 708, Falls Church, VA 22041-3401, Fax: 703-931-4533: http://www.iccsafe.org/

2-5.17 Electronic Industries Association Telecommunications Industry Association (EIA/TIA). EIA/TIA Standards

EIA/TIA 568A and EIA/TIA-570 are available from Electronic Industries Association, Engineering Department, Order From: Global Engineering Documents, 15 Inverness Way East, Englewood CO 80112, Phone: 800-854-7179, Fax: 303-397-2740.

2-5.18 Institute of Electrical and Electronics Engineers (IEEE): The National Electrical Safety Code (NESC) C2-2002. IEEE 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ, 08855; Phone 800-678-4333, Fax 732-981-9667.

2-5.19 Illuminating Engineering Society of North America (IESNA). The IESNA Lighting Handbook, is available from Illuminating Engineering Society of North America, (IESNA), 120 Wall St., 17th Floor, New York, NY 10005-4001, Ph: 212-248-5000, Fax: 212-248-5017: http://www.iesna.org/

2-5.20 Not used.

2-5.21 International Ground Source Heat Pump Association. Oklahoma State University, P.O. Box 1688, Still Water, Oklahoma 74076-1688.

2-5.22 National Electrical Manufacturers Association (NEMA). NEMA standards listed below are available from the National Electrical Manufacturers Association (NEMA), National Electrical Manufacturers Association (NEMA),2101 L St., NW, Suite 300,Washington, DC 20037-1526
Ph: 202-457-8474 Fax: 202-457-8473 NEMA DC 3, Wall-Mounted Room Thermostats; and NEMA WD 1, General Requirements for Wiring Devices: http://www.nema.org/

2-5.23 National Environmental Balancing Bureau (NEBB), NEBB-01, Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems, is available from NEBB, 875 Grove Mount circle, Gaithersburg, MD 20877-4121, Ph: 301-977-3698, Fax: 301-977-9589: http://www.nebb.org/

2-5.24 National Fenestration Rating Council (NFRC). NFRC 100-91, Procedure for Determining Fenestration Product Thermal Properties, is available from NFRC, 1300 Spring Street, Suite 500, Silver Spring, MD. Telephone: (301) 589-NFRC, http://www.nrfc.org

2-5.25 National Fire Protection Association, Inc. (NFPA). NFPA codes listed in Table 2-6 are available from the National Fire Protection Association, Inc. (NFPA), 1Battery March Park, P.O. Box 9101, Quincy, MA 02269. Telephone: (617) 770-3000, Fax: (617) 770-0700: http://www.nfpa.org/

TABLE 2-6– NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) CODES

Code No.	Code Description
NFPA 70	National Electrical Code (DoD Adopted)
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
NFPA 101M	Alternative Approaches to Life Safety
NFPA 255	Method of Test of Surface Burning Characteristics of Building Materials
NFPA 501A	Manufactured Home Installations
NFPA 701	Standard Methods of Fire Tests for Flame Resistant Textiles and Films

2-5.26 National Wood Window and Door Association (NWWDA) standard, NWWDA I.S.2, Standard for Wood Window Units is available from the National Wood Window and Door Association (NWWDA), 1400 East Touhy Ave., Suite 470, Des Plaines, IL 60018, (847) 299-5200, Fax: (847) 299-1286: http://www.nwwda.org/.

2-5.27 Sheet Metal and Air Conditioning Contractors National Association (SMACNA). SMACNA Installation Standards for Residential Heating and Air Conditioning Systems and SMACNA-07, HVAC Systems, Testing, Adjusting, and Balancing, are available from SMACNA, 4201 Lafayette Center Drive, Chantilly, VA 22180, (703) 803-2980, Fax: (703) 803-3732: http://www.smacna.org/

2-5.28 Underwriters Laboratories, Inc. (UL) specifications listed in Table 2-7 are available from the Underwriters Laboratories, Inc. (UL), 333 Pfingston Road, Northbrook, IL 62096. Telephone: (847) 272-8800. Fax: (847) 509-6220: http://www.ui.com/.

TABLE 2-7 – UNDERWRITERS LABORATORIES SPECIFICATIONS

No.	Description (Specs. Are DoD Adopted)
UL 174	Water Heaters, Household Electric Storage Tank Type
UL 181A	Closure Systems for Factory-Made Rigid Ducts
UL 430	Waste Disposers
UL 507	Electric Fans
UL 746C	Polymeric Materials - Use in Electrical Equipment Evaluations
UL 749	Household Dishwashers
UL 858	Household Electric Ranges
UL 900	Test Performance of Air Filter Units

3. SITE PLANNING AND DESIGN.

3-1 Scope. This project consists of 183 housing sites to be planned178 housing units to be constructed on the preferred housing development area of 34.8 hectares (86 acres) of land, with an additional 4 hectares (10 acres) of land available for development at the south end of the project area. However, it is preferred that only the area of 86 acres be developed. The project site is approved for LOW DENSITY siting. Site development shall comply with the minimum requirements for LOW DENSITY siting. Siting, grading and construction of housing and infrastructure shall not disturb portions of development area with slopes exceeding 25%. Additional consideration shall be given to proposals in which siting and construction of housing and infrastructure do not disturb portions of development area with slopes exceeding 15%.

3-2 Site Verification. The existing landscape is a mix of predominantly Oak and Maple deciduous hardwood trees with some Cherry, Poplar, Walnut and Sycamore and scattered Cedar conifers on forest edges. The proposed site comprises 86 acres of moderately sloped hillsides and large expanses of rolling open space incorporating the first, tenth, eleventh, seventeenth and eighteenth holes of the golf course. Immediately to the east of the proposed home sites and west of Wilson Road, which may be widened at some future date, is the existing club house, an indoor swimming pool, the Wickam Guest House for visitors to Fort Knox. An existing area of housing, known as the Binter Court neighborhood, shall be demolished to accommodate some of the new home sites for this initial phase of development. Existing underground irrigation piping shall be capped at the development area boundary. Remove all existing irrigation lines, heads, manifolds, valves and riser cabinets within the area.

3-3 Area Development Plan. Landscape and site improvements include the planning and construction of pedestrian sidewalks, patios, planting, recreation area development, site furnishings and signage. The site design and construction shall incorporate single family homes. The tenets of sustainable design should be implemented wherever possible. Creative site design is encouraged. Site boundaries and project composition, and thus the density of 3-5 units per acre net plus open space, are fixed.

3-3.1 Density. The project site is approved for LOW DENSITY, siting.

3-3.2 Land use. A major site planning objective is to ensure an interesting, attractive, livable residential environment and to utilize the potential advantages of the site. Planning shall incorporate consideration of topography, existing significant trees, plus other significant vegetation worth protecting, natural characteristics of the site, climatic conditions, and prevailing winds. Design should capitalize upon ecological and economical opportunities inherent in the natural character of the site, using existing terrain to minimize cut and fill, minimizing impervious surfaces and combining utilities and common open spaces. Site design shall be based upon, and include, spatial balance, environmental sensitivity, site composition, life safety and reduction of conflict between pedestrian and vehicular circulation patterns. Buffer zones, visual and sound control and landscaping shall be coordinated with storm water drainage, utilities, roadways and passive outdoor recreation areas. Units shall incorporate a commonality of theme and character, but offer a variety of unique facades and floor plans and orientation to the street and to side and backyards.

3-3.3 Environment. The environment and natural setting of the site should be maintained during and after construction by providing houses that accommodate the existing topography and by selective cutting of the trees and/or shrubs. Excessive cutting, filling, and re-contouring of the site is discouraged. Avoid site clearing that removes and/or destroys trees without preserving groups of trees in front of, between, behind, and/or around the houses. Design should focus on integrating the new improvements, including units and recreational facilities, into the existing assets of the site with emphasis on cross-utilization of existing recreational and meeting facilities as well as parking.

3-3.4 Buffers and Screening. Provide appropriate buffer areas to separate and visually isolate the residential community from undesirable external influences. Provide berming and vegetative screening around existing public elements, such as the Guest House, Pool Building, Gallota's, and along Wilson Road to enhance the neighborhood atmosphere. Berms shall have a natural form, slopes 4:1 or less, and mixed vegetation on and around the landform. Berm height shall not exceed eave-line of adjacent homes and screening shall benefit the new housing, and existing buildings. All possible methods of mitigating the impact to the site and adjacent areas shall be exploredBerm &

buffer plantings shall not be located closer than 18m (60 feet) to the westerly edge of pavement/back of curb along Wilson Road. Screen unsightly structures, including transformers and other utilities, and trash receptacles, with buffer plantings .91m (3 feet) from structures. Planting shall be on three sides.

3-3.4.1 Provide a buffer area of at least seventy five feet around sinkholes; no housing, yards or recreation facilities shall be located in this buffer area.

3-3.4.2 If streets walks or utility lines are located within a known sinkhole buffer zone, they shall be designed and constructed according to the requirements of the Kentucky Division of Water and in accordance with the written recommendations of Contractor's geotechnical engineer, and as approved by the Contracting Officer. At a minimum, the Contractor's design shall:

3-3.4.2.1 Prohibit ponding or drainage to such sinkholes and provide adequate support for the street, walk or utility line.

3-3.4.2.2 Provide for removal of soft soils, lining of the sinkhole with filter fabric, and filling the sinkhole with KY #57 aggregate. Above and around the filled sinkhole, three 20.32 cm (8") lifts of KY #57 shall be placed, with geogrid over the first two lifts. The third lift shall receive a layer of filter fabric, after which compacted fill for street or utility line construction can be placed in compliance with the provisions of this RFP. As an alternative, the top three lifts of KY #57 aggregate and geogrid may be replaced with 61 cm (two feet) of concrete, with compacted fill for construction placed above the concrete.

3-3.4.2.3 The filter fabric shall meet the following criteria: non-woven and AOS of 70 to 100 (ASTM D4751-87). Materials that meet these requirements include Amoco (BP) ProPex 4506, Carthage Mills FX-40HS, and Mirafi 140N.

3-3.4.2.4 The geogrid shall meet the following criteria: polypropylene or polyethylene grids with a minimum Wide Width Tensile Strength of 150 psf at 5% strain (ASTM D4595-86), and seams run on the north south axis. Materials that meet these requirements include Tensar BX 1100, Hueskar Fornit 20 and Tenax Corporation LBO202/SAMP.

3-3.5 Housing unit grouping. Variety in groupings, arrangements, and siting configurations of housing units is encouraged to fit varying terrain conditions and to provide compatible and functional residential layouts and street scapes. Building arrangements should be informal and imaginative with setbacks and orientation to provide for the best view, privacy, and variety. The proper grouping of housing units will provide backyard screening, separation of pedestrian and vehicular traffic, play lots, neighborhood parks, and natural open spaces. The layout should reflect simplicity of design and provide a visual sense of community.

3-3.6 Housing unit variation. Housing unit variation shall afford distinctly different exterior appearances within each housing unit type. Provide stylistic compatibility that will give the neighborhood a sense of order. Housing units shall vary in two or more of the following: Floor plans, massing, elevation, garage location (with face of garage set back a minimum of 1.5m (5 feet) from principle structure, and exterior materials. In addition, housing units shall vary in color and siting. A reverse floor plan (mirror-image), although an acceptable means of creating variety, shall not constitute a housing unit change. Offerors shall comply with land-use restraints set forth in this document and shall design a minimum of six (6) different unit types: 2 four-bedroom, 2 three- bedroom, and one each four-bedroom and three-bedroom accessible. To accept the design freedom objective of this RFP, Offerors are encouraged to offer 1-story and 2-story construction for detached units. The preferred colors are earth tones available in commonly used durable materials. The design shall reflect life cycle maintenance and energy efficiency. Variation in the arrangements and siting of dwelling units to fit varying terrain conditions and to provide attractive residential patterns and streetscapes shall be viewed as an opportunity, not a constraint. Building arrangements along curvilinear roadways shall be informal and imaginative as they are in the private sector with setbacks and orientation to provide for the best view, privacy and variety. The proper grouping of units shall provide backyard screening, separation of pedestrian and vehicular traffic, recreation, and natural open spaces.

3-3.7 Housing unit orientation. Whenever possible, it is desirable that the housing units be situated along the east-west axis, exposing more surface area to the south during the winter for the collection of solar radiation.

This allows the south elevation to receive much less radiation in comparison to the roof and east and west elevations during the summer. Existing and proposed vegetation shall be incorporated to provide screening from solar gain wherever feasible.

3-3.8 Grading. Avoid construction on slopes greater than 15%. Construction and grading on slopes in excess of 25% is prohibited. Added value is brought to a development that facilitates an appropriate balance of unit floor area, open space, recreation space, and pedestrian and vehicular circulation consistent with quality design, good land planning practices and economics.

3-4 Site Design Criteria. The following specific criteria are to be used as guidance in site design, and offers will be scored accordingly.

3-4.1 Housing units per hectare (ha) (acre (ac)) by site density are shown in Table 3-1 below.

TABLE 3-1 - HOUSING UNITS PER HECTARE (ACRE)

Pay Grade	Low Density	
	units/ha	units/ac
E-7 - E-9	7.4-12.4	3-5

3-4.2 Housing unit types by site density are shown in Table 3-2.

TABLE 3-2 - HOUSING UNIT TYPES BY DENSITY

Bedrooms/ Grade	Low Density
3 & 4 Bedrooms E-7 - E-9	1-2 Floor Detached Homes

3-4.3 Parking Requirements. Three spaces per unit – one garage and two off-street in driveway, 3m X 6m (10 feet x 20 feet) parallel to one another, and ½ space per unit grouped on-street guest parking in clusters of 2 to 4 spaces, perpendicular to the road and dispersed throughout the neighborhoods.

3-4.4 Children's outdoor play areas. Recreational Facility Requirements – All recreational facilities and picnic areas shall be accessible, including the path of travel to these facilities.

TABLE 3-3 - RECREATION ELEMENTS

Facility:	Quantity:	Requirements:
Play Lot	3	Surface of poured, recycled rubber aggregate.
Basketball Court	2 Full	Regulation size.
Picnic Shelter	2	Group picnic shelter w/ 4 picnic tables & 2 grills
Jogging Path	1	1.8m (6 feet 0 inches) wide, 1.6 km (1 mile) long.
Soccer Field	1	Non- regulation size with fixed posts, located on old par 3 course.
Pre-Teen Play Areas	2	Surface of poured, recycled rubber aggregate.
Open Space	N/A	Design open space to be integrated as comparable to similar private sector residential communities.

3-4.4.1 Play Lot. Each play lot shall be a minimum of total area of 325 m^2(3,500 ft^2) and shall be sized to fit the appropriate scale of the neighborhood where they are to be located. The play lot shall be designed to accommodate two age groups; 6 weeks to 5 years age group and 5 to 9 years age group. The play lot shall have a capacity for approximately 15 to 35 children. These play lots should be located within site lines of the housing units and provide colorful, imaginative play experiences with elements such as slides, swings with tot-buckets, climbing/crawling areas and interactive play panels . All play (tot) lots shall be ADA accessible and provide the minimum number of accessible-level play experiences as outlined in the Consumer Product Safety Commission's Handbook for Public Playground Safety, and ASTM's Standard Consumer Safety Performance Specification for Playground Equipment in Public Use F1487-98. Play lots shall have a 1.2m (4-foot 0-inch) tall vinyl coated chain-link fence around the perimeter, out of the safety buffer area if located within 18.3m (60 feet) from a collector street and /or within 12.2m (40 feet) of a slope greater than 25%. Design consideration shall be given to the use of play equipment made from recycled plastic & metals in lieu of treated wood or virgin metals.

3-4.4.2 Basketball Court. The basketball courts should be located within a safe buffer from play lot areas. Basketball courts shall be regulation size, 25.6m (84 feet) by 15.2m (50 feet) with a 6m (20-foot) clear safety zone. Courts shall be orientated on a north/south axis. Rims shall be breakaway style. Standards shall be fixed. Provide one trash container for each basketball court.

3-4.4.3 Picnic Shelter. As a component of the open space development, provide for two sheltered picnic areas, ADA accessible, which shall contain one covered picnic shelter, an enclosure capable of holding four trash receptacles at each picnic shelter, four picnic tables, one of which shall be wheelchair accessible, and two embedded barbecue grills, briquette-burning type out from under the roof drip-line yet wheelchair accessible. Locate picnic areas within close proximity to parking areas and sidewalk access. Landscape enhancements shall provide for shade and shrub material which create a buffer area around the picnic spaces. Design consideration shall be given to the incorporation of two additional (4 total) shelters.

3-4.4.4 Jogging Path. A bituminous jogging path / bike path at least 1.6 km (one mile) in length, 1.8m (6 feet-0 inches) wide over 101.6mm (4 inches) of compacted aggregate over filter fabric soil separator on a compacted sub-grade. Loop trail independent of the street network. Trail shall conform to the rules of ADA accessibility, with a

maximum 5% vertical slope and 2% cross-slope. Provide curb-cuts, crosswalk striping and accessible pedestrian ramps where trail bi-sects roads. Include (1) park bench every 304m (1000 feet) and a minimum of (2) litter receptacles along the path. Refer to Paragraph 3-4.4.8. Provide a path connection to the MacDonald School adjacent to this development, conforming to the jogging path construction specifications.

3-4.4.5 Soccer Field. A soccer field with fixed goals shall be located on the existing par 3 golf course area east of the Wickam Guest House. Recommend the use of natural land forms for grass stadium-style seating for viewers. No fixed seating structures shall be required and no nets are to be installed. Minimum soccer field size is 50m (165 feet) x 91m (300 feet), to be located on a north-south axis.

3-4.4.6 Pre-Teen Play Areas. Provide two play areas for pre-teens and teenage users, age group of 9 years to 15 years, in close proximity to tot-lot play areas. Play areas shall encourage group interaction while providing both active and passive recreation spaces. Elements such as wall climbers, swings, overhead ladders, rockers and small group congregation spaces are desired. Design consideration should be given to the implementation of one additional (3 total) pre-teen play areas and the development of an access drive with off-street parking and picnic shelter proximity. See Paragraph 3-4.4.1 for regulatory agency references.

3-4.4.7 Open Space. Through the planning of picnic space, play lots, etc. open space should occur such to reflect the character found in most private sector residential areas. Design consideration should be given to the preservation of as much natural open space, topography and existing trees as possible. Consideration should also be given to the incorporation of one turf volleyball court, minimum size to be 9m (30 feet) x 18m (60 feet), with a 6m (20-foot) clear-zone for safety, with fixed poles in proximity to picnic shelters and pre-teen play areas.

3-4.4.8 Seating. Provide the following two bench types, where noted, in the development of recreational spaces.

3-4.4.8.1 Recreational Bench: A back-less bench without arms, 1.8m (6 feet) in length, direct bury, recycled plastic seat and metal frame. Locate out of the safety buffer but intermixed with play lot equipment. Refer to Specifications Section 02870A, Site Furnishings.

3-4.4.8.2 Park Bench: A backed bench with arm rests at each end, 1.8m (6 feet) in length, direct bury, recycled plastic seat and metal frame. Locate along the edge of play lot paving, orientated to view the play lot and along the jogging path, facing the path itself. Refer to Specifications Section 02870A, Site Furnishings.

3-5 Building Setbacks and Spacing. Clearances between and adjacent to buildings must consider requirements for fire protection, safety, privacy, and emergency access in addition to the following minimum criteria. Setback or yard dimensions shall be from the building wall to an imaginary lot line around each building measured perpendicular to the building. Wall lengths with horizontal offsets of 1.8m (6 feet) or more may be measured separately when determining yard depth. Distance between buildings shall be not less than the sum of setbacks or yards, as required.

3-5.1 Minimum setbacks and spacing for low density sites is shown in Table 3-4.

TABLE 3-4 - MINIMUM SETBACKS AND SPACING, LOW DENSITY SITES

(See Notes at the end of the Table)

Description	Meters	(Feet)
From front of house to curb of residential street.	9.0	30
From house to major/arterial highway. (Edge of pavement)	39.0	130
Setback to Wilson Road	39.0	130
Side of garage to curb.	6.0	20
Side of house to curb.	7.6	25
Between sides of garages to houses.	6.0	20
Between outside walls of houses.	7.6	25
Between rear walls of houses.	24.0	80
Rear backyard.	6.0	20
Design consideration for rear yard.	7.6	25

Table 3-4 Notes:

(a) Projections into required yards shall not exceed 40 percent of the setback (yard) distance.
(b) Where slope is 3:1 or steeper, top and toe of slope shall be a minimum of 4.5m (15 feet) from the building.
(c) When patios are located within the side yard, provide a 40-foot minimum separation.
(d) No housing may be located on collector streets.
(e) Vary house setback distance from streets, within allowable minimum, for visual interest throughout the development.
(f) Setback from Wilson Road measured from the westerly edge of pavement/back of curb.
(g) Building setback from the water tower shall be equivalent to the height of the tower, to be field-verified by Offeror.
(h) When patios are located within the rear yard a minimum 5% slope for a distance of 6m (20 feet) shall be provided.

3-5.2 Setback Notes.

3-5.2.1 Where the slope is 3:1 or steeper, top and toe of slope shall be a minimum of 4.5m (15 feet) from the building. Slope 3:1 or greater are to be sodded and staked.

3-6 Circulation, Parking, and Bus Stops. The vehicular and pedestrian circulation system shall promote safe, efficient movement of vehicles and pedestrians within the housing area. It should maintain the maximum separation of vehicles and pedestrians. Safe circulation systems have a clear hierarchy of movement, lead to a clear destination, and do not interrupt other functions. The following criteria shall be considered for designing streets and drives for vehicles and pedestrians:

3-6.1 Vehicular circulation. Vehicular circulation layout is determined by applying the design vehicle templates to

the site design. The passenger car class includes passenger cars and light delivery trucks, such as vans and pick-ups. The passenger car template is equivalent to the non-organizational - privately owned vehicle (POV). The truck class template includes single-unit trucks, recreation vehicles, buses, truck tractor/semi-trailer combinations, and trucks or truck tractors with semi-trailers in combination with full trailers. Templates showing the turning movements for design vehicles are provided by the American Association of State Highway and Transportation Officials (AASHTO). Design site entrances, exits, service drives, and special circulation areas to accommodate the largest vehicle and therefore the design vehicle that uses the area. In the case of family housing the largest vehicle to use the area on a weekly basis would be the 18m (60-foot) tractor/semi-trailer combination. Provide the vehicle clearances that are required to meet traffic safety for emergency vehicles, service vehicles, and moving vans. Streets shall include required traffic control and street identification signage, maximum spacing between drives, right-angle turns, and limit points of conflicts between traffic.

3-6.1.1 Definitions.

3-6.1.1.1 Nonresidential Streets

3-6.1.1.1.1 Arterial. Major roads and street systems external to the residential area.

3-6.1.1.1.2 Collector. Feeder street connecting external street system with residential streets in the subdivision and adjoining areas subject to future development.

3-6.1.1.2 Residential Streets

3-6.1.1.2.1 Loop. Both ends open to traffic.

3-6.1.1.2.2 Cul-De-Sac. Only one end open to access street and a turnaround (Circle) at the other end.

3-6.1.2 Cul-De-Sac Design. The circulation system may be based on cul-de-sacs a maximum 250m (820 feet) long, measured from the center of the cul-de-sac to the centerline of the access street.

3-6.1.3 Intersection Design. Provide "T" intersection offsets of at least 38.1m (125 feet). The preferred angle of intersection is right-angle (90 degrees).

3-6.1.4 Street design. Street dimensions are determined by the selected design vehicle templates. Separation, corner clearances, and sight distance are established when the design vehicle templates and speed limits are selected. Streets shall be designed for vehicles with not less than 2721.5 kg (6,000 lb) code wheel load. Streets shall be provided with concrete curbs and gutters. Curbs shall be depressed at entrances to driveways. All gradients shall provide positive drainage with no ponding. A meandering street design, similar to those found in the private sector subdivision developments, is preferable over a straight road layout. Street design is also encouraged to use traffic circles at the intersection of roads leading to and from major collectors to help calm traffic speeds.

3-6.1.5 Unit Driveways. Minimum width of driveway shall be 6.1m (20 feet- 0 inches) for two-car parking to allow for circulation. Drives shall be concrete with control joints every 3m (10 feet-0 inches) and expansion joints every 12m (40 feet-0 inches). Use expansion joint material where driveway meets building, back of curb and any other permanent man-made element.

3-6.2 Recreation Accessible-Only Parking. A 90-degree parking layout is preferable. Provide two parking spaces at each picnic and play area.

3-6.3 Bus stops. Four school bus stops with shelters shall be provided along collector streets at intersections with residential streets for use as school bus stops. Bus stop shelters shall have roofs, a compatible style of architecture, concrete slab floor and shall be located near street lights to provide illumination.Tee intersections may share bus stops if within reasonable walking distances of these intersections. Provide for four school bus stops distributed equally throughout the neighborhood depending upon the design. Sidewalks at bus stops shall be located adjacent

to the curb for ADA access. Roads shall have pull-outs located in front of bus shelters for full-sized busses to load and unload safely.

3-6.4 Pedestrian circulation. Pedestrian circulation should be safe, separated from vehicle circulation, and relate to the housing units, parking, and community facilities. Pedestrian circulation should be based on pedestrian desired lines of walking between facilities. Desired lines should be weighted to predict the most traveled routes. These routes would require paving. Topography and vegetation can be used to reinforce a sense of movement. Design pedestrian concentration areas with adequate paved area.

3-6.4.1 Sidewalk design. Walks shall be provided to allow pedestrian circulation between various elements of the project including units, parking, streets, recreation, etc. Sidewalks are required on both sides of the street where housing is located and all sidewalks to be placed 4 feet from the back of the curb and on one side of the street along the internal parkway collector. Walks shall be a minimum of 4 feet wide, exclusive of curb width, and made of non-reinforced concrete with a minimum thickness of 4 inches over a 6-inch compacted base. Sidewalks shall be constructed with a 2% cross slope to promote drainage to the street. Where walks are adjacent to the curb, such as bus stops, the curb width is not to be included as sidewalk. Ramps for the handicapped shall be provided at intersections by depressing street curbs and adjacent sidewalk.

3-6.5 Site Planning – Roadway Planning.

3-6.5.1 Streets, Parking, Walks and School Bus Stops. The street system shall provide convenient and safe access and circulation (including collections, deliveries, and fire protection) within the housing area.

3-6.5.1.1 Street Types.

3-6.5.1.1.1 Nonresidential Streets.

3-6.5.1.1.1.1 Arterial. Major road/street systems external to residential area. No housing units shall front on arterial streets and no direct individual driveway or lot access shall be provided to arterials. Only collector streets shall access arterials.

3-6.5.1.1.1.2 Collector. No housing units shall front on collectors and no direct lot or driveway access shall be provided to collectors. Residential streets only access collectors, except as specifically allowed herein.

3-6.5.1.1.2 Not used.

3-6.5.1.1.2.1 Not used.

3-6.5.1.1.2.2 Not used.

3-6.5.2 Street Layout. The criteria presented in “A Policy on Geometric Design of Highways and Streets”, 2001 Edition, American Association of State Highway and Transportation Officials, shall be used in the design of the street system. The following specific criteria shall be considered for designing streets and roads for family housing.

3-6.5.2.1 Avoid rigid gridiron-like street and building layouts. Layout should relate to the natural contours of the site and should take into account adverse weather conditions such as snow and ice.

3-6.5.2.2 Avoid street patterns which encourage on-post vehicular traffic through housing areas. Circulation plans based on courts and cul-de-sacs are more desirable. Houses shall be clustered around courts and cul-de-sacs whenever possible.

3-6.5.2.3 Avoid loop streets that are either excessively long or excessively short (forming small islands with few dwelling units surrounded by streets).

3-6.5.2.4 Limit the number of intersections. Avoid four-way intersections and intersections near the crests of hills. Provide 'T' intersection offsets of at least 38.1 meters (125 feet). The angle of intersection shall be between 60 and 90 degrees (the minimum angle permitted being 60 degrees and the maximum angle permitted being 90 degrees). 'T' and 'Y' turn-arounds are not permitted.

3-6.5.2.5 Minimize paved areas as much as possible to increase the green space in the community; large areas of paved parking should be broken up by green islands or dividers in such a way as to not adversely affect routine ground maintenance.

3-6.5.2.6 Provide appropriate buffer areas to separate and visually isolate the community from undesirable external influences.

3-6.5.2.7 Pedestrian circulation shall relate to housing units, parking and community facilities, and shall be safe and attractive. Sidewalks in this development shall be made of concrete and located on both sides of residential streets, 0.9m (4 feet-0 inches) in width and placed 4 feet from the back of the curb. Along collector streets, sidewalk on one side of the street, 0.9m (4 feet-0 inches) is required. Sidewalks to the entrance of the development shall also be 0.9m (4 feet-0 inches). Design consideration shall be given to providing sidewalks that meander away from the road and that are within street light illumination along collector streets. See Paragraph 3-6.4.1.

3-6.5.2.8 Local streets should provide convenient access to housing units and all housing shall be accessible by emergency vehicles, service vehicles and moving vans.

3-6.5.2.9 Housing unit entrances should relate to parking spaces to provide convenient and safe access. Avoid siting houses such that driveways have steep drives, greater than 5% vertical slope.

3-6.5.2.10 Not used.

3-6.5.2.11 Emergency Vehicle Access Road: Include the construction of a ‘buried street’ for fire department access to the Wickam Guest House from the residential area. This road is to have a sub-grade support system of synthetic grid designed for the purpose of supporting heavy emergency vehicles yet allowing turf grass to grow on the surface or between the grid cells.

3-6.5.2.12 The project is allowed one collector street access to each of Dixie Street and Wilson Road.

3-6.5.2.13 The collector access from Wilson Road is required to provide the sole access from Wilson Road to the former clubhouse facility, Wickam Guest House and the pool. If the existing access onto Wilson Road is utilized, the existing traffic control signal system must be reinstalled at the intersection. In addition, the existing intersection must be reconstructed to provide a maximum slope of 0.5 percent for a distance of 50 feet from the shoulder of Wilson Road. If the current access off Wilson is closed and a new one created, the existing intersection shall be removed in its entirety and the existing signal shall be removed from its current location and re-installed at the new intersection. Any new intersection must be constructed in accordance with the requirements of the design guidelines of Kentucky Transportation Cabinet (KYTC) Geometric Design Standards 500-04. If a shared access is proposed, access to existing buildings for vehicles must be maintained throughout the demolition/construction period. Offerors shall submit a traffic routing plan and schedule for work on Dixie Street and Wilson Road, with regard to access construction.

3-6.5.2.14 Access to Gallota's, the Wickam Guest House and pool area shall be from the Wilson Road collector street and not through housing area residential streets.

3-6.5.2.15 The primary north-south collector street is to be extended to the southern boundary of the project to provide access to a potential future housing development. A temporary cul-de-sac shall be constructed at the southern end of the street stub.

3-6.5.2.16 The existing access from Binter Court onto Wilson Road must be demolished and cannot be utilized in

the design of the project road system.

3-6.5.3 Minimum Street Dimensions

3-6.5.3.1 Streets shall have the following minimum dimensions face to face of curb.

Type of Street	On-Street Parallel Parking (Guest & Service)	
	None	One Side
Width, main collector road:	26 ft	N/A
Width, all residential streets:	N/A	28 ft
Minimum cul-de-sac radius:	N/A	55 ft
Minimum 'T' or 'Y' turn-around size	Not Permitted	Not Permitted

NOTE: Center planting circle is not permitted in a cul-de-sac.
Street widths are measured from the face of the curb.
All streets shall have signs at intersections indicating the street name, MUTCD std. size.

3-6.5.4 Street Design

3-6.5.4.1 Streets shall be provided with 152mm (6-inch) Type V (non-mountable) concrete curbs and gutters. Curbs shall be depressed at entrances to driveways. Sidewalks shall be designed to work with driveway grades with a maximum cross-slope of 2%. All gradients shall provide positive drainage (no ponding). Streets shall be designed for vehicles with not less than a 6,000-pound code wheel load. Pavement shall be asphaltic concrete. Design speed for main collector streets shall be 25 miles-per-hour and the design speed for residential streets shall be 15 miles-per-hour.

3-6.5.4.2 Crosswalks: All intersections where sidewalk and accessible curb ramps are on opposite sides of the street shall have surface paint on the roadway indicating crosswalk, as well as vehicular signage noting 'Crosswalk-Yield to Pedestrians'.

3-6.6 Street Signage and Striping

3-6.6.1 General Criteria: Manual on Uniform Traffic Control Devices, Latest Edition, US Department of Transportation.

3-6.6.2 Specific Requirements.

3-6.6.2.1 No centerline striping will be required on residential streets.

3-6.6.2.2 Signage. Add the following signs, on telespar poles, throughout the proposed development using the standards as outlined in the Manual noted in Paragraph 3-6.6.1.

'NO PARKING'	Within 9m (30 feet) of intersections at collector streets, at beginning, midpoint and end of side of street with mailboxes, every 152.4m (500 feet) along streets not designed for on-street parking, at handicapped loading stalls, on doors of trash enclosures.
'NO PARKING-FIRE LANE'	To be located where directed by the local fire marshal.

'SPEED LIMIT'	Post speed limit signs along all roadways with the applicable speed for each road type. For each speed limit sign located closest to the entrance to the development, add 'speed enforced by radar' sign below speed limit, facing incoming traffic.
'STOP'	Place stop signs at all road intersections and place smaller stop signs where the biking/jogging trail intersects any roadway, facing trail traffic.
'CROSSWALK' (GRAPHIC) 'YIELD TO PEDESTRIANS'	Where surface crosswalks are painted, place signs facing both directions of traffic.
'HANDICAPPED' (GRAPHIC) 'VAN-ACCESSIBLE ONLY' 'UNAUTHORIZED VEHICLES SUBJECT TO $200 FINE'	Install wherever dedicated handicapped parking is placed, in conjunction with required surface painting.
'PLAY AREA RULES'	Install at the entry to all play areas.
'NATURAL AREA'	Install every 152m (500 feet) at native prairie grass installations such as the sink-hole buffer zones.

3-7.1 Child Safety and Accessibility.

3-7.1.1 Accessibility to children and adults with disabilities. Play areas shall be accessible to children and adults with disabilities. In addition to wheelchair users, the needs of children and adults who walk with canes, walkers, or crutches; who have limited use of the upper body; who have visual or hearing disabilities, or who have developmental disabilities shall be considered. Design criteria based on child dimensions should be used for the proper functioning of the play area. Every part of a play area may not be accessible to all its users, but the social experience provided should be accessible to everyone. When more than one play activity of the same type is provided, one shall be accessible. When one activity is provided, it shall be accessible. A diverse play area has the greatest potential for meeting the needs of all users. Separate play areas for the physically challenged are not acceptable. Integrating all children in the same play setting shall be emphasized. Guidelines available from this design district for accessible routes, ramps for wheelchair access, transfer points, wheelchair accessible platforms, and accessible stepped platforms should be followed.

3-7.1.2 Age appropriate scale. Age appropriate scale is a term used to describe equipment, which will allow safe and successful use by children of a specific chronological age, mental age, and physical ability. Play equipment height and complexity will not exceed the user's ability. The children's outdoor play areas shall meet age appropriate scale for the age groups that the areas are designed to accommodate.

3-7.1.3 Use zones. In accordance with ASTM F 1487, a use zone is a clear, unobstructed area under and around play equipment where a child would be expected to land when jumping or falling from a piece of play equipment. These zones require a playground safety surface in accordance with ASTM F 1292. Requirements for use zones vary for the age group and for different pieces of equipment. All use zones for play equipment should be shown on the site plan to ensure there is no conflict between play activities on the ground and swinging or jumping from the equipment. Use zones shall not overlap except for spring rocking equipment, balance beams, and play houses.

3-7.1.4 Playground safety surface. A playground safety surface is constructed of a poured, recycled rubber aggregate over 101.6mm (4-inch) reinforced concrete base that meets the shock absorbency criteria recommended in ASTM F 1292. Playground safety surfaces shall be provided throughout all use zones and under all play equipment as required. Ensure playground surface has adequate drainage, not to exceed slope requirements. Any drains proposed must meet with regulatory requirements in Paragraph 3-4.4.1.

3-7.1.5 Inappropriate play events. The following play events are not appropriate for use in unsupervised play areas, only for children under 9 years of age: Chain walks, chain or tire climbers, fulcrum seesaws, log rolls, May poles, merry-go-rounds, rotating equipment, spring rocking equipment intended for standing, swinging exercise bars, trapeze bars, and whirls. Any skateboard related elements are strictly prohibited for all age groups.

3-7.2 Manufactured play equipment setting. This setting includes an age appropriate composite structure consisting of multiple play events for each of the following age groups: 6 weeks to 5 years of age, 5 to 9 years of age, and 9 to 15 years of age (pre-teen). Other play events include free standing equipment such as spring rocking equipment, swing, and balance beam. The swing shall be located as a free standing play event on the perimeter. Play lots shall be composed of the following minimum of colorful, multi-user and accessible play equipment elements:

Play Lots for 6 weeks to 5 years of age and 5 to 9 years of age. Play lots shall include:

(a) One play structure for each age group, per play lot, with interactive play panels, transfer platforms, climber, tunnel or bridge connection piece and partial roof.

(b) One 6-unit swing set, 2.4m (8 feet) high

(c) One slide, 1.8m (6 feet) high

(d) One kindergarten swing set (8 feet) high with child bucket seats only.

(e) Four spring rider play pieces to accommodate 1 to 3 children.

(f) Two Recreational Benches and Two Park Benches

(g) One litter receptacle

(h) One bicycle rack (six bikes per rack)

Pre-teen Play Lots 9 years of age to 15 years. Play lots shall include:

(a) One play structure with slide, climbing wall, rope wall and partial roof.

(b) One overhead-ladder or zip-line play piece.

(c) One 4-unit swing set, 3.6m (12 feet) high with belt seats only.

(d) One small group congregation play piece, with partial roof.

(e) Two spring mounted, group play pieces

(f) Two Recreational Benches and Two Park Benches

(g) One litter receptacle

(h) One bicycle rack (six bikes per rack)

3-7.3 Plant materials. Plants and ground cover should be integrated into play settings. Plants provide a variety of learning opportunities, as they become a source for play material for crafts, dramatic play, and sensory experience. Plants define space and provide shade. Poisonous plants and plants with thorns are not allowed and should be removed from the play areas.

3-8 Landscape Planting Plan. Landscaping with trees and shrubs is a mandatory requirement for this project. A minimum preservation of 85% of those trees identified and located as significant is required. A damage clause is included for failure to comply with this requirement. Protection of all existing mature trees is desirable. Design consideration should be given to the preservation of 95% of the significant trees. Offerors are encouraged to incorporate as many existing mature trees into their proposal as possible, including those not specifically marked as significant in the field.

3-8.1 A complete and comprehensive landscaping design shall be provided for the overall family housing project including the site restoration made necessary by demolition and construction activities as required. Seed and/or sod all disturbed areas. Sod and stake slopes of 3:1 or greater.

3-8.2 The plan is required to incorporate only material complying with ANSI/ANLA 260.1 and compatible with stock approved by the University of Kentucky and Kentucky Department of Transportation. It shall provide trees and shrubs of adequate size, species, quantity and grouping, of foundation plantings, yard, common green area, streetscape and solar shading of each housing unit to insure a complete landscaped project. Use of deciduous vegetation as a solar screen is a mandatory requirement. Deciduous trees on the south side shall allow for shading in summer and direct solar gain in winter. Selected plant materials shall be easily maintained, locally hardy, and tolerant of the specific site conditions. The Contractor shall provide water and maintenance to the newly planted turf, perennials, shrubs and trees to ensure their survival. A penalty equivalent to the cost of the plant plus labor, shall be assessed against the Contractor should plants die and not be replaced within 60 days of notification. The Contractor shall provide a warranty for one full growing season, from the date of Government acceptance, all work and new plantings.

3-8.3 One shade tree, one evergreen tree, and 8 shrubs per unit is mandatory. Minimum 1-3/4-inch caliper deciduous stock is required. Evergreen trees shall be a minimum of 1.8m (6 feet-0 inch) height. A casual feel is desired at residences and a park-like character is desired throughout the open spaces system. Street trees planted every 18m (60 feet) on-center are required, as well as additional open space, recreational and buffer plantings. Locate trees to provide shade on roads and parking areas. Shrubs shall be a minimum of 0.6m (24-inch) spread and/or height. Additional plant materials to supplement the allocated unit planting shall be installed throughout open spaces, at recreational areas and at picnic areas. Locate some shrubs in the sink-hole buffer area which are compatible with native grasses to create a natural landscape.

3-8.3.1 Choose plant materials on the basis of plant compatibility, climate, soil conditions, low maintenance, and esthetic suitability. Refer to Specification Section 02930A for a listing of approved plants.

3-8.3.2 Contractor shall be responsible for proper care and watering of ground cover and plants for the period of time required for their establishment. The entire housing area, within the limits of construction, shall present a neat and finished appearance.

3-8.3.3 Contractor shall review the site and remove any construction debris, foreign or natural, prior to any planting activities. Smooth any rough areas, fill depressions and provide a uniform finished grade to the landscaped areas.

3-8.3.4 In accordance with the project sustainability requirements, plantings shall be drought-tolerant. Irrigation is prohibited anywhere in the development.

3-8.3.5 Existing trees within the work limits, that can be adapted to fit the Contractor's landscaping scheme, shall remain if the following requirements are met:

3-8.3.5.1 No fill is placed within the drip line.

3-8.3.5.2 No construction traffic is permitted within the drip line.

3-8.3.5.3 No utility cuts are to be made within 10 feet of the trunk.

3-8.3.5.4 Tree protective structures are to be provided to insure that 3-8.3.5.1, 3-8.3.5.2, and 3-8.3.5.3 are met.

3-8.4 Trees, shrubs, and ground cover. Plant varieties shall be nursery grown or plantation grown stock conforming to ANSI/ANLA Z60.1. They shall be grown under climatic conditions similar to those in the locality of the project. Plants shall be locally available and of species presently growing in the greater Fort Knox region. Ornamental trees which produce fruit or unpleasant odor, or are messy plants are prohibited.

3-8.4.1 Quality. Well shaped, well grown, vigorous, healthy plants having healthy and well branched root systems shall be provided. Plants shall be free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement, and abrasion. Plants shall be provided that are typical of the species or variety, and conforming to standards as set forth in ANSI/ANLA Z60.1.

3-8.4.2 Shade and flowering trees. A height relationship to caliper shall be provided as recommended by ANSI/ANLA Z60.1. Height of branching should bear a relationship to the size and variety of tree specified, and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.

3-8.4.2.1 Single stem. Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

3-8.4.2.2 Multi-stem. All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk that branches more than 150mm (6 inches) from the ground level.

3-8.4.2.3 Specimen. A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

3-8.4.3 Deciduous shrub. Plants shall be provided that have the height and number of primary stems as recommended by ANSI/ANLA Z60.1 An acceptable plant shall be well shaped with sufficient well-spaced side branches recognized by the trade as typical for the variety grown in the region.

3-8.4.4 Coniferous evergreen. Trees shall be provided that have the height-to-spread ratio as recommended by ANSI/ANLA Z60.1. Trees shall not be "poled" or the leader removed. An acceptable plant shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

3-8.4.5 Broadleaf evergreen. Plants shall be provided that have ration of height-to-spread as recommended by ANSI/ANLA Z60.1. An acceptable plant shall be well shaped and recognized by the trade as typical for the variety grown in the region.

3-8.4.6 Ground cover. Plants shall be provided with the minimum number of runners and length of runner as recommended by ANSI/ANLA Z60.1. Plants shall be furnished that have heavy, well developed, and balanced top with vigorous well developed root system, and shall be furnished in containers.

3-8.4.7 Measurement. Plant measurements shall be in accordance with ANSI/ANLA Z60.1.

3-8.4.8 Percolation test. Test for percolation shall be done to determine positive drainage of plant pits and beds. All soil and drainage conditions detrimental to the growth of plant material shall be identified and a proposal correcting the conditions shall be submitted.

3-8.5 Soil test. A soil test shall be performed for pH, chemical analysis, and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plant material specified.

3-8.6 Installation. Verify the location of underground utilities. When obstructions below ground or poor drainage affect the planting operation, proposed adjustments to plant location, type of plant, and planting method or drainage correction shall be submitted. The plant material shall be installed during appropriate planting times and conditions recommended by the trade for the type and variety of plant material specified. Plant pits shall be excavated and backfilled as recommended by the trade and ANSI/ANLA Z60.1. The planting operation shall be performed only during periods when beneficial results can be obtained. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted.

3-8.7 Pruning. The total amount of foliage shall be pruned by one-fourth to one-third on installed trees and shrubs to compensate for loss of roots and transplanting shock. The typical growth habit of individual plants shall be retained. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off."

3-8.8 Maintenance during planting operation. Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences.

3-8.9 Plant establishment period and warranty. If turf is not established as defined in the specifications, at the time of turnover to the Government, the Contractor is required to return until acceptable turf is established. Furthermore, the tree and shrub warranty period of one growing season, (12-month minimum), shall commence upon turnover to the Government.

3-8.10 Maintenance during establishment period. The maintenance of plants shall include straightening plants, tightening stakes and guying material, repairing tree wrap, protecting plant areas from erosion, maintaining erosion material, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, watering, weeding, removing and replacing unhealthy plants.

3-8.11 Unhealthy plant. A plant shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit in accordance with the following warranty paragraph.

3-8.12 Plant replacement. Furnished plant material shall be guaranteed to be in a vigorous growing condition upon planting and for a period of one growing season, regardless of the contract time period. A plant shall be replaced one time under this guarantee and be of the same size & species. Substitute for an alternate species if directed by the Government.

3-8.13 Turf. Turf consists of seed, sod, and sprigs. There may be several different types of turf mixtures applied; one for lawn areas around housing units and one for field or recreation areas. The boundaries of each area shall be clearly defined on the planting plan. Lawns, boulevards and open spaces shall incorporate a rolling landform where appropriate and shall be seeded or sodded and appropriately landscaped. All disturbed areas not otherwise surfaced shall incorporate topsoil, be tilled, receive soil amendments, and either seeded or sodded. Inverts of all drainage ditches and swales shall be sodded. Sod shall be laid between the residential street curb and sidewalk, for .9m (3 feet) along the unit drive/walkway, and for .9m (3 feet) along the unit patio areas. Sod shall be placed and staked on all slopes of 3:1 or greater. Turf seed shall be placed in all other disturbed areas, except in the 22.8m (75-foot) sink-hole buffer area, which will be seeded with native prairie grass seed. See Paragraph 3-8.9 above for warranty.

3-8.13.1 Seed quality. State approved seed of the latest season's crop shall be provided in the original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with applicable State seed laws. Seed mixtures shall be proportioned by weight. Weed seed shall not exceed one percent by weight of the total mixture. All ground areas to be seeded shall be topsoiled to a minimum depth of 4 inches using topsoil stripped at the project site and supplemented as necessary by offsite topsoil. Topsoil shall be leveled and brought to proposed grades. All topsoil utilized shall be submitted for a soil test and amended accordingly.

3-8.13.2 Sod. State approved sod shall be provided as classified by applicable State laws. Each individual sod section shall be of a size to permit rolling and lifting without breaking.

3-8.13.2.1 Quality. The sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 50mm (2 inches) in any dimension, woody plant roots, and other material detrimental to a healthy stand of turf. Sod that has become dry, moldy, or yellow from heating, or has irregular shaped pieces of sod and torn or uneven ends shall be rejected.

3-8.13.2.2 Thickness. Sod shall be machine cut to a uniform thickness of 31.75mm (1 1/4-inch) within a tolerance of 6mm (1/4-inch) excluding top growth and thatch. Measurement for thickness shall exclude top growth and thatch.

3-8.13.2.3 Time limitation. The limitation of time between harvesting and placing sod shall be 36 hours.

3-8.13.3 Sprig quality. The cultivar shall be provided as healthy living stems, stolons, or rhizomes with attached roots, including two or three nodes, and shall be from 100mm to 150mm (4 inches to 6 inches) long, without adhering soil. Sprigs shall be provided which have been grown under climatic conditions similar to those in the locality of the project. Sprigs shall be obtained from heavy and dense sod, free from weeds or other material detrimental to a healthy stand of turf. Sprigs that have been exposed to heat or excessive drying shall be rejected. The time limitation between harvesting and placing sprigs shall be 24 hours.

3-8.13.3.1 Soil test. A soil test shall be performed for pH, chemical analysis, and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of turf specified.

3-8.14 Temporary turf cover. When there are contract delays in the turfing operation or a quick cover is required to prevent erosion, the areas designated for turf shall be seeded with a temporary seed. When no other turfing materials have been applied, the quantity of one-half of the required soil amendments shall be applied and the area tilled.

3-8.15 Installation. The turf shall be installed during appropriate planting times and conditions recommended by the trade for the type and variety of turf specified. The turf operations shall be performed only during periods when beneficial results can be obtained. Drainage patterns shall be maintained. The turf shall be installed by using the methods as recommended by the trade for the type and variety of turf specified.

3-8.16 Protection. Immediately after turfing, the area shall be protected against traffic or other use by erecting barricades and providing signage as required. Install erosion control blanket over newly seeded areas where drainage patterns indicate erosion has or could occur during a standard rain event. Also install erosion control blanket over native seed planted in the sink-hole buffer area.

3-8.17 Turf establishment period. The turf establishment period for establishing a healthy stand of turf shall begin on the first day of work under the turfing contract and shall end three months after the last day of the turfing operation. An unsatisfactory stand of turf shall be repaired as soon as turfing conditions permit.

3-8.18 Satisfactory stand of turf.

3-8.18.1 Seeded lawn area. A satisfactory stand of turf from the seeding operation for a lawn area is defined as a minimum of 160 grass plants per square meter. Bare spots shall be no larger than 150mm (6 inches) square. The total bare spots shall not exceed two (2) percent of the total seeded area.

3-8.18.2. Seeded field area. A satisfactory stand of turf from the seeding operation for a field area is defined as a minimum of 100 grass plants per square meter. The total bare spots shall not exceed two (2) percent of the total seeded area.

3-8.18.3 Sodded area. A satisfactory stand of turf from the sodding operation is defined as living sod uniform in color and texture. Bare spots shall be no larger than 50mm (2 inches) square.

3-8.18.4 Sprigged area. A satisfactory stand of turf from the sprigging operation is defined as a minimum of 20 sprigs per square meter. Bare spots shall be no larger than 225mm (9 inches) square. The total bare spots shall not exceed two (2) percent of the total sprigged area.

3-8.19 Maintenance during establishment period. The maintenance of the turfed areas shall include eradicating weeds, eradicating insects and diseases, protecting embankments and ditches from erosion, maintaining erosion control materials and mulch, protecting turf areas from traffic, mowing, watering, post-fertilization, and replacing unsatisfactory turf areas.

3-9 Sprinkler and/or Irrigation system. Irrigation systems are prohibited anywhere in the development. Water for newly planted materials shall be potable and applied with a commercial watering truck.

3-10 Seed Classification. State-approved seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for mixture percentage, purity, germination, weed seed content, and inert material. Labels shall be in conformance with USDA-01 and applicable state seed laws.

3-10.1 Seed Mixtures

3-10.1.1 Turf Seed mixture shall be KDoT for its Seed Mix #1 proportioned by weight as recommended and outlined in Kentucky Standard Specifications for Construction, 2000 edition.

3-10.1.2 Native seed mixes, forbes and wildflowers with mix as recommended by local growers and appropriate to the sight shall be proposed for review and consideration as part of the detailed landscape plan. Limit the planting of native grasses to the 22.8m (75-foot) buffer zone around sink-holes and to transition between the development back-yards and the existing tree/underbrush stands.

3-10.2 Weed Seed

3-10.2.1 Weed seed shall not exceed 1 percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed will be rejected. Perform field mixes on site in the presence of the Contracting Officer. All seed and mulch shall be certified weed free.

3-10.3 Seeding

3-10.3.1 Lawns and other grass areas within the project limits (and outside the project limits where disturbed by construction) shall be seeded. Seed shall be sown from 25 April to 15 May for spring planting and from 15 September to 15 October for fall planting. Broadcast seeding or Drill seeding shall be at an application rate of 6 pounds per 1000 square feet. Hydroseeding shall be as directed by the Contracting Officer. Germination shall be 85% or better. Seed shall be labeled in accordance with U. S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date this solicitation. Planting shall not be done when the ground is frozen, snow covered or otherwise in an unsatisfactory condition for planting.

3-10.4 Sod

3-10.4.1 State-certified Nursery-grown sod shall be provided as classified by applicable state laws. Each individual sod section shall be of a size to permit rolling and lifting without breaking. Grass species shall be proportioned as defined by KDot Seed Mix #1 and as outlined in Kentucky Standard Specifications for Construction, 2000 edition.

3-10.4.2 The sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 2 inches in any dimension, woody plant roots and other material

detrimental to a healthy stand of turf. Sod that has become dry, moldy, or yellow from heating, or has irregularly shaped pieces of sod and torn or uneven ends shall be rejected. Sod shall be machine cut to a uniform thickness of 1-1/4 inches within a tolerance of 1/4-inch. Measurement for thickness shall exclude top growth and thatch. Refer to specifications for sod anchoring.

3-10.5 Mulches

3-10.5.1 Mulches shall be certified weed free and devoid of mold, and other deleterious materials. Mulch shall be disk anchored after application. A 9.5mm (3/8-inch) thick commercial grade black steel edger strip shall be installed to contain all foundation planting beds, at the entrance signs, and other ground cover / flower beds. Use commercial grade weed barrier fabric under woody shrubs and around non-spreading perennials. Install mulch to a uniform depth and remove mulch from the branches of newly planted materials. A mulch minimum depth of 76mm (3 inches) shall be maintained.

3-10.5.1.1 Straw. Straw shall be stalks from oats, wheat, rye, barley, or rice and shall be furnished in air-dry condition in a consistency for placing with commercial mulch blowing equipment.

3-10.5.1.2 Not used.

3-10.5.1.3 Wood Cellulose Fiber. Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate visual metering during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 3.5 to 5. Use with hydroseeding application of grass seed and fertilizer. When added to water, it forms a homogenous slurry.

3-10.5.1.4 Wood Chips. Wood chips shall be chips or shredded bark with maximum particle size of 3/16-inch.

3-10.6 Mowing. The seeded or sodded areas (as applicable) shall be mowed with approved mowing equipment to height of 2 inches whenever the height of vegetation becomes 4 inches, until the entire project is accepted by the Government.

3-10.7 Repairing Sod and Reseeding. The Contractor shall replace all damaged grassed areas. These areas shall be made to present a neat and finished appearance prior to final acceptance

3-11 Housing Area Signs. Each entrance to the housing area shall have a sign of permanent, low maintenance construction with the project name in relief lettering. Signs shall be constructed from durable, low maintenance materials such as stone, brick, or other masonry products. Wood signs and/or components are prohibited. Signs shall be located out of the sight-triangle of intersections for safety. Low, colorful plantings shall be placed around the sign base as well as an edger strip for the maintenance of turf grass. Signs shall be orientated to face travelers entering the development. The back of the sign shall be incorporated into a natural landform or screened with natural plant materials. No part of the sign may be neon, marquee or automated.

3-12 Retaining Walls. Any retaining walls proposed as part of the development shall be designed and certified by a professional registered engineer, who is to be hired by the Offeror. Walls composed of pre-cast concrete block, form-lined and stained cast-in place concrete, or natural stone are acceptable. Materials such as wood timbers, rubber tires, railroad ties, concrete cores or other hazardous/bio-degradable materials are prohibited.

3-13 Fencing. In addition to the fencing required in Paragraph 3-4.4.1, provide fencing at the top of slopes of 4:1 or greater, adjacent to housing areas. Fencing is not desired around individual house lots. Screen fencing at the garbage storage areas of homes is per Paragraph 5-22. Also, refer to Specification Section 02821A, Fencing.

4. SITE ENGINEERING.

4-1 Soils.

4-1.1 Soil and Foundation Report (Geotechnical Report). A preliminary Soil and Foundation Report is provided as part of this RFP. A drawing indicating Subsurface Explorations and Geologic Profiles for the proposed site is also provided. The report provides an overview of soils and geologic conditions, and is furnished for informational purposes only. The Offeror to whom this contract is awarded shall, with his or her consulting professional geotechnical engineer experienced in geotechnical engineering, be responsible for determining site specific geotechnical conditions.

4-1.1.1 The Contractor provided site specific geotechnical conditions report shall include, but not be limited to:

4-1.1.1.1 Classification of soil and rock.

4-1.1.1.2 Depth to bedrock.

4-1.1.1.3 Extent of boulders.

4-1.1.1.4 Bearing capacity of soil and rock.

4-1.1.1.5 Settlement potential.

4-1.1.1.6 Compaction requirements.

4-1.1.1.7 Groundwater characteristics.

4-1.1.1.8 Infiltration and permeability.

4-1.1.1.9 Erosion and siltation.

4-1.1.1.10 Surface and subsurface drainage.

4-1.1.1.11 Soil resistivity.

4-1.1.1.12 Sinkhole location, extent, condition, and recommendations for sinkhole repair for street or utility construction. See also SOW 3-3.4.2.

4-1.1.1.13 Recommendations for paving sections, with a minimum requirement of an 11cm (4-inch) base layer, an 11cm (4-inch) drainage layer, and an 11cm (4-inch) paving course.

4-1.1.2 The Offeror and his or her professional geotechnical engineer consultant shall certify in writing that the design of the project has been developed consistent with the site specific geotechnical conditions. The certification shall be stamped by the consulting professional geotechnical engineer and shall be submitted with the 50 percent design submission. If revisions are made to the 50 percent design submission, a new certification shall be provided with the final design submission.

4-1.2 Soil compaction.

4-1.2.1 Soil compaction shall be achieved by equipment approved by a professional geotechnical engineer. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the compaction specified with the equipment used. Compact each layer to not less than the percentage of maximum density specified in Table 4-1, determined in accordance with ASTM D 1557 Method D.

TABLE 4-1 – SOIL COMPACTION

Subgrade Preparation, Fills, Embankments, and Backfills	Cohesive Soils Compaction Requirements (Percentage of Maximum Density)	Cohesionless Soils Compaction Requirements (Percentage of Maximum Density)
Structures & Building Slabs	90	95
Streets, Paved Areas, Bike Paths	90	95
Sidewalks	85	90
Grassed Areas	85	90

4-1.2.2 The requirements shall be verified or modifications recommended by the consulting professional geotechnical engineer in the report wherever engineering, soils, or climatic factors indicate the necessity. Any modification to the stated compaction requirements shall require the approval of the Contracting Officer.

4-1.3 Capillary water barrier. A capillary water barrier is required for all interior slabs on grade, including garages, carports and storage rooms. As a minimum, the capillary water barrier shall consist of a capillary fill base course of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel, 15cm (6 inches) thick. The base course shall be overlaid with a 10-mil vapor barrier membrane. The membrane shall be overlaid by a minimum of 10mm (4 inches) of capillary fill. The maximum particle size shall be 1 1/2-inches and no more than 2 percent by weight shall pass the No. 4 size sieve.

4-1.4 Soil treatment. Soil treatment for termites shall be by the chemical method. Methods and extent of protection required shall follow State and Local codes. Prior to soil treatment, the Contractor shall submit a soil treatment plan to the Contracting Officer for approval.

4-1.5 Radon mitigation. The design and construction of foundation walls, slabs, and crawl spaces shall include provisions for the reduction of radon entry and facilitate its removal. Radon mitigation shall comply with the requirements of ASTM E1465. The Contractor shall provide a passive soil depressurization system (passive subslab suction system) for each unit. Such systems shall be based on criteria available at the EPA's radon website: http://www.epa.gov/iaq/radon/.

4-2 Water Distribution System. Connection to the existing water distribution system shall be made as required.

4-2.1 Water Mains and Building Service Connections. Mains shall be considered as that part of the distribution system supplying fire hydrants, or fire hydrant laterals. Service connections supply water from the main to the building. Mains shall be looped with no dead ends and be of adequate size to satisfy both domestic and fire flow requirements. Minimum main size is 0.15m (6 inches). Sufficient sectional control valves shall be provided so that no more than two fire hydrants will be out of service in the event of a single break in a water main. A copper tracer wire shall be placed directly above all non-metallic mains when plastic marking tape does not provide means of determining alignment of pipe by metal detecting equipment. The pipe, valves, and all other materials shall meet the American Water Works Association (AWWA) standards for a 1,034.2 kPa (150 psi) working pressure system. Provide sacrificial anodes for all valves and metal pipe. Building connections shall be designed and constructed in accordance with the International Plumbing Code.

4-2.2 Flow requirements. Water must be supplied by mains of appropriate capacity to provide 1125 gpm at all structures for a flow duration of 1-1/2 hours. This mandatory flow is over and above domestic requirements. Domestic

requirements shall be based on 1135.6 liters/day (300 gal/day) per housing unit for single family housing, and 946.3 liters/day (250 gal/day) per housing unit for multi-family housing. Mains shall be sized to carry this flow with a 2.5 peak hourly factor. Pressure shall be a minimum of 137.9 kPa (20 psi) at each fire hydrant, and a maximum of 1,034.2 kPa (150 psi) at each outlet after allowing for friction, elevation, and other pressure losses. Pressure at each housing unit shall not exceed 517.1 kPa (75 psi). No specific pressure test has been conducted on the area in question. DBOS staff state that the existing water pressure is between 45 and 55 psi. The DBOS point of contact for Site utilities is Warren Clifford (502-624-7917), Building 1110A – Third Floor.

4-2.3 Trenches. Water mains shall have a minimum of 0.9m (3 feet) of earth cover. Minimum cover above water lines shall be 0.75m (2 feet-6 inches) in grassed areas and 0.9m (3 feet) in paved areas. Adequate cover must be provided for freeze protection. Where frost penetrates to a depth greater than the minimum above, greater cover will be required. Sufficient cover must also be provided to protect the pipe against structural damage due to superimposed surface loads. Lines laid lower than the minimums stated shall be concrete encased with a minimum concrete thickness of 0.15m (6 inches).

4-2.4 Fire hydrants. Hydrants shall conform to AWWA C502, Dry-Barrel Fire Hydrants, or AWWA C503, Wet-Barrel Fire Hydrants, except as required by the local utility supplier. Valves shall conform to AWWA C500, Gate Valves for Water and Sewerage Systems. Fire hydrants shall be compatible with those presently in use at the installation or local Government Juridicant, with similar pump and hose connections. Fire hydrant spacing shall be no greater that 152m (500 feet) apart, by paved road. In addition, a hydrant shall be provided so that all parts of the housing units can be reached by hose lines not over 107m (350 feet) long. Hydrant laterals shall be 0.15m (6 inches) minimum size, shall not exceed 150 feet in length, and shall have an underground shutoff valve. Valve box, at each lateral, shall be located within 3m (10 feet) of the hydrant, and shall not be located where obstructed by parked vehicles, shrubbery.

4-2.5 Shutoff valve. Each unit shall be provided with a separate service and main shutoff valve, readily accessible to maintenance and emergency personnel. Shutoff valves in walks are prohibited.

4-2.6 Metering. Metering of utilties shall be provided as follows:

4-2.6.1 Master Meters. Master meters for water shall be provided for the project.

4-2.6.2 Individual Meter and Meter Drops. Individual water utility meters shall be provided for all housing units. Locate meter drops in an area readily accessible by service personnel. Meters and meter bases shall be sight screened, and located to provide convenient access while not distracting from building appearance.

4-2.6.3 Shutoff Valve

4-2.6.3.1 Each dwelling unit shall be provided with a separate service and main shutoff valve, readily accessible to maintenance, emergency personnel and the occupant. Shutoff valves shall not require special tools to operate. Shutoff valves in walks are prohibited.

4-2.6.4 Back Flow Prevention Device: All individual water meters shall be equipped with a backflow prevention device.

4-2.6.5 During demolition of the Binter Court facilities, sanitary, water, gas and electrical supply to the Wickam Guest House and pool shall not be interrupted without written permission by the Base Engineer. At the conclusion of the project, the connections to Wickam Guest House, Pool and Clubhouse facilities shall be made permanent and shall be equal in capacity to the existing connections.

4-3 Sanitary Sewerage System. Design of the sanitary sewerage system and its components shall comply with the requirements of “Recommended Standards for Sewage Works”, 1990, Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (known as the 10-State Standards). A Wastewater Facility Construction permit is required from the Kentucky Department of Environmental Protection (KYDEP), Division of Water, Facilities

Construction Branch, Design and Construction Section. The Contractor shall be responsible for the preparation, submittal and support of the permit application as well as for the associated review fee of $800. Connection to the existing sewage collection system shall be made at the appropriate location best serving the housing sites. Sewage collection systems shall be designed and constructed in accordance with the International Plumbing Code criteria in this Paragraph, and installation requirements. Pipe sizes and slopes shall be calculated using the Manning Formula. Manholes are required at all changes of direction and spaced not more than 400 feet apart. Curved sewers are prohibited. Pipes shall be designed to flow at one-half full and maintain a minimum velocity of 0.6m (2 feet) per second. If siphons are used, two lines of equivalent capacity shall be used with cleanouts. Where pumping is required, force mains shall be sized to minimize pumping head, with a 0.9m to 1.5m (3 feet to 5 feet) per second velocity. The DBOS point of contact for Site utilities is Warren Clifford (502-624-7917), Building 1110A – Third Floor.

4-3.1 Sewer mains. Design shall be based on an average daily per capita flow of sanitary sewage of 378.5 L (100 GAL) per day with a 4.0 peak hourly factor. Mains shall be a minimum of 0.2m (8 inches) in diameter.

4-3.2 Sewer Building Laterals. Each building lateral shall be connected directly to a sewer main. Combining multiple building laterals is prohibited. Multiple housing units within a building may not use a single building lateral. Cleanouts shall be provided to allow cleaning of all lines to grade. Cleanouts, in yard areas, shall be set in a box with a bolted cover. Laterals from one building shall not cross under another building. Lines shall be sized in accordance with the International Plumbing Code. Sewer laterals shall be a minimum of 0.15m (6 inches) in diameter. Laterals serving three or more housing units shall be a minimum of 0.2m (8 inches) in diameter.

4-3.3 Trenches. Sewer and water lines, mains or laterals, shall be placed in separate trenches. The separate trenches shall maintain a minimum lateral separation of 3.0m (10 feet).

4-3.4 Cover. Sewer lines shall be located at a depth greater than the frost penetration. Minimum cover above the top of pipes shall be 0.6m (2 feet) in areas not subject to vehicular loads and 0.9m (3 feet) in all other areas. If the minimum cover can not be met, the length of pipe shall be concrete encased with a minimum 0.07m (3-inch) thickness of concrete.

4-3.5 Pump Stations.

4-3.5.1 Design of the pump station and its components shall comply with the requirements of “Recommended Standards for Sewage Works”, 1990, Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (known as the 10-State Standards) and NFPA 820. Pump stations shall be designed to pump the peak flow for the entire pump station service area such that the minimum cycle time between two successive cycles in 15 minutes. Pump stations shall be of the duplex type either dry pit with wet well or submersible grinder. Pump stations shall have a pedestal mounted exterior control panel.

4.3.6 During demolition of the Binter Court facilities, sanitary, water, gas and electrical supply to the Wickam Guest House and pool shall not be interrupted without written permission by the Base Engineer. At the conclusion of the project, the connections to Wickam Guest House, Pool and Clubhouse facilities shall be made permanent and shall be equal in capacity to the existing connections.

4-4 Storm Drainage System.Contractor must apply for a Kentucky Stormwater Discharge Permit for Construction Activity. Compliance with that permit will require preparation of a Stormwater Best Management Practices Plan to be submitted to Ft. Knox DBOS. The storm drainage system shall be properly coordinated with surrounding properties to ensure that runoff does not cause damage to other properties. All drainage lines, if required, shall remain in conduit to stable grade. The minimum velocity of flow in conduits during a design storm shall be 0.07 m/s (2 ft 6 in/s). Storm water collection, disposal and retardation system shall be designed for a minimum of a 10-year return frequency. Rainfall intensities for project locations shall be in accordance with KYDOT design parameters. The DBOS point of contact for Site utilities is Warren Clifford (502-624-7917), Building 1110A – Third Floor.

4-4.1 Site specific storm drainage criteria. Maximum stormwater discharge rates shall be controlled through the use of “Best Management Practices” (BMPs) and shall conform to the requirements of TM 5-804-4. Temporary or

permanent stormwater storage will not be allowed in yards and recreation areas. Connections to the existing storm drainage system shall be verified for capacity and the existing lines increased to adequate capacity or rerouted as necessary. Sinkholes shall not be used to collect storm drainage, unless approved in writing by the Base Engineer. The maximum allowable grade for any open drainage swale or ditch is 2%.

4-4.2 Manholes. Manholes shall be located at intersections and changes in alignment or grade. Intermediate manhole maximum spacing shall be 76.2m (250 feet) for pipes 0.9m (3 feet) or less in diameter or box drains with the smallest dimension less than 0.9m (3 feet). Maximum spacing for intermediate manholes on larger pipes and drain boxes shall be 152m (500 feet). Manholes shall be 4-foot diameter precast concrete and shall conform to ASTM C 478 or AASHTO M 199. Rubberized or plastic rungs shall be installed where the depth of the manhole exceeds 0.9m (3 feet). The wall along the rungs shall be vertical. The manhole shall have a 0.6m (2-foot) minimum opening as measured from the face of the rungs.

4-4.3 Drainage of roads and pavements. Provide a positive crown or sheet drainage to all streets and roads. Pavement collectors for storm water shall be primarily by curb inlets and gutters. Open areas shall be drained by surface water collection systems or by field inlets and an underground collection system. No roadside ditches shall be permitted. Overland flow shall be held to a minimum and shall be confined to non-residential areas. Sheet flow is encouraged where practical in overland flow regimes. Vertical curbs may be replaced with flat or rolled curbs on collector streets to facilitate overland sheet flow as required for low-impact stormwater management.

4-4.4 Pipe for culverts and storm drains may be of concrete, clay, corrugated steel, corrugated aluminum alloy, PVC, or PE.

4-4.5 Grates and Covers

4-4.5.1 Inlets shall have openings sized to carry the inflow but shall not have openings large enough to catch a bicycle tire or child's foot. Grates and covers shall be secured or locked so as to be non-removable without a special tool.

4.5 Utility Easement:

4-5.1 Right-of-way for all utilities that connect to family housing shall be in a dedicated strip where no permanent construction will be permitted except for road crossings. A minimum of 15 feet in width shall be required for all incoming utilities and distribution systems.

4-6 Roadway Design:

4-6.1 All roadway designs, including both geometric and pavement designs, shall comply with the requirements of the Kentucky Transportation Cabinet (KYTC) Highway Design Manual (most current revision).

4.6.2 The DBOS point of contact for Site transportation coordination is Warren Clifford (502-624-7917), Building 1110A – Third Floor.

4-7 Tracer Wire and Plastic Marking Tape:

4-7.1 Plastic marking tape shall be acid and alkali-resistant polyethylene film, 150mm (6 inches) wide with minimum thickness of 0.004 inches. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be of a type specifically manufactured for marking underground utilities. A copper tracer wire shall be placed directly above all non-metallic conduits to provide a means of determining alignment of conduit by metal detecting equipment. The tracer wire shall be brought to the surface at all risers and connection shall be made by split-bolt connectors. Tape color shall be as specified in TABLE 4-2 and shall bear a continuous printed inscription describing the specific utility. Tape shall be located 12 inches above the pipe in the backfill.

TABLE 4-2 – TAPE COLOR

Tape Color	Utility
Red	Electric
Yellow	Gas Oil Dangerous Materials
Orange	Telephone Telegraph Television Police and Fire Communication
Blue	Water Systems
Green	Sewer Systems

4-8 Electrical distribution. The main electric power service will be provided by Nolin Rural Electric Cooperative Corporation (RECC). The contact person is Mr. Vince Heuser, Vice President System Operations, Nolin RECC, 411 Ring Road, Elizabethtown, KY 42701-8701. Phone: (270-765-6153). Fax (270-735-1068). E-mail: vheuser@nolinrecc.com. The cost of the Contractor's work required to coordinate and support Nolin's distribution system design and construction (as described below) shall be included in the Contractor's base bid. Nolin's work will be performed under their existing contract with the Government, and payment for Nolin's work will be made directly from the Government to Nolin under that contract.

4.8.1 System design. Nolin RECC will assign and identify a design project manager to design the electrical distribution and lighting systems and to assist the Contractor in coordinating utilities. Nolin RECC shall provide a new electrical distribution system as necessary to serve the new housing units and connect it to Nolin RECC's existing system. The electrical distribution system shall be comprised of a medium voltage, underground, looped distribution system fed from existing systems and with provisions for extension to serve future housing in the adjacent site. Nolin RECC will probably provide 4 feeds into the development. One from Dixie Street, one from Miami Street, and two from Wilson Road. Three switch cabinets will likely be installed at different street intersections to accommodate distribution. A switch cabinet will be placed at the dead end street for future development. This provision for future development shall provide capacity for additional load equal to twice the load anticipated for this project without substantial revisions to the systems installed in this project.

4-8.1.1 Coordination. Each Offeror selected to participate in Phase 2 of the selection process shall submit proposed site plans to Nolin, so that Nolin can develop a preliminary design for site electrical distribution and site lighting. The site plans submitted to Nolin shall show as a minimum: the street, sidewalk, and building layout as well as individual dwelling unit electrical load calculations. Load calculations for the dwelling units shall be in accordance with the NEC. The plans must be submitted to Nolin no later than three (3) weeks prior to the date the Contractor's Phase 2 proposal is due to the Government. The Contractor's submittal to Nolin shall include all Contractor requirements for temporary power and phasing.

4-8.1.1.1 After contract award, and during preparation of project design, the Contractor shall coordinate final site plans with Nolin RECC so that Nolin RECC can finalize their design for the site electrical distribution and site lighting. The final site plan design shall be closely coordinated with Nolin RECC to ensure a properly designed and efficient electrical system. The timing of the final site plan submittal to Nolin RECC shall be coordinated with Nolin RECC to allow them adequate time to finalize their design and coordinate with the local telephone and CATV service providers.

4-8.1.1.2 The Contractor shall coordinate among Nolin RECC, the local telephone service provider, Bell South (see Paragraph 4-10), and the local CATV service provider, Insight Communications (see Paragraph 4-11) to ensure the common trench system and service lateral trenches are adequate for all three service providers and

coordinated with all site utilities. The Contractor shall conduct a minimum of one face-to-face meeting of utility representatives before starting construction. Utility equipment installed below ground and above ground shall be coordinated with all trades. Equipment installed above ground shall be located so as to not detract from the residential aesthetics of the project.

4-8.1.2 Nolin RECC shall provide the Contractor with an electrical distribution design that complies with the NESC, applicable parts of 7 CFR as described in the USDA RUS Electric Program Regulations, and Nolin RECC's corporate rules and operating procedures.

4-8.1.3 Nolin RECC shall provide master metering of the new distribution system and individual metering of each dwelling unit.

4-8.1.4 Service laterals. Service laterals shall be underground in conduit. The length of secondary distribution service laterals from the transformer secondary to the building service entrances shall be minimized.

4-8.1.5 Service entrance. One service entrance per dwelling unit shall be provided. The service entrance conduit shall be buried 48 inches below finished grade with a minimum separation of 12 inches from telephone or TV cables. System shall be designed such that the fault current available at the service entrance equipment will not exceed 10,000 amps.

4-8.1.6 Transformers. Transformers shall be pad-mounted with secondary voltages of 120/240 volt, single-phase, three-wire, with a solid neutral.

4-8.1.6.1 Transformers shall be Energy Star compliant.

4-8.1.6.2 Transformers shall be located on the street side of the dwelling units in the side yard. Rear lot placement shall not be used.

4-8.2 Nolin RECC shall provide all conduit, wire, transformers, vaults, switch cabinets and metering equipment necessary for electric service to each dwelling unit. This includes primary distribution through secondary service to each dwelling unit meter. Both primary and secondary feeders will be in conduit Nolin RECC will assign and identify a construction project manager to install the electrical distribution and lighting systems and to assist the Contractor in field coordinating utilities.

4-8.2.1 The Contractor shall provide trenches and excavation necessary for conduit and transformer placement. Trenching shall be on one side of the street. The trenches shall be 48 inches deep (measured from final grade) and a minimum of 24 inches wide at the bottom. In addition, the trench must provide a minimum of 12 inches of separation from the electrical conduits and telephone and CATV conduits/cables. Trenches shall be inspected and approved by Nolin RECC before they will begin installation work. The Contractor shall provide proper backfill and compaction of trenches.

4-8.2.2 The Contractor shall provide trenches for secondary service from transformers to each housing unit. Trench depth shall be 48 inches. Trenches shall be inspected and approved by Nolin RECC before they will begin installation work. The Contractor shall provide proper backfill and compaction of trenches.

4-8.2.3 The Contractor shall provide a poured, 4-inch thick concrete pad for each transformer and switch cabinet per Nolin RECC specifications.

4-8.2.4 The Contractor shall provide lever bypass type meter base for each dwelling unit per Nolin RECC specifications and connect to underground service conduit at grade level. The meter base shall be inspected and approved by Nolin RECC before Nolin RECC will install the meter.

4-8.2.5 Nolin RECC shall terminate all wire in the distribution system, up to and including the secondary attachment in meter base at each dwelling unit.

4-8.2.6 The Contractor shall provide a UL Listed, copper clad ground rod, minimum eight feet long and one-half inch diameter and grounding electrode conductor per NEC at each meter location.

4-8.2.7 The Contractor shall secure service lateral conduit to each dwelling unit.

4-8.2.8 The Contractor shall provide a minimum of four convenience GFCI receptacles on a minimum of two circuits in the picnic pavilion.

4-8.2.9 Nolin RECC shall provide power for picnic pavilion convenience receptacles and lighting derived from adjacent roadway lighting circuits. See Paragraph 4-8.4.5.

4-8.3 Demolition of Binter Court. The Contractor shall coordinate with Nolin RECC (see Paragraph 4-8), Bell South (see Paragraph 4-10), and Insight Communications (see Paragraph 4-11) for the disconnection and removal of services from the existing buildings on Binter Court and any service interruptions to the Wickam Guest House. In addition, the Contractor shall coordinate with the Housing Division for any service interruptions to the Wickam Guest House. Expect significant restrictions on allowable service interruptions to the Wickam Guest House. The point of contact for housing is Melinda Stickle (502) 943-1000

4-8.3.1 The Contractor shall disconnect and remove electrical equipment from the buildings except for the disconnection of services as noted below.

4-8.3.2 Nolin RECC shall remove the overhead electrical services from the buildings.

4-8.3.3 Nolin RECC shall remove poles, transformers, and site lighting equipment.

4-8.3.4 The existing overhead electric line shall remain as a temporary feed until new permanent underground feeds are installed.

4-8.3.5 Nolin RECC shall set a new switch cabinet to intercept the existing underground feed to the Wickam Guest House and provide new permanent, underground feed as required to serve the Wickam Guest House.

4-8.3.5.1 The Contractor shall provide a poured, 4-inch thick concrete pad for the switch cabinet.

4-8.3.6 Bell South shall remove the overhead telephone cables up to the demarcation point on the buildings. See Paragraph 4-10 for contact information.

4-8.3.6.1 Bell South shall provide new permanent underground service to the Wickam Guest House.

4-8.3.7 Insight Communication shall remove the overhead CATV cables up to the point of termination on the buildings.

4-8.3.7.1 Insight Communications shall provide new permanent underground service to the Wickam Guest House. See Paragraph 4-11 for contact information.

4-8.3.8 The Housing Division has installed a 12 strand, single mode, 8.3/125, fiber optic cable from Wilson Road to the Wickam Guest House routed through Binter Court. The Contractor shall provide a new 12 strand, single mode 8.3/125 fiber optic cable to match existing and in compliance with ANSI/TIA/EIA-568-B from the pole on Wilson Road to the Wickam Guest House. Provide conduit from the point of entry into the Wickam Guest House, in the utility trench and up the existing pole on Wilson Road. Provide a pole mounted, weatherproof splice box on the pole at the height of the existing cable. Install the new cable from the point of termination in the Wickam Guest House to the splice box, disconnect the existing cable and terminate the new one in its place in accordance with ANSI/TIA/EIA-568-B. Splice the new cable to the existing in the splice box on the pole (at Wilson Road) in accordance with ANSI/TIA/EIA-568-B. Visually inspect connectors for scratches, pits or chips and re-terminate if any adverse conditions exist. Test each circuit lag and complete circuit in accordance with

ANSI/TIA/EIA-568-B. Test at 1310 and 1550 mm using a light source similar to the existing communication equipment. Perform High Resolution Optical Time Domain Reflectometer (OTDR) tests from one end of each fiber. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80 percent of the ordinate axis. Verify proper operation of the existing communications equipment over the circuits and make corrections to the circuits as necessary to restore full operation.

4-8.4 Roadway and area lighting. Nolin RECC (see Paragraph 4.8) shall provide roadway and area lighting based on the Contractor's site design and submittal per Paragraph 4.8.1. Nolin RECC's lighting shall include luminaires, poles, lamps, conduit, wire, control devices, and accessories for a complete roadway and area lighting system as described below.

4-8.4.1 The roadway lighting design shall meet the IES recommended average maintained illuminance values and uniformity ratios for residential collector and local streets.

4-8.4.1.1 The poles shall be located primarily on one side of the street (the same side as the underground primary feeder) with a maximum spacing of 200 feet.

4-8.4.1.2 The baseline luminaire shall be a commercial, specification grade, high pressure sodium, decorative "Historic" lantern style fixture with cast iron or cast aluminum housing; segmented, cut-off type, optics; tempered glass lens; straight, round, fluted steel or aluminum pole; cast iron or cast aluminum decorative base; cast iron or cast aluminum decorative fitter and polyester powder-coat finish. The pole shall match the luminaire and the assembly shall have a residential scale and appearance. The fixture and pole shall match the existing assembly presently installed in the Historic District. The existing fixture is W.J. Whately Model 1010LS/33-100HPS-D-MT-TA-BK. The roadway lighting shall have simple photocell control.

4-8.4.2 Sidewalks along roadways shall be lit in accordance with IES recommended average maintained illuminance levels for pedestrian ways in residential areas adjacent to roadways.

4-8.4.3 Sidewalks that meander or diverge slightly from the roadway shall be considered adjacent to the roadway. Walkways that depart from the roadway routing for another destination such as the adjacent school or pool complex shall be lit in accordance with IES recommended average maintained illuminance levels for pedestrian ways (walkways) distant from roadways. The luminaires used for walkways distant from roadways shall be the same as those used for roadways but should have lower wattage lamps and shorter poles.

4-8.4.4 Basketball courts shall be lit in accordance with IES recommended average maintained illuminance values and uniformity ratios for class III or IV recreational facilities. The baseline luminaire shall be a commercial, specification grade, 250 watt metal halide rectangular floodlight fixture with die cast aluminum housing and front bezel; hydroformed, NEMA distribution rated optics, tempered glass lens; straight, square, steel pole; polyester powder-coat finish. The pole shall match the luminaire and the assembly shall have a residential scale and appearance. Lighting control for recreational areas shall be via a timer switch and photocell for each court. The photocell shall prevent the operation of the lights during daylight and allow the use of the lights (through the timer) after dark. The timer shall allow manual selection of time periods from 15 minutes to 2 hours and shall have an adjustable lock-out timer feature (in series) to prevent lights from being operated after 10 PM (nominal). Power for basketball court lighting shall be derived from adjacent roadway lighting circuits.

4-8.4.5 Picnic pavilions shall be lit in accordance with IES recommended illuminance levels for outdoor entertainment lighting. The fixtures provided for inside the pavilions shall be vandal resistant and wet location listed. The open area adjacent to the picnic pavilion shall be provided with general lighting using two (2) luminaires of the same type as used for roadway lighting. Power for picnic pavilion convenience receptacles and lighting shall be derived from adjacent roadway lighting circuits. Picnic area lighting controls shall be the same as described for basketball courts above.

4-8.4.6 Bus stop lighting shall be accommodated by strategic placement of streetlights so that there is a light next to each bus stop.

4-8.4.7 Not used.

4-8.4.7.1 Not used.

4-8.4.8 Soccer field will not be lit.

4-8.4.9 Jogging path will not be lit.

4-8.4.10Playgrounds will not be lit.

4-8.4.11The Contractor shall provide trenches for lighting conduits.

4-8.4.12The Contractor shall provide concrete pedestals for roadway and area lighting poles. The pedestals shall be flush with the final finished grade. The pedestals shall be designed to properly support the pole and light fixture in the wind and soil conditions for the location.

4-9 Not used.

4-10 Telephone. Telephone service to the dwelling units will be provided by Bell South. The contact person is Mr. Bob Kohler, Bell South Telecommunications, 3719 Bardstown Road, Louisville, KY, 40218. Phone: (502-452-8815).

4-10.1 Telephone service design, equipment and installation will be in accordance with the rules and operating procedures of Bell South and industry standards.

4-10.2 Telephone cable shall be placed in a common trench with the electrical distribution cable (see Paragraph 4-8.2.1). The Contractor shall closely coordinate exact routing, requirements, and installation.

4-10.2.1 Where telephone cables cross under roadways, the Contractor shall provide 4-inch conduit in the trench for the telephone cable.

4-10.2.2 Where the trench cannot be excavated to the required depth due to subsurface rock or other conditions, the Contractor shall provide 4-inch conduit to protect the telephone cable.

4-10.3 The Contractor shall provide payment to Bell South for the cost of the new cable to serve the Wickam Guest House.

4-11 Cable Access Television (CATV). Cable television service will be provided by the local CATV service provider, Insight Communications. The contact person is Mr. Danny Campbell, Insight Communications, 4701 Commerce Crossings Drive, Louisville, KY, 40229. Phone: (502-357-4387), Cell: (502-817-4928).

4-11.1 CATV service design, equipment and installation shall be in accordance with the rules and operating procedures of Insight Communications and industry standards.

4-11.2 CATV cable shall be placed in a common trench with the electrical distribution cable (see Paragraph 4-8.2.1). The Contractor shall closely coordinate exact routing, requirements, and installation.

4-11.2.1 Where CATV cables cross under roadways, the Contractor shall provide 4-inch conduit in the trench for the CATV cable.

4-11.2.2 Where the trench cannot be excavated to the required depth due to subsurface rock or other conditions, the Contractor shall provide 4-inch conduit to protect the CATV cable.

4-11.3 The Contractor shall provide payment to Insight Communications for the cost of the new cable to serve the Wickam Guest House.

5. UNIT DESIGN - ARCHITECTURE.

5-1 Unit Design. The dwelling unit design shall be one- and two-story detached single family units. A total of 178 new dwelling units shall be built consisting of 118 three-bedroom units and 60 4-bedroom units. Five percent of each bedroom type shall be handicapped adaptable. A minimum of 6 unit types and distinct designs are required. Variety in the exterior appearance is required to enhance the streetscape and provide individuality. No two identical units shall be sited adjacent to each other. All garage entrances shall be recessed from the front and side facades a minimum of 1.5m (5 feet). Design consideration should be given to and proposed by the Offeror for building systems that incorporate measures beyond the minimum requirements of this Statement of Work and RFP. Design consideration should also be given for providing an enhanced living environment, such as, bigger bedroom spaces, flexible open spaces and other unique design features (proposed at the Offeror's discretion) to enhance his/her proposal, providing best value to the Government within the Construction Cost Limit (CCL).

The minimum net and gross area for each unit type is listed in the table below.

TABLE 5-1- MINIMUM SIZE OF HOUSING UNITS BY GRADE

Pay Grade	Number of Bedrooms	Minimum Gross Floor Area		Minimum Net Floor Area	
		M^2	Ft^2	M^2	Ft^2
E-7 to E-9 SNCO	4	200	2,153	170	1,830
	3	173	1,862	147	1,582

Note[1]: Minimum Net Floor Area is 85% of Gross Floor Area.

5-1.1 Gross and Net Area Definitions. Gross building area is measured to the outside face of exterior enclosure walls. Do not include normal roof overhangs in gross building area. Exterior covered areas such as covered entries count as half area towards gross area, and are measured from the face of the enclosure wall to the edge of the covered area. Net floor area is defined as the space inside the exterior walls. Net area excludes:

(a) Exterior and party walls.

(b) Half thickness of interior walls adjacent to excluded areas.

(c) Utility and laundry rooms.

(d) Interior and exterior bulk storage.

(e) Washer and dryer room (not to exceed 2.8 square meters (30 square feet)).

(f) Furnace, domestic water heater, and solar equipment spaces.

(g) Stairwells

(h) Landings

(i) Walls and interior spaces specifically designed for passive solar systems (other than required habitable areas).

(j) Weather vestibules (not to exceed 1.5 square meters (16 square feet) sheltering the main entry).

(k) Unfinished attic space.

(l) Patios (covered or uncovered), porches or balconies and terraces.

(m) Garages.

(n) Increases required to meet adaptability standards.

5-1.2 Allowable area increases.

5-1.2.1 Net floor area may be increased to meet ADAAG requirements.

5-1.3 Handicapped adaptability is required. Five percent (5%) of each dwelling unit type shall be handicapped adaptable. The facility shall be designed and constructed to meet the requirements of UFAS and ADA-AG. These units shall be one-story dwelling units. The adaptable units shall be evenly distributed throughout the neighborhood.

5-1.3.1 Handicapped adaptable dwelling units shall be provided with the same spaces and finish requirements specified in this Statement of Work. Interior and exterior unit circulation shall be a minimum of 1219mm (48 inches) wide. Entry doors shall be 914mm (36 inches) wide and provided with a second viewer located 1067mm (42 inches) above finished floor. Extra blocking shall be provided in the bathroom walls and other areas for future installation of grab bars, lower light switches and modifications to bathroom fixture height. Faucet handles and door hardware shall be lever type. Provisions shall be taken to adjust height of cabinets. Van accessible garages shall be provided in 30% of the handicapped adaptable units. A ramp shall be provided to the garage as well as access to the patio. Additional egress shall be provided from the unit such as the patio and kitchen.

5-2 Functionality. Rooms shall be sized and arranged for efficient use, good circulation, and furniture placement. Room spaces shall be arranged according to good spatial relationships and functions. The distribution of space for food preparation, living and dining, sleeping, bathing, halls, closets, and utility/laundry and garage areas shall be balanced and shall enhance the intended functions. Wasted spaces shall be avoided and minimized as much as possible. Bathrooms shall be designed to avoid direct sight lines into common areas, such as living/dining rooms, family rooms, and kitchens.

5-2.1 Habitable rooms shall not be used as halls for entry into a housing unit or for primary circulation within a housing unit.

5-2.2 Provide convenient access between garage and laundry areas, garage and kitchen areas and between kitchen and laundry areas.

5-2.3 Sliding glass door shall not be used as a primary housing unit access.

5-3 Indoor and Outdoor Integration. Emphasize factors that enhance indoor and outdoor living and features that encourage family use of outdoor areas, such as patios, porches and yards. Design considerations should be given to larger sized patios, patios with stamped colored concrete finish, and front porches.

5-4 Fire Protection and Safety. Housing units shall comply with the applicable National Fire Codes, including NFPA 101, Life Safety Code. Contractor shall use the latest edition of the Fire Protection Life Safety Code review form, as provided as an attachment to this RFP. Construction features shall be provided in accordance with the International Building Code (IBC).

5-4.1 Fire resistance of roof material. Provide Class A (ASTM E108, Standard Methods of Fire Tests of Roof Coverings) roof covering material throughout.

5-4.1.1 Duplexes. Prohibited, therefore deleted.

5-4.1.2 Townhouses. Prohibited, therefore deleted.

5-4.1.3 Apartments. Prohibited, therefore deleted.

5-4.2 Party Floors. Prohibited, therefore deleted.

5-4.3 Utility Rooms and Chases. Provide full clearance from within the utility room around mechanical equipment with access in accordance to manufacturer's requirements. Provide one-hour fire rated walls and ceilings.

All horizontal runs for mechanical, electrical and/or plumbing shall be contained within an interstitial space between the first floor ceiling and the second floor structure of the two-story units. A chase shall be provided in non-livable spaces (i.e. storage, closet, bathrooms) for vertical runs of mechanical, electrical and/or plumbing. HVAC distribution in the attic is prohibited in two-story construction. HVAC distribution is allowed in the attic for one-story construction. For additional information regarding chases refer to Chapter 10 Unit Design – Heating, Ventilating, and Air Conditioning. HVAC supply and return air ductwork in the attic is prohibited in two-story housing units but permitted in single-story housing units.

5-4.4 Alarm Systems. Not required, therefore deleted.

5-4.5 Sprinkler Systems. Single family detached dwelling units do not require sprinklers.

5-5 Sound Attenuation:

5-5.1 Testing. Certified proof-of-performance field tests shall be conducted to demonstrate that the floor and wall systems as constructed provide the required sound isolation. Tests for air-borne sound shall be made in compliance with ASTM E336. Tests for impact sound shall be made in compliance with ASTM E1007. Testing of 10 percent (minimum) of each type of floor and wall system is required. Location of test sites will be chosen at random by the Contracting Officer.

5-5.1.1 Primary habitable areas (living, dining, family room, bedrooms, and hallways) shall provide a minimum of FSTC 52 and 52 Field Impact Isolation Class (FIIC). Wet areas (kitchen, baths, laundry, and utility room) shall provide a minimum of FSTC 52 and 52 FIIC. Habitable areas over garages shall provide a minimum of FSTC 52.

5-5.1.2 Any wall or floor system found to be inadequate shall have the deficiencies corrected and the additional qualifying tests conducted at the Contractor's expense. Testing at the Contractor's expense of greater than 10 percent of each system may be required if the Contracting Officer determines that the quality of construction requires this additional testing.

5-5.1.3 Wall, floor, and ceiling systems shall be designed to meet or exceed the requirements stated above. In cases where the field tested performance of the systems does not meet the designed performance, the maximum acceptable difference between field tests and sound transmission ratings shall be 2 decibels (dB) for airborne sound ratings and 5 dB for impact sound ratings.

5-5.2 Plumbing and HVAC equipment. Design of plumbing and Heating, Ventilating, Air-Conditioning (HVAC), and dehumidifying equipment shall include design provisions such as location, enclosure and acoustical treatment, to minimize transmission of noise generated by equipment within each housing unit. Provide a HVAC isolation pad to localize the vibration of equipment from the rest of the structure.

5-6 Dimensions and Areas. Minimum areas and dimensions for interior spaces are shown in Table 5-3. Minimum areas and dimensions for exterior spaces are shown in Table 5-4.

TABLE 5-3 - MINIMUM NET AREAS AND DIMENSIONS - INTERIOR SPACES

Space	Area		Length		Width/Depth		Height[1]	
	m^2	ft^2	mm	ft-in	mm	ft-in	mm	ft-in
Living[2,9]	14.0	150	3550	11-8	3910	12-10	2438	8-0
Dining (3 BR)[2]	8.4	90	2900	9-6	2900	9-6	2438	8-0
Dining (4 BR)[2]	10.2	110	3200	10-6	3200	10-6	2438	8-0
Family Room[2,9]	14.0	150	3550	11-8	3910	12-10	2438	8-0
Kitchen[3,4,6,9]	9.3	100	3050	10-0	3050	10-0	2438	8-0
Laundry Room[5]	1.7	18	1800	6-0	900	3-0	2438	8-0
Master Bedroom #1[8]	14.0	150	3658	12-0	3656	12-0	2438	8-0
BR #2[8]	11.2	121	3353	11-0	3353	11-0	2438	8-0
BR #3[8]	11.2	121	3353	11-0	3353	11-0	2438	8-0
BR #4[8]	11.2	121	3353	11-0	3353	11-0	2438	8-0
Half Bath[6]	-	-	-	-	900	3-0	2438	8-0
Full Bath[6]	-	-	-	-	1500	5-0	2438	8-0
Vestibule	1.2	13	1000	3-3	1200	4-0	2438	8-0
Hall[6]	-	-	-	-	1200	4-0	2438	8-0
Stairway Width[6,7] (interior)					965	3-2		

Note[1]: Ceiling heights in all rooms shall be a minimum of 2438mm (8 feet-0 inches). Ceiling heights shall not be reduced.
Note[2]: Room dimensions are exclusive of circulation. Circulation paths along one side of a room are permitted but add 1200mm (4 feet-0 inches) to the minimum dimension.
Note[3]: A minimum of 1200mm (4 feet-0 inches) must be maintained in front of and between cabinets.
Note[4]: Minimum area and dimensions are measured from face of cabinets to walls.
Note[5]: Dimensions indicated are for washer and dryer appliances and does not include circulation.
Note[6]: Accessible units must conform to UFAS and ADA-AG. UFAS and ADA-AG require greater minimum dimensions.
Note[7]: Clear width is measured between railings.
Note[8]: Design consideration should be given to larger bedrooms.
Note[9]. Preference for larger square footage in these areas.

TABLE 5-4 - MINIMUM NET AREAS AND DIMENSIONS - EXTERIOR SPACES

Spaces	Area		Length		Width/Depth		Height[1]	
	m^2	ft^2	mm	ft-in	mm	ft-in	mm	ft-in
Garage[2]	21.6	240	6100	20-0	3650	12-0	2300	7-6
Patio - 3 BR[1]	25.1	270	3048	10-0	8230	27-0	2400	7-10
Patio - 4 BR[1]	25.1	270	3048	10-0	8230	27-0	2400	7-10

Note[1]: Ceiling heights apply when patios, porches and balconies are covered.
Note[2]: Garages for handicap units shall comply with UFAS and ADA-AG.

5-6.1 Minimum area requirements for kitchen cabinets, counters, and pantries are shown in Table 5-5. Flat area is shown for countertops and drawers. Combined shelf area is shown for pantry and base, wall and wall cabinets.

TABLE 5-5 - KITCHEN CABINET, COUNTER, & PANTRY AREA

Type of Housing Unit	Wall		Base		Drawer		Counter		Pantry	
	m^2	ft_2	m^2	ft^2	m^2	ft^2	m^2	ft^2	m^2	ft^2
4 BR	2.8	30	3.8	40	1.7	18	1.5	16	1.5	16
3 BR	2.3	24	3.0	32	1.3	14	1.1	12	1.5	16

5-6.2 Minimum closet width requirements are stated in Table 5-6. Closets requirements are the same for three- and four-bedroom units.

TABLE 5-6 - MINIMUM CLOSET WIDTHS[1]

Type of Closet	SNCO	
	mm	ft
Coat/ Entry Hall	900	3
Master BR #1	1800	6
BR #2	1200	4
BR #3	1200	4
BR #4	1200	4
Broom	1200	4
Linen[2]	900	3

Note[1]: Minimum inside clear depth for standard/broom closets shall be 600mm (2 feet).
Note[2]: Minimum clear inside depth for linen closets shall be 430mm (1 foot-6 inches).

5-6.3 Minimum requirements for interior, exterior, and combined bulk storage are shown in Table 5-7.

TABLE 5-7 - MINIMUM INTERIOR, EXTERIOR, & COMBINED BULK STORAGE[1]

Unit Type	Storage Type	SNCO	
		m^2	ft^2
3 BR	Int.	3.0	32
	Ext.	3.7	40
	Comb.	7.9	85
4 BR	Int.	3.7	40
	Ext.	4.5	48
	Comb.	9.3	100

Example[1]: If interior bulk storage is 2.3 m^2 (24.8 ft^2), then exterior bulk storage must be 4.2 m^2 (45.2 ft^2) to obtain the combined bulk storage requirement of 6.5 m^2.

5.7 Not used, therefore deleted.

5-8 Major Zones. Living and Dining, Kitchen, Family Room, and Bedrooms.

5-8.1 Living and dining. The living room shall have direct access to the front entrance foyer and to the dining area without passing through another room. When circulation is required along the perimeter of the space or between areas in open plans, minimum circulation space of 1219mm (4 feet) shall be added to the required minimum room dimension. Ceiling fans with lights shall be provided in the living room, family room, dining room, and all bedrooms. Fireplaces are not permitted.

5-8.1.1 The dining area may be an extension of, or an "L" off the living room.

5-8.1.2 The dining area shall be directly accessible from the kitchen without passing through another room.

5-8.1.3 Design consideration should be given to enhancing the living and dining areas by providing architectural features such as cathedral ceilings, crown moldings, columns, built-in book shelves, open floor plans and open stairs with wood banisters, etc.

5-8.2 Kitchen

5-8.2.1 Kitchen design shall provide an efficient work triangle. A base cabinet, minimum 460mm (18 inches) wide, shall be provided on the handle side of the refrigerator. The range shall not be located adjacent to the refrigerator or sink, in a corner, or adjacent to a passageway. The dishwasher shall be installed adjacent to the kitchen sink. Provide a backsplash behind the range, extending to the underside of the range hood, finished to match the range and the range hood. Kitchen sinks shall be commercial quality stainless steel 18 gauge, double bowl, having a

minimum depth of 178mm (7 inches). A cabinet opening for a tenant-owned microwave oven shall be provided in the kitchen. A breakfast bar shall be provided in the kitchen. The breakfast bar shall be part of one of the kitchen base cabinets. The breakfast bar shall not face or be part of the living and/or dining room spaces. In the kitchen, shoe molding (1/4 round) shall be required at all base cabinets where they meet the floor surface. Design consideration should be given to enhancing the kitchen area by amenities such as kitchen islands and greater counter, base, and wall cabinet space.

5-8.3 Family room. Provide a separate family room, adjacent to and contiguous with the kitchen. The family room is the primary family gathering place and shall be designed for use as casual dining, seating for TV watching, games, and for doing homework. Ceiling fans with lights shall be provided in the family room. Design consideration should be given to enhancing the family rooms by providing architectural features such as cathedral ceilings, crown moldings, columns, built-in book shelves, open railing, etc.

5-8.4 Bedrooms. Bedrooms shall be designed to accommodate king-size beds in master bedrooms and two twin beds in the other bedrooms. Window, door, and closet placement should enhance furnishability. Each bedroom shall be accessible without passing through another bedroom. Ceiling fans with lights shall be provided in all bedrooms. Design consideration should be given to enhancing all bedrooms by providing cathedral ceilings, crown moldings, etc., and by providing greater square footage.

5-9 Minor Zones. Bathrooms, Laundry, Closets, Utility Room, Garage, and Bulk Storage.

5-9.1 Bathrooms. Emphasis shall be placed on size, furnishings, layout, and privacy. The Master Baths shall have double sinks in the vanities. Design consideration should be given to separating the vanity space from the tub and toilet space in the Master Bathroom. Vanities that are a minimum of 1524mm (5 feet) long shall be provided for all double bowl sinks. Vanities that are a minimum of 914mm (3 feet) long shall be provided for all single bowl sinks. Determine the number of bathrooms based on Table 5-8.

TABLE 5-8 - BATHROOM REQUIREMENTS

Number of Bedrooms per Floor	Number of Bathrooms Per Floor
None	.5
1 - 2	1
3 - 4	2

5-9.1.1 The full bath shall contain a water closet, lavatory, and a tub with shower assembly. Full baths shall be directly accessible from the bedroom hall without passing through another room. Master Baths shall have a direct access to the Master Bedroom. All tubs shall have a solid surface full height surround. Tubs with shower assemblies shall include shower rods. Glass or plastic enclosures and doors are prohibited. Bathtubs shall be constructed of porcelain enameled formed steel. See Chapter 8, Unit Design Plumbing, Paragraph 8-4.4, “Bathtubs” for additional information on tub materials. A half bath shall contain a lavatory and a water closet. The half-bath shall be located on the first floor of all two-story units.

5-9.1.2 Provide solid surface integral lavatories mounted in 610mm (2-foot) deep (minimum) countertops, with vanity bases. Countertops shall be solid surface type material, with minimum 102mm (4-inch) high back splashes.

5-9.1.3 Bathroom accessories may be surface mounted or recessed, of non-corrodible metal or ceramic tile, and shall include a toilet paper holder, soap dish (at tub/shower), shower curtain rod, bathrobe hook, and towel bars totaling not less than 1067mm (42 inches) for a full bath and not less than 762mm (30 inches) for a half bath. Provide blocking for all accessories that are to be wall mounted.

5-9.1.4 A recessed medicine cabinet shall be provided in each bathroom. Cabinets shall be the corrosion-resistant, hinged door type.

5-9.1.5 A full width vanity mirror shall be provided in each bathroom. Vanity mirrors shall be mounted flush to the vanity backsplash. Provide blocking for the mounting of mirrors. Vanity mirrors shall have a minimum height of 914mm (3 feet) with the top of the mirror set 1 inch below the light fixtures.

5-9.1.6 Tubs and showers shall not be placed under windows.

5-9.1.7 Exhaust fans shall be provided in all baths. See Chapter 10 Unit Design – Heating, Ventilating, and Air-Conditioning, Paragraph 10-6 Exhaust Fans for additional information.

5-9.2 Laundry. Units shall have a separate laundry room equipped with a utility sink. Utility sinks shall be on four legged stands. The stands shall be securely fastened to the floor and wall using bolts and washers with an epoxy bonding agent in the floor slab. Self tapping screws or mechanically driven fasteners are prohibited. Plastic utility sinks are prohibited. Washer and dryer are tenant-provided. Design consideration should be given for laundry rooms to be sized to accommodate extra shelving and adequate space for a free-standing freezer measuring 610mm x 914mm x 1828mm (2 feet deep x 3 feet wide x 6 feet high).

5-9.2.1 Two full-length vinyl-coated wire shelves, 250mm (10-inch) minimum nominal depth, are required above the washer and dryer. One of the shelves shall be equipped with a hanging rod. Design consideration should be given to providing additional hanging and shelving space.

5-9.2.2 Minimum net clear door width to washer and dryer space when open is 864mm (2 feet-10 inches).

5-9.2.3 Utility Room. Units shall have one utility room to house all mechanical equipment. The utility room shall have exterior access; however, the exterior access shall be restricted from resident use. Interior access shall only be sufficient for residents to change equipment filters. Exterior access shall be limited to maintenance personnel and shall be keyed separately from housing unit. The mechanical equipment shall be arranged so that the filter can be changed by the occupant through an access wall panel without entering the utility room and maintenance personnel can change the filter from within the utility room without disturbing the occupant. Full access from within the utility room to three sides of all the mechanical equipment without moving any equipment or fixtures shall be provided for maintenance purposes.

5-9.3 Closets. Closets shall provide the minimum widths indicated in Table 5-6. Broom and pantry closets shall be provided convenient to the kitchen, linen closets shall be provided convenient to bathrooms, and a coat closet shall be provided convenient to the housing unit entrance. A walk-in closet shall be provided in the Master Bedroom.

5-9.3.1 Closet shelving. Closets (except linen, broom, and pantry closets) shall be equipped with a 305mm (12-inch) deep shelf and a clothes hanger rod. Linen and pantry closets shall be provided with at least four full-depth shelves. Broom closets shall be provided with a 305mm (12-inch) deep shelf. Closet shelving and rods in excess of 1200mm (4 feet) shall have center supports. Supports must be anchored to studs or blocking. Shelves and supports shall be capable of carrying 52 kg/m (35 lbs/ft). Closet shelving shall be factory finished, vinyl-coated, welded wire shelving meeting the capacity requirements. Design consideration should be given to heavier gauge vinyl-coated wire shelving.

5-9.3.2 Closet doors. Closet doors should be located to permit placement of furniture in the corners of the rooms by providing a 460mm (18-inch) return adjacent to a furnishable wall. Closets 1800mm (6 feet) or more in width shall have hinged double doors, maximum 2000mm (6 feet-8 inches) high. Wall closet width shall not extend beyond either door jamb more than 510mm (20 inches). Sliding and bi-fold doors are prohibited.

5-9.4 Garage. Garages shall be fully finished, including base molding. The garage walls and ceiling shall be taped and finished smooth. For more information on garages, see Paragraph 5-11, Garages, in this Section.

5-9.5 Bulk storage. Provide each housing unit with interior and exterior bulk storage space meeting the minimum requirements of Table 5-7. Provide interior storage in a separate room. Provide exterior storage in the garage or a separate storage area with access from the rear yard, integrated into the building design. Interior bulk storage shall have vinyl composition tile with wood base. Exterior bulk storage flooring shall have sealed and broom finished concrete with no base. If the exterior storage is in the garage, then it, too, shall have base molding.

5-9.5.1 Not used, therefore deleted.

5-9.5.2 Bulk storage space should be at least 1200mm (4 feet) in depth and a minimum clear height of 2000mm (6 feet-6 inches). Space under stairs shall not be counted as bulk storage.

5-9.5.3 Provide a minimum of three nominally 305mm (12-inch) deep shelves with a combined length of 7300mm (24 feet) within each bulk storage room. Design consideration should be given to providing additional shelving/storage space above the minimum requirement.

5-9.5.4 Common walls and ceilings. Not used, therefore deleted.

5-9.5.5 Stairs. Interior stairs shall have oak treads and oak risers. Tread and riser dimensions shall conform to the International Building Code and to International Residential Code (IRC) One and Two Family Dwelling Units. Stairs shall provide sufficient space to allow for residents to easily move furniture from floor to floor. Design consideration shall be given to floor plan layouts that provide for the use of open wood staircase with open railing and banister.

5-10 Interior Finishes

5-10.1 Walls and ceilings. Provide 13mm (1/2-inch) gypsum wallboard, taped and smooth finished. Water-resistant wallboard shall be used in wet areas such as full and half baths, laundry rooms, and at wet areas of kitchen. Cementitious backer board shall be used for ceramic tile applications and solid polymer (solid surface) tub and shower surrounds. Water-resistant wallboard shall be used for painting purposes in all wet areas not receiving ceramic tile. Provide 16mm (5/8-inch) type 'x' gypsum wallboard in the garage for walls and ceilings. Interior wall and ceiling finishes shall have a flame-spread rating of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E84. Painted finishes shall be smooth and durable (scratch, chip mold and mildew resistant). A 1219mm (4-foot) high ceramic tile wainscot shall be provided in all full bathrooms. All finishes shall contain low VOC (Volatile Organic Compound) emitting products.

5-10.2 Flooring, stairs, and base. Living room, dining room, family room, bedrooms and hallways shall have hardwood floors with a clear finish, and a wood base with wood shoe molding (1/4 round). Interior stairs shall be hardwood (oak treads and oak riser) with clear finish. Veneer, parquet, and laminate flooring are prohibited. Kitchen and foyer shall have ceramic tile flooring with wood base. Bathroom flooring shall be non-skid (slip-resistant) ceramic tile with ceramic tile cove base. Laundry and interior storage flooring shall be vinyl composition tile with wood base. Sustainable design consideration shall be given to the use of ceramic tile flooring and VCT flooring with a high recycled material content. Utility rooms shall have broom finished, sealed concrete floors. Wood base in the utility room is not required.

5-10.2.1 Vinyl composition floor tile (VCT) shall conform to ASTM F1066, Standard Specification for Vinyl Composition Floor Tile, and have a minimum thickness of 2.381mm (3/32-inch). Design consideration should be given for use of recycled content material as well as locally available vinyl composition floor tile material. Glues used for vinyl composition tile shall be low VOC (Volatile Organic Compound) emitting glue.

5-10.2.2 Sheet vinyl. Prohibited, therefore deleted.

5-10.2.3 Ceramic tile shall conform to ANSI 137.1, moderate or heavy grade. Ceramic tile flooring shall be provided in the entry, kitchen, and bathrooms. Ceramic tile shall be non-skid/slip resistant. Larger sized ceramic tiles shall be provided in the kitchen and bathrooms, i.e., 355mm x 355mm (14 inch x 14 inch) or larger. Tile flooring

with thin joints. i.e., 6.35mm (1/4-inch) or less. Grout joints shall be colored (not white or cream) to complement the flooring. Ceramic tile with dimensions less than 152mm x 152mm (6 inches x 6 inches) is prohibited. Design consideration should be given for use of recycled content material as well as locally available ceramic tile flooring material.

5-10.2.4 Carpet. Prohibited, therefore deleted.

5-10.2.5 Hardwood flooring shall conform to NOFMA Grading Rules. Hardwood flooring shall be required in all living areas, except entries, storage areas, laundry rooms, utility rooms, kitchens, and bathrooms. Flooring shall be installed on 1x strip sleepers. Hardwood flooring shall be 19mm (¾- inch) thick, 57mm (2¼-inch) wide, tongue and groove hardwood flooring. Design consideration should also be given to locally available hardwood flooring material.

5-10.3 Painting. Finishes shall be lead free. All interior surfaces, except factory pre-finished material, shall be painted a minimum of one prime coat and two finish coats. All interior trim shall have solid wood paint grade trim as a minimum. Caulking of trim and wall joints shall be provided. All walls shall have smooth finish and painted with satin or eggshell washable paint. All ceilings shall have a smooth finish using flat finish paint only. All painted trim shall be semi-gloss. All paints shall be specified as washable. Colors shall be submitted by the Contractor and approved by the Contracting Officer. Colors shall be white, off-white, or a neutral earth tone. Cold gray finishes are prohibited. Blown-on acoustical finish is prohibited. Design consideration shall be given to the use of low or no VOC (Volatile Organic Compound) emitting paints and stains such as water based products. Design consideration should be given for use of stain on trim and interior doors (using stain grade wood) in lieu of paint.

5-11 Garages. Provide a single-car garage for each housing unit. If trash or bulk storage areas are included in the garage, such areas are in addition to the required car storage area. Refer to Table 5-4 for minimum dimensions. Set the garage slab elevation a minimum of 100mm (4 inches) below the level of the housing unit floor and the floor of the adjoining exterior storage. Slope slabs to drain out the garage door. Provide movement joint between garage and driveway. Garages shall be designed to be recessed a minimum of 1524mm (5 feet) from the front facade. Garage doors shall have hardware that can be opened and locked from inside and outside of the garage. Garages shall be pre-wired to receive a resident-provided automatic garage door opener. Garages shall have insulated metal sectional overhead doors. Design consideration should be given to providing painted OSB over the gypsum board above 1067mm (3 feet-6 inches) around the garage interior and to providing a work bench with peg board on one interior wall.

5-12 Roofing and Drainage. Minimum slopes for roofs shall be as shown in Table 5-9.

TABLE 5-9 – ROOF SLOPES

Roof Types	Rise	Run
Shingle	1	4

5-12.1 Roof water. Gutters and downspouts shall be provided for all roof areas. Roof runoff shall be collected into the gutter system. Uncontrolled roof runoff shall not be allowed to flow onto lower roof surfaces or the ground without passing through a collection system. A one-piece integral cover and gutter "leaf guard type" shall be provided. Downspouts draining onto a lower roof shall have metal or plastic splash deflectors. Concrete splash blocks shall be provided under downspouts if not downspouts are not connected to the storm drainage system. Splash blocks shall extend a minimum 0.610mm (2 feet) beyond the exterior wall of the house. Proper backfilling, drainage away from the building, and soil compaction along the perimeter of the building and around downspout locations is required to minimize soil erosion.

5-12.1.1 Eaves and Valleys. Provide an ice and water barrier sheathing for all eaves and valleys.

5-12.2 Roof surface. Wood shake or shingle roofs. Prohibited, therefore deleted.

5-12.2.1 Roofing shall be limited to the following: Provide 113 kg (250 lb), Class A wind-resistant, anti-algae, anti-fungus fiberglass shingles with a 30-year warranty. The shingles provided shall conform to ASTM D3018, Specification for Class A Asphalt Shingles Surfaced with Mineral Granules. Shingles shall be hail resistant. Contractor shall provide a minimum of three (3) alternative color selections to the Contracting Officer. The Contracting Officer shall make the final color selection. Shingles shall have a uniform color on the surface and throughout the thickness of the shingle and shall come from the same color lot.

5-12.2.2 Standing or flat seam, metal roofing. Prohibited, therefore deleted.

5-12.2.3 Clay, concrete, metal, or fiberglass tile. Prohibited, therefore deleted.

5-12.2.4 Aluminum standing seam roofing. Prohibited, therefore deleted.

5-12.2.5 Copper. Prohibited, therefore deleted.

5-12.3 Common roofs. Parapet walls. Prohibited, therefore deleted.

5-12.4 Ridge vents. Ridge vents shall be provided at all roof ridges. Ridge vent installation shall comply with manufacturer's recommendations. Ridge colors shall match roofing material colors.

5-12.5 Roof overhangs. Roof overhangs shall be a minimum of 457mm (18 inches). Soffits of overhangs shall be perforated vinyl or aluminum.

5-12.6 Roof extensions. Not used, therefore deleted.

5-12.7 Roof penetration. All roof penetrations shall be provided at rear elevations of the units.

5-13 Exterior Finishes. Vinyl siding shall be provided on all sides of one-story units. A 1.2meter (4-foot) high wainscot of brick veneer shall be provided on all sides of one-story units. The entire first story of two-story units shall be fully bricked on all sides. The roof coverage shall be asphalt shingles. Emphasis shall be placed on low maintenance and durability for exterior finish materials. Materials shall be residential in size, scale, and texture. Flat front building facades are prohibited. Front facade elevations shall have relief and depth as can be achieved by using, for example, different masonry, building configurations, bump outs, porches, dormer windows, etc. Exterior finish materials for exterior bulk storage buildings and garages shall match the primary dwelling unit. The following siding materials shall be used:

5-13.1 Brick and Cultured Stone. Brick shall conform to ASTM C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale). Cultured stone shall conform to ASTM C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile. Brick and cultured stone shall have a uniform color on the surface and throughout the thickness of the brick and cultured stone and shall all come from the same lot. The Contractor shall provide the Contracting Officer alternative color schemes so that the CO may select a minimum of 3 alternative color schemes. Provide brick cap and flashing for all offset brick veneer. Provide concrete cap and flashing for all offset cultured stone veneer. For grade beam design, the brick shall run a minimum of one course below the finished floor and shall be flashed at that level.

5-13.2 Factory-prefinished siding.

5-13.2.1 Vinyl siding shall conform to the requirements of ASTM D3679, Rigid Poly (Vinyl Chloride) (PVC) Siding and shall be a minimum of 1.16mm (0.046-inch) thick, maximum 127mm (5-inch) exposure. Use either nails or staples for fastening methods, complying with the siding manufacturer's instructions. Vinyl siding shall have a wind load resistance of 90 mph. Earth tone and off-white colors shall be used for vinyl siding. Green colors are prohibited. The Contractor shall provide the Contracting Officer alternative color schemes so that the CO may select a minimum of 3 alternative color schemes. Color and style shall be as approved by the Contracting Officer. Provide vinyl mounting blocks for all exterior wall mounted items on vinyl siding surfaces. Horizontal siding panels shall have a

maximum length of 3.68 meters (12 feet–1 inch). Panels shall have a uniform color on the surface and throughout the thickness of the panel and of the same color/dye lot.

a) Manufacturer's Representative: A manufacturer's representative shall instruct the installer of the siding, appurtenances, and accessories as to the manufacturer's required installation procedures. The Army construction inspectors for this project shall be included in their instruction.

b) Minimum exterior wall construction for installation of vinyl siding: Wood framing shall be as a minimum 51mm x 10 mm (2-inch x 4-inch) studs at 406mm (16 inches) on center with manufactured wood sheathing (plywood, oriented strand board, etc.) and covered with building (air infiltration) wrap or building paper (roofing felt). Framing/sheathing system shall be in compliance with the siding manufacturer's recommendations.

5-13.2.2 Aluminum Siding. Prohibited, therefore deleted.

5-13.2.3 Steel Siding: Prohibited, therefore deleted.

5-13.2.4 Hardboard and cement asbestos shingle siding: Prohibited, therefore deleted.

5-13.3 Concrete masonry units. Prohibited, therefore deleted.

5-13.4 Stucco. Prohibited, therefore deleted.

5-13.5 Trim elements. Aluminum or vinyl clad wood trim is required.

5-13.5.1 Fascias and Rakes. Fascias and rakes are required and shall be vinyl or prefinished metal. Plywood, hardboard, or gypsum board are not permitted for fascias or rakes.

5-13.5.2 Exposed wood, such as window trim, door sills, window sills, railings and balusters, wood fencing, solar shading devices including louvers, arbors, and trellis shall not be permitted.

5-13.5.3 Exterior surfaces requiring painting shall be minimized. These surfaces shall be back primed and receive a minimum of one prime coat and two finish coats of paint.

5-13.6 Exterior ceilings and soffits. Ceilings and soffits shall be of vinyl or prefinished metal and all joints shall be trimmed or otherwise architecturally treated. Soffits shall be perforated. Cement asbestos shingle siding, ceiling or soffit shall not be permitted.

5-13.7 Patios, Porches, and Balconies. Patios and porches shall be sloped to drain away from the unit and have a broom-finished concrete floor surface. Plastic coating or films over concrete decks are not acceptable. Exposed wood decks, stained or painted, are prohibited. Exterior rails and trim shall be vinyl or aluminum. Exposed wood rails and trim are prohibited.

5-13.8 Balconies. Plastic coating or films over concrete decks are not acceptable. Exposed wood decks, stained or painted, are prohibited. Exterior rails and trim shall be vinyl or aluminum. Exposed wood rails and trim are prohibited. If balconies and porches are provided, then they shall be sloped to drain away from the unit and have a concrete floor surface that provides a waterproof and non-slip surface. Design consideration shall be given for using stamped colored concrete for patios.

5-13.9 Exterior Stairs. Exterior stair treads and landings shall be constructed of concrete and provided with non-slip finish.

5-14 Glazed Openings. Windows and glazed doors (50 percent or more glass, such as French patio doors) units shall meet the following standards and must be certified by an independent testing laboratory. Double-hung window units are required. Skylights are prohibited. All windows in habitable rooms shall be operable. All windows in

bedrooms shall comply with NFPA. Windows above the first floor shall have operable sections that tilt in or are removable for cleaning. Weather stripping shall be factory applied. Casement windows are prohibited. Window units shall be constructed of either aluminum clad wood or vinyl clad wood. All windows shall have solid-wood, paint-grade interior stools with a minimum thickness of 19mm (3/4-inch). Integral blinds are prohibited. As a minimum, windows shall be double-pane, low-E2 (insulated glazing). Design consideration should also be given to better sealing windows with higher insulated glazing as well as Energy Star qualified windows.

Windows and glass exterior doors shall meet or exceed the requirements of the following standards.

Vinyl Clad Wood Windows: NWWDA I.S. 2-87, Class B.

Aluminum Clad Wood Windows: NWWDA I.S. 2-87 Class B.

The Contractor shall provide the manufacturer's certification that the window provided meets or exceeds the following test requirements:

5-14.1 Required tests. Hung units shall meet a National Fenestration Rating Council (NFRC) design pressure rating of 25. Evidence of passing the following specific tests and minimum standards are required to achieve these design pressure standards.

5-14.1.1 Structural testing. Using ASTM E330 test results shall demonstrate no glass breakage, damage to hardware, or permanent deformation that would cause any malfunction or impair the operation of the unit. Residual deflection of any member shall not exceed 0.4 percent of its span. Hung windows shall be tested at pressures of 1796 Pa (37.5 lb/ft^2).

5-14.1.2 Operating force. The force necessary to unlatch and open units shall not exceed 13.6 kg (30 lb) for hung units.

5-14.1.3 Air infiltration. Using ASTM E283 leakage rate shall not exceed 0.65 l/min/m^2(0.25 ft^3/min/ft^2) for hung units, at a test pressure of 7.66 k/m^2 (1.57 lb/ft^2).

5-14.1.4 Water penetration. Using ASTM E547, no leakage shall be evident when tested in three, five-minute cycles with a one-minute rest period between cycles at 18.3 k/m^2(3.75 lb/ft^2) for hung units.

5-14.1.5 U-Value. Whole window U-values shall comply with Chapter 7 (Unit Design – Thermal Performance), Paragraph 7-1 Thermal Characteristics. U-values shall be calculated using ASHRAE calculations and standards.

5-14.2 Glazed doors. Glazed French doors to patio shall be provided to rear patio spaces. Glazed doors shall be insulated steel, vinyl clad wood, or thermally broken aluminum frames conforming to the above requirements. Finish shall be factory applied and conform to 44-C-22431 in accordance with the requirements of the National Association of Architectural Metal Manufacturers (NAAMM) Metal Finishes Manual. Doors shall have interior operated latch, and securing pin or throw-bolt in frame. Sliding glass doors are prohibited.

5-14.3 Glazing. Units shall be double glazed with low–E2 insulated glazing.

5-14.4 Interior window stools shall be solid-wood, paint-grade with a minimum thickness of 19mm (3/4-inch).

5-15 Screens. Screens shall be provided at all operable sashes. Screens shall be nonferrous, of window manufacturer's standard design, and conform to AAMA 1002.10, Voluntary Specification for Aluminum Insulating Storm Products for Windows and Sliding Doors. Screens shall be factory finished to match the window.

5-16 Window Treatments. Provide 25mm (1-inch) metal blinds at windows. Provide 76mm (3-inch) vertical metal blinds at glazed hung doors (French patio doors). All blinds shall be a minimum 8 gauge metal. Color shall be manufacturer's standard off white, and shall be coordinated with wall color. Design consideration should be given for

a higher gauge, commercial grade, mini-blind or 50mm (2-inch) wooden plantation style blind.

5-17 Doors. See Chapter 7 (Unit Design – Thermal Performance), Paragraph 7-3.2 Air Infiltration for thermal performance requirements for exterior doors.

5-17.1 Entrance doors (Front and Rear Entry and Garage Pedestrian). Raised panel, insulated, metal entry doors shall be provided. The housing unit primary entrance shall be a thermal insulated metal door measuring 914mm (3 feet) wide by 2050mm (6 feet-8 inches) in height by 45mm (1-3/4 inches) thick, with a 305mm (12-inch) wide sidelight. A door viewer shall be provided for the primary entrance door. Insulated glazing shall be provided for sidelight at entry door. Rear entry and garage pedestrian doors shall meet the above requirements, but shall be 914mm (3 feet) wide only and without a sidelight. Exterior doors and frames shall be galvanized. Doors shall have top edges, closed flush and sealed against water penetration. Doors and frames shall be prepared to receive hardware. Rubber silencers shall be installed into factory predrilled holes in door frames. Adhesive applied silencers are not acceptable. Design consideration should be given to providing a 914mm (3-foot) wide by 2050mm (6 feet-8 inches) in height by 45mm (1 3/4-inch) thick thermal insulated metal entry door, flanked by two sidelights (one on each side of the door), each measuring 457mm (18 inches) wide by 2050mm (6 feet-8 inches) in height by 45mm (1-3/4 inches) thick, and an oval shaped glass on the entry door. Sidelights and oval glass light on door shall have insulated glazing.

5-17.2 Overhead garage door. Provide insulated metal, sectional garage door. Garage door shall have hardware that can be opened and locked from the inside and outside of the garage.

5-17.3 Bulk storage and Utility room doors. Exterior bulk storage door shall be a minimum 35mm (1-3/8 inches) thick, exterior grade, thermal metal or hollow core metal. Doors may be omitted when storage areas are located in garages. Design consideration should be given to using raised panel metal doors for all exterior application. For utility room doors, door shall be accessible to exterior only. Utility room doors shall be keyed different from resident doors and accessible only to the Government.

5-17.4 Aluminum screen and storm doors. Screen and self-storing storm doors shall be provided for all housing unit exterior hinged doors except French patio doors, utility room, and garage doors. Frames shall be a minimum of 32mm (1-1/4 inches) thick and 51mm (2 inches) wide. Aluminum alloy materials shall be not less than 1.27mm (0.05-inch) thick and 51mm (2 inches) wide. Doors shall have solid bottom panels and midsection protective grills. Screening materials shall be nonferrous.

5-17.5 Interior doors. Interior doors shall be 2050mm (6 feet-8 inches) in height by 35mm (1-3/8 inches) thick by 914mm (3 feet) wide, solid core wood doors for the living room, dining room, family room, kitchen, and all bedrooms. Wood doors shall be primed and painted. Pocket doors and bi-fold doors are prohibited. A full height door shall be provided for the pantry. Design consideration should be given to the use of stain as the door finish (with stain grade wood) in lieu of providing a painted finish and for the use of Stewardship Council certified wood products for wood doors. Design consideration should be given for the use of raised panel solid wood doors.

5-18 Builders Hardware. Hinges, locks, and latches shall comply with the specifications indicated in Table 5-10, and the following subparagraphs:

TABLE 5-10 – HARDWARE SPECIFICATIONS

Hardware Type/ Specification	Specific Requirements
BHMA-01	Directory of Certified Locks & Latches.
BHMA-02	Directory of Certified Door Closers.

Hardware Type/ Specification	Specific Requirements
Butts and Hinges BHMA 156.1	Hinges shall be 102mm x 102mm (4 inches x 4 inches) at exterior doors, and 90mm x 90mm (3-1/2 inches x 3-1/2 inches) at interior doors.
Bored & Preassembled Locks & Latches BHMA 156.2	Series 4000, Residential grade, Bored Locks and Latches, with F75 or F76 operations, Grade 2.
Door Controls - Closers BHMA 156.4	Series CO2000, Grade 1, surface type, standard cover, with options PT-4H, PT-4F, and PT-4D with back check position valve.
Auxiliary Locks & Associated Products BHMA 156.5	Series 4000, Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel.
Template Hinge Dimensions BHMA 156.7	Template Hinge dimensions shall use the full mortise template hinges 63.5mm (2.5-inch) and 76.2mm (3-inch) sizes (A25M & A30M).
Cabinet Hardware BHMA 156.9	Back mounted knobs: Knobs shall be fastened from back. Series B02131. Frame Concealed Hinges or Frameless concealed hinges: These hinges shall be mounted to either framed or frameless type cabinets. Series B01602 or B01603 for frameless concealed hinges. Series B01612 or B01613 for frame concealed hinges. Side mounted Self Closing Drawer Slides: Slides shall be mounted on sides of drawer. Slides shall cause drawer to self close from open position. Series B05091 or B05092.
Mortise Locks and Latches BHMA 156.13	F13 operation: Comply with BHMA A156.13, (Mortise Locks and Latches), series 1000, Grade 1 Operational and Grade 1 Security. Locksets in fire rated doors shall also comply with NFPA 80. Inactive leaf on patio doors (French Doors) shall have one pair of flushbolts.

Hardware Type/ Specification	Specific Requirements
Auxiliary Hardware BHMA 156.16	Auxiliary hardware, consisting of Floor and Wall Bumpers, Combination Stop and Holders, Door Viewers, Garment Hooks, Garment Rods, Hand Rail Brackets, and Coat Hooks shall incorporated into each unit and shall comply with BHMA A156.16, Grade 1. Door Viewers shall be mounted at eye level on all exterior doors (except exterior storage units and utility room doors).
Materials and Finishes BHMA 156.18	Finishes shall be either 612 or 640.
Thresholds BHMA 156.21	Series J16190 or J36190. Bronze, latching/rabbeted with fluted surface and barrier free.

5-18.1 Locks and keys. Lock cylinders shall have six pin tumblers and interchangeable cores that are removable by a control key manufactured by Best or approved equal. Each unit shall have its own unique and matching locking system (keyed alike), including the garage, throughout the unit. A total of 178 different lock combinations, one for each unit shall be provided. Locks and keys shall conform to the standards and requirements of the Builders Hardware Manufacturers Association (BHMA) listed above. All utility rooms shall be keyed alike but shall be different from the units.

5-18.2 Weather stripping and Exterior Thresholds. Weatherstripping shall consist of extruded aluminum retainers not less than 1.8mm (0.07-inch) wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be bronze anodized. Weatherstripping material shall be of an industrial/commercial grade. Seals shall remain functional through all weather and temperature conditions. Exterior thresholds shall be bronze, latching/rabbeted with fluted surface and barrier free, conforming to BHMA A156.21 (Thresholds). Air leakage rate of weatherstripping shall not exceed 14.2 L (0.5 cubic feet) per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

5-18.3 Applications. Locks and hinges shall be applied as follows:

5-18.3.1 Exterior hinged doors shall have 1-1/2 pair (3 pair on French Doors) of full mortise hinges complying with BHMA A156.1 (Butts and Hinges). Hinges used on metal doors and frames shall also conform to BHMA A156.7 (Template Hinge Dimensions). Locksets (with minimum 1-inch deadbolt) shall comply with BHMA A156.13 (Mortise Locks and Latches) with F13 operation, Grade 1 Operational and Grade 1 Security. Inactive leaf on patio doors (French Doors) shall have one (1) pair of flushbolts.

5-18.3.2 All *front* entry doors that are windowless shall have a viewer mounted at eye level.

5-18.3.3 Exterior bulk storage doors shall have 1-1/2 pair of full mortise hinges complying with BHMA A156.1 (Butts and Hinges). Hinges used on metal doors and frames shall also conform to BHMA A156.7 (Template Hinge Dimensions). Locksets (with minimum 25.4mm (1-inch) deadbolt) shall comply with BHMA A156.13 (Mortise Locks and Latches) with F13 operation, Grade 1 Operational and Grade 1 Security.

5-18.3.4 Interior doors shall have 1-1/2 pair of full mortise hinges complying with BHMA A156.1 (Butts and

Hinges). Locks and Latches shall comply with BHMA A156.2 (Bored and Preassembled Locks and Latches).

5-18.3.5 Doors in fire-rated walls, housing unit to garage, shall have 1-1/2 pair of ball-bearing hinges, lockset, auxiliary lock or interconnected lock and latch and closer.

5-18.3.6 Not used therefore deleted.

5-19 Postal Service and Building Signage.

5-19.1 Postal Service. Mail boxes shall be provided in accordance with the local US Postal Service and shall be located at the curb in front of the units on one side of the street.

5-19.2 Building Signage. All new units shall be provided with building identification signage. Cast aluminum house numbers are required. Street names, neighborhood identification signs, and house numbers shall be coordinated with Bill Hickok, Directorate of Base Operations Support Group (DBOS). Mr. Hickok may be contacted at (502) 624-8515. House number signs shall conform to the following requirements:

Size. 229mm (9 inches) horizontal x 127mm (5 inches) vertical x 6.35mm (1/4-inch) thick.

Material/Finish. 6.35mm (1/4-inch) thick cast aluminum, plain border, black leatherette background.

Typestyle. Helvetica medium, with 76.2mm (3-inch) characters raised 6.35mm (1/4-inch) centered on plaque.

Placement. Place house number sign on front of each dwelling unit in location identified by DBOS representative.

5-19.3 Flag Bracket. A mounted flag bracket shall be provided for each unit.

5-20 Kitchen Cabinets. Cabinets shall be factory manufactured of solid oak with raised cathedral style panel doors. Wall cabinets shall be full height and extend to the ceiling. Bulkheads and furred-down soffits are prohibited. Wall cabinets shall have adjustable shelves. Cabinets shall have spring-loaded self-closing hinges. European style hinges are preferred. Cabinets shall include pulls and shall conform to ANSI A161.1, Recommended Performance and Construction Standards for Kitchen and Vanity Cabinets, except where modified below. Wall and base cabinets shall be essentially of the same construction and appearance. Refer to Table 5-5 for minimum kitchen cabinet area requirements. Design consideration should be given for additional cabinet and counterspace.

5-20.1 Cabinet Construction. Construct cabinets with frame fronts and solid ends, or of frame construction throughout. Frame members shall be mortised and tenoned, dove-tailed or doweled, and glued together. Brace the top and bottom corners with hardwood blocks that are glued with water-resistant glue and nailed in place. Wood blocking behind the wall shall be provided for upper cabinets. Materials and minimum dimensions and thicknesses for cabinet construction materials shall comply with Table 5-11.

TABLE 5-11 – KITCHEN CABINET SPECIFICATIONS

Element Description	Specific Requirements
Frame Members	19mm x 38mm (3/4-inch x 1-1/2 inch) kiln-dried solid oak.
Base Cabinet Toe Space	64mm deep x 102mm high (2-1/2 inches x 4 inches). Minimum (base cabinets).

Element Description	Specific Requirements
Cabinet Bottoms, Backs & Tops (Unexposed)	5mm (3/16-inch) hardwood plywood. Provide bottoms in kitchen sink cabinets. Brace bottoms with wood members glued in place.
Cabinet Ends & (Exposed Backs/Bottoms)	Hardwood plywood, 5 ply, good grade for natural finish to match door front finish. Base Cabinets: 13mm (1/2-inch). 5 ply material to match door front finish. Wall Cabinets: 10mm (3/8-inch) to match door front finish.
Doors	16mm (5/8-inch) solid oak, good grade for natural finish, with hardwood trim. Raised panel with rail and stile frame.
Drawer Slides/Glides	20 gauge metal.
Drawer Fronts	16mm (5/8-inch) solid hardwood, matching doors.
Drawer Bottoms	3mm (1/8-inch) softwood plywood, Grade A-A veneer or 3mm (1/8-inch) hardwood plywood. Bottoms 380mm (15 inches) wide shall be braced and glued in place.
Drawer Backs	12mm (1/2-in) hardwood.
Interior Partitions	13mm (1/2-inch) hardwood or softwood plywood, Grade A-A or 12mm (1/2-inch) hardwood of comparable grade.
Shelves	12mm (1/2-inch) softwood plywood, Grade A-B veneer; 12mm (1/2-inch) hardwood plywood, good grade veneer; or 12mm (1/2-inch) glued-up solid wood. Support shelves on ends and on 610mm (24-inch) centers. Plywood shelf edges that are exposed when cabinet doors are open shall have an hardwood edge rounded, filled, and sanded prior to finishing. Exposed plywood surfaces are unacceptable.

5-20.2 Countertops. Countertops shall be solid polymer (solid surface) fabrication with integral backsplash. Backsplashes and endsplashes shall be 12.7mm (1/2-inch) thick and 102mm (4 inches) high. See Chapter 8 Unit Design – Plumbing, for information on sinks.

5-21Appliances. Provide the following equipment in accordance with specifications listed, one each per housing unit. A listing of currently labeled Energy Star appliances is available through the internet at the EPA website:

http://www.energystar.gov/index.cfm?c=appliances.pr_appliances.

5-21.1 Refrigerators. Refrigerators are Government-furnished and Contractor-installed items. See Chapter 8 Unit Design – Plumbing, Paragraphs 8-6 Refrigerator Ice Maker Connection , and 8-7 Kitchen Appliances for additional for information.

5-21.2 Ranges and ovens. Ranges and ovens are Government-furnished and Contractor-installed items.

5-21.2.1 Not used, therefore deleted.

5-21.2.2 Not used, therefore deleted.

5-21.3 Microwave ovens. Provide a microwave cabinet opening at least 24 inches wide, 18 inches high and 18 inches deep with a dedicated receptacle located within the opening for a resident-provided microwave oven.

5-21.4 Range hoods. See Chapter 8 Unit Design – Plumbing for information on range hoods.

5-21.5 Dishwashers. See Chapter 8 Unit Design – Plumbing for information on dishwashers.

5-21.6 Water heater. See Chapter 8 Unit Design – Plumbing, Paragraph 8-11 Water Heater.

5-21.7 Ceiling Fans. See Chapter 10 Unit Design – Heating, Ventilating and Air Conditioning, Paragraph 10-9 Ceiling Fans.

5-21.8 Washers and Dryers. Washers and dryers are tenant-provided.

5-21.9 Freezers. Freezers are tenant-provided.

5-21.10 Color. Kitchen appliances, except disposals, shall be of matching finish, white in color.

5-22 Garbage Storage Area. The garbage storage area shall be screened and located near the kitchen or within the garage with direct access to the street. Design consideration should be given to providing a recycle bin area with the garbage area. Sustainable design consideration should be given to the use of reconstituted plastic screening.

5-23 Not used.

6. UNIT DESIGN- STRUCTURAL.

6-1 Structural design for residential housing (materials and construction) shall comply with the International Building Code (IBC) and with International Residential Code (IRC) One and Two Family Dwelling Units. Structures which qualify as "Manufactured Homes" shall comply with the Federal Manufactured Housing Construction and Safety Standards Act (FMHCSS) USC Title 42, except as modified herein, and with the regional model code (International Building Code). Structural calculations shall be provided by a Registered Engineer.

6-1.1 Structural System Requirement. The structure shall be economical, durable, and sustainable. All construction shall be designed and detailed to resist the lateral loads associated with the appropriate seismic and wind load criteria found in the current ASCE 7 - 2002. The construction of the building shall result in a system that provides a complete load path capable of transferring all loads from their point of origin through the load resisting element to the foundation. Design wind loads shall be for 144.8 kmh (90 mph) wind speeds.

6-1.2 Foundation. Slabs-on-grade, with thickened edge, or foundation walls and footings shall be provided. Floor slabs shall be designed in accordance with International Residential Code (IRC) One and Two Family Dwelling Unit and ACI-318. Underground utility pipes, except those associated with the unit, shall not be located under the slab. Place a 10 mil (0.01-inch) vapor barrier on top of the base course. A minimum of 10 cm (4 inches) of capillary fill shall be placed on top of the vapor barrier to separate the concrete slab from the base course. Ensure proper placement of slab-on-grade or foundation walls and footings is as recommended in the Contractor's Geotechnical Report. Provide control joints in slabs to prevent random cracking. Thickened edge of slab-on-grade or foundation walls and footings shall be designed per the Contractor's Geotechnical Report. A thermal break shall be maintained at the edge of the slab. Insulation shall extend downward from the top of the slab to the bottom of the thickened edge. Slabs shall not run continuous from heated to unheated areas. See conceptual wall section, which is Attachment 12 to this Statement of Work.

6-1.3 Design Load Criteria. Design load criteria for single family dwelling units. Design guidance for live load, dead load, roof live load, and wind and snow loads shall be taken from ASCE-7. Design wind load for the units shall be 144.8 kmh (90mph). Seismic load guidance shall be taken from FEMA 302 and ASCE-7. Necessary detailing shall be provided regardless of controlling load type.

6-1.4 Walls. All walls shall be anchored at their top and bottom to resist minimum lateral loads as specified in the criteria and codes listed. Design consideration shall be given to the use of steel studs instead of wood to enhance construction quality and provide greater sustainability. All welds of galvanized steel shall be touched up with either an alkyd-based or zinc-rich paint. All wood shall be of quality grade without checks, knots, warps, bows, cups, breaks, etc. Dimensional lumber shall be stamped Grade No. 2 or better. Stud spacing of 16 inches on center (o.c.) is required throughout the frame construction.

6-1.5 Load Bearing Walls and Shear Walls. Wood or steel stud construction shall be used for load bearing and shear walls. Shear wall wood sheathing shall be selected in accordance with the current IRC for One and Two Family Dwelling Units. Provide double 2 x top plates on all wood-stud walls. Provide 2 x pressure-treated sill typical. Dimensional lumber shall be stamped Grade No. 1 Dense or better. Plywood sheathing shall be Grade C-D or better. Lap all joint per IBC and structural engineer’s requirements. Size all beams and headers per structural engineer’s recommendations. Walls with structural cracks shall not be acceptable and must be removed and replaced at the Contractor’s expenses.

6-1.6 Exterior Walls. Exterior walls with brick veneer shall be sized for a maximum deflection of L/600, as per criteria provided by the Brick Institute of America, under maximum design lateral loads where specified. L is the distance between wall supports.

6-1.7 Interior Partition Walls. Partition walls shall be adequately braced for lateral loading. Provide 203 cm (8 inches) thickened slab under interior partition slab typical or as recommended by the Structural Engineer of Record. Stud spacing of 16 inches on center (o.c.) is required throughout the interior wood frame construction.

6-1.8 Prefabricated Wood Truss Roof. Prefabricated wood truss roofs shall be provided. Design consideration shall be given to the use of light gauge, cold formed trusses for metal construction. If used, metal truss welds shall be touched up with either an alkyd-based or zinc-rich paint. A licensed professional engineer experienced in structural design shall design open web wood trusses in accordance with the applicable codes. Trusses shall be designed to meet all span and load requirements. A complete design analysis that establishes conformance to applicable codes and the suitability of the trusses for the support of the building against snow, wind and earthquake loads, shall be submitted along with shop fabrication drawings. Design consideration should be given to the use of alternative roofing systems (i.e., TJI, parallel chord or solid web joists, etc.). Contractor shall not mix steel and wood framing systems.

6-1.9 Wood Roof Sheathings. Wood roof sheathing, minimum of 15.8mm 5/8-inch) thickness – CDX Exterior Grade, Structural I, shall be selected in accordance with the current IRC for One-and Two- Family Dwelling Units. Stagger all plywood joints typical.

6-1.10 Masonry Crack Movement Joints. Spacing and location of movement joints shall be determined by a registered structural engineer. Movement joints shall be placed and spaced to divide walls or wythes into a series of rectangular panels. Movement joints shall be placed in areas of high stress concentrations. Minimum spacing and minimum required locations are noted below:

6-1.10.1 Required Movement Joint Spacing:

a) When joint reinforcement is spaced at 40.6 cm (16 inches) on center: maximum ratio of panel length to wall height, (L/H) shall be three and spacing of joints shall not exceed 7.3 meters (24 feet).

b) When joint reinforcement is spaced at a minimum of 20.3 cm (8 inches) on center: maximum ratio of panel length to wall height (L/H) shall not exceed 4 and spacing of control joints shall not exceed 9.1 meters (30 feet).

The above spacing as defined in (a) and (b) shall be reduced by at least 50% near masonry bonded corner or other similar conditions where one end of masonry panel is restricted.

(L/H) is defined as follows: "L" is the horizontal distance between control joints and "H" is the vertical distance between control joints.

6-1.10.2 Required Control Joint Locations:

a) At regular intervals as noted above;

b) At changes in wall height or thickness (this does not include pilasters);

c) At other points of stress determined by the Structural Engineer of Record.

6-1.10.3 Locations and details of movement joints, bond beams, brick expansion joints and structural expansion joints shall be indicated on the contract construction drawings in both plan and elevation views.

6-2 Lateral Resistance. Walls used or required for lateral resistance to wind or earthquake, shall be considered bearing walls and shall have thickened footing under slab.

6-3 Embedded Steel. Nonstructural steel (handrails, etc.) embedded in concrete shall be galvanized or painted wrought iron. All damaged galvanized areas shall be repaired prior to embedment, e.g., galvanized fluid metal.

6-4 Wood Flooring Systems. Wood flooring systems shall be glued and screwed. Glue nails shall not be considered for stress transfer. Floor construction shall be recessed to accommodate the installation of 1x strip

sleepers. Hardwood flooring shall be 19 mm (¾-inch) thick, 57 mm (2-1/4 inch) wide tongue and groove hardwood flooring.

6-4.1 Subfloor. Plywood subfloor is required for all areas. Subfloor shall be rated for Exposure 1 or exterior use.

6-4.2 Underlayment: Cementitious backer board underlayment (cement board) is required for ceramic tile installed on the second floor of two-story units. Underlayment must be a minimum thickness of 8.7 mm (11/32-inch). Acceptable sanded face underlayment panels can be APA rated A-C, B-C, A-D, B-D, or C-C plugged. Underlayment shall be rated for Exposure 1 or exterior use. Underlayment shall be installed after interior finish work is complete to avoid damage to the underlayment.

6-5 Frost Penetration. Foundations and utilities shall be located below the depth of maximum frost penetration. Frost depth shall be verified by the Contractor's geotechnical report.

6-6 Concrete Construction Tolerances. Allowable variations from level, or specified slopes, shall be as follows:

6-6.1 For overall length, or surface of 3000mm (10 feet) or less: plus or minus 3mm (1/8-inch).

6-6.2 Up to 6100mm (20 feet): plus or minus 6mm (1/4-inch).

6-6.3 Up to 12 000mm (40 feet): plus or minus 9mm (3/8-inch).

6-6.4 No water shall be added to mix on site.

6-7 Concrete Reinforcement: Fiber reinforced concrete is prohibited. Provide reinforcing steelfor shrinkage/temperature/cracking control in all concrete.

6-8 Tornado Protection Shelters. Not used, therefore deleted.

7. UNIT DESIGN - THERMAL PERFORMANCE.

7-1 Thermal Characteristics. See Table 7-1 for identification of appropriate weatherregion. Housing unit construction shall provide at least the minimum R values/maximum U values for external insulation and at most the maximum whole window U values for the appropriate weather region. Contractor's designer shall determine the R and U values based on ASHRAE calculations and standards.

TABLE 7-1 - WEATHER REGION DEFINITIONS

Weather Region	Cooling Degree Days	Heating Degree Days	
7	<1,111 (2,000)	> 4,616 (8,302)	</= 3,056 (5,500)

NOTES:

1. Include in the solicitation the correct weather data for the project site, taken from TM 5-785, Engineering Weather Data, and indicate the appropriate weather region on this table.
2. Heating Degree Days are formulated on a Range Base of 18C (65F)
3. Cooling Degree Days are formulated on a Range Base of 18C (65F)
4. Weather Regions 4, 5, 6, 7, 8, and 9 are determined by the Cooling Degree Days being less than 1,111 (2000) and then by the appropriate range bracket for the Heating Degree Days.

7-2 Thermal Insulation.

7-2.1 Characteristics. Thermal insulation shall have a flame-spread rating of 25 or less and a smoke-development rating of 50 or less, exclusive of the vapor barrier, when tested in accordance with ASTM E84. A vapor barrier shall be provided on the warm-in-winter side of exterior wall and ceiling insulation. Polyurethane is allowed as an insulation material for slabs and outside concrete or unit masonry walls. Polyurethane is prohibited as an injected insulation material in walls or floor cavities or within the building envelope. See Chapter 6 Unit Design - Structural, Paragraph 6-1.2, regarding insulation for slab-on-grade foundations.

7-3 Air Infiltration.

7-3.1 To limit air infiltration, buildings shall be sealed with an air infiltration barrier, installed in accordance with the manufacturer's recommendations. The building envelope shall be caulked, gasketed, weatherstripped or otherwise sealed: around window and door frames, between wall cavities and frames, between walls and ceiling and roof, between walls and floors, at access doors and panels, at utility penetrations through walls, floors, and roofs, and at any other exterior envelope joint which may be a source of air leakage. These steps, in combination with provision of a continuous vapor barrier and sealed ductwork as specified in Paragraph 10 shall constitute tight building construction.

7-3.2 A blower door test, performed in accordance with ASTM E 779, Measuring Air Leakage by the Pressurization Method, shall be performed on 15% of the project buildings, which have been randomly selected by the Contracting Officer. If buildings are to be turned over in phases, the blower door test shall be performed on 15% of the buildings completed in each phase (not to exceed 10 buildings per phase). No additional testing shall be required if ALL of the tested buildings pass the test requirements. If less than 100% of the tested buildings pass the test, an additional 10% of the project buildings (not to exceed 10 buildings) shall be tested. This process shall continue until 100% of the total number of tested buildings pass the blower door test. All proto-type units shall be included in the required blower door testing procedures. All completed prototype housing units shall have blower door tests performed in

accordance with ASTM E 779. See Paragraph 1-10 for description of prototype housing units.

7-3.2.1 Before beginning the test, all combustion devices shall be turned off, and all intentional openings in the building envelope (dryer vent, bathroom and kitchen exhausts, etc.) shall be sealed. All doors and windows shall be closed and latched.

7-3.2.2 To pass the blower door test, the building shall have an air tightness rating within the range of 3 to 4 ACH at 50 Pa (0.2 inch of water). The Contractor shall correct all housing units not found in compliance, and shall be responsible for all labor and materials required to reduce air leakage to within acceptable parameters. All testing shall be performed by a firm certified by the Associated Air Balance Council, the National Environment Balancing Bureau, or State licensed to perform such tests within the state where the project is being constructed.

7-3.2.3 Any measures taken to reduce the air leakage to acceptable values shall be permanent, and shall be implemented on all similar housing units.

8. UNIT DESIGN - PLUMBING.

8-1 Plumbing system shall be designed and installed in accordance with the International Plumbing Code and any local regulations, codes or authorities. Inspection and testing of the plumbing system shall be performed as prescribed in the International Plumbing Code. Consideration should be given to systems which incorporate measures beyond the minimum requirements of this Statement of Work and RFP which are designed to increase energy conservation, ease of maintenance, or occupant comfort such as water filtration and purification, higher efficiency water heating systems, and higher grade plumbing fixture materials.

8-1.1 Seismic Protection. Seismic restraints shall be provided in accordance with ASHRAE and International Plumbing Code requirements.

8-2. Water Piping. Under slab supply piping shall be limited to housing unit service entrance only. Service line to each housing unit shall be no less than 25mm (1-inch) diameter. All water piping shall be sized in accordance with methods outlined in the International Plumbing Code, to limit water velocity in the pipe to 2440 mm/sec (8 ft/sec) unless a lower velocity is recommended by the plumbing fixture manufacturer(s). An isometric diagram of the water system shall be included in the design submittal. Allowable pipe materials are listed below:

8-2.1 Copper tubing. Water piping under concrete slabs shall be copper tubing, type K, annealed. Joints under the slabs are prohibited. Fittings for soft copper tubing shall conform to ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes, and for hard-drawn to ANSI B16.22, Wrought Copper and Copper alloy Solder Joint Pressure Fittings.

8-2.2 Not used.

8-2.3 All underground domestic water and soil piping outside the building perimeter shall be installed with the top of pipe a minimum of 915mm (36 inches) below grade.

8-3 Soil, Waste, Vent, and Drain Piping. Soil, waste, vent, and drain piping may be cast iron, copper, steel, or plastic suitable for installation in a residential waste, soil, vent, and drain system. Each fixture and piece of equipment, except water closets, requiring connection to the drainage system, shall be provided with a trap. Provide deep seal trapped floor drain in the utility room and the laundry room. Soil, waste, and drain piping installed below floor slabs shall be service weight hub and spigot cast iron or plastic pipe. Building waste main lines shall be no less than 102mm (4-inch) diameter. All soil, waste, and drain piping shall be sized in accordance with the methods outlined in the International Plumbing Code. An isometric diagram of the sanitary sewer system shall be included in the design submittal.

8-4 Plumbing Fixtures. Fixtures shall be manufacturer's designer line, model and color and shall be approved by Contracting Officer. Fixtures shall be provided complete with fittings, and chromium plated, nickel-plated or Gold tone finish brass (polished bright or satin surface) trim. All fixtures, fittings, and trim in a project shall be from the same manufacturer and shall have the same finish.

8-4.1 Plumbing shall meet the following criteria:

8-4.1.1 Exposed traps shall be chromium-plated, adjustable-bent tube, 20-gauge brass. Concealed traps may be plastic (ABS).

8-4.1.2 Faucets shall be single-control type, with seals and seats combined in one replaceable cartridge designed to be interchangeable among lavatories, bathtubs and kitchen sinks, or having replaceable seals and seats removable either as a seat insert or as a part of a replaceable valve unit. Water flow shall be no more than 0.158 L/s (2.5 gpm) from any faucet.

8-4.1.3 Shower and bath combination shall be controlled by a diverter valve. Baths and shower and bath combinations shall be provided with waste fitting pop-up, concealed with all parts removable and renewable through

the overflow and outlet openings in the tub. Showers and shower and bath combinations shall be equipped with a combination valve and flow control device to limit the flow to 0.158 L/s (2.5 gpm) at pressures between 137.9 to 413.7 kPa (20 and 60 psi).

8-4.1.4 Piping shall be concealed. Individual shutoff or stop valves shall be provided on water supply lines to all plumbing fixtures except bathtubs and showers. Shutoff valves shall be provided for each bathtub and shower combination.

8-4.1.5 Fixtures shall be water conservation type, in accordance with the International Plumbing Code.

8-4.1.6 Vitreous china plumbing fixtures shall conform to ANSI A112.19.2, Vitreous China Plumbing Fixtures. Stainless steel fixtures shall be in accordance with ANSI A112.19.3, Stainless Steel Plumbing Fixtures (residential design). Enameled steel fixtures shall comply with ANSI A112.19.4. Plastic fixtures are prohibited.

8-4.1.7 Where tubs are installed in an end-to-end configuration in adjacent bathrooms the shower valve faucet end of the tubs shall not be back to back, but shall be located at opposite ends of the tubs to allow for maintenance and repair.

8-4.1.8 Backflow preventers shall be provided in accordance with International Plumbing Code. Provide backflow preventers for all housing unit potable water service lines. Provide backflow preventers for all make up water connections.

8-4.2 Water Closets. Water closets shall be one piece, manufacturer's designer line as specified in specification section 15400. Water closets shall have siphon jet flush, floor outlet with wax gasket, closed-front seat and cover, and an anti-siphon float valve. Water consumption shall be no more than 6 L (1.6 gal) per complete flushing cycle. Water closets with 3 L (0.8 gal) per flush cycle are prohibited. Water closet trim shall conform to ANSI A112.19.5, Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards).

8-4.3 Lavatories. Lavatories shall be polymer solid surface counter top with integral bowl. Lavatories shall be manufacturer's designer line, model and color and shall be approved by the contracting officer. Lavatories shall be rectangular counter-top type, minimum 508 by 457mm (20 by 18 inches) in size or oval minimum 480 by 410mm (19 by 16 inches) in size. Lavatories shall have pop-up drains.

8-4.4 Bathtubs. Bathtubs shall be slip resistant and shall be constructed of porcelain enameled formed steel. Bathtubs shall have full height, polymer, solid surface tub surround. Premolded tubs and tub surrounds shall be prohibited.

8-4.5 Handicap Fixtures – All fixtures installed in handicap accessible housing units shall be in full compliance with the Americans with Disabilities Act and this RFP.

8-4.6 Kitchen Sinks. Kitchen sinks shall be Type 302 stainless steel, 18-gauge minimum, seamless drawn, and sound deadened. Sinks shall be double bowl, self-mounting without mounting rings. Sink shall have a single lever faucet with gooseneck spout and food spray down gun. Sinks shall be equipped with a garbage disposal.

8-4.7 Utility sink. Utility sinks shall be four-legged with integral backsplash guard. Utility sinks shall have minimum inside dimensions of 610 mm (24") width and 508 mm (20") depth. Plastic utility sinks are prohibited.

8-5 Clothes Washer Connections/Floor Drains. Drainage and hot and cold water supply shall be provided for automatic clothes washers. Washer connection, complete with 50mm (2-inch) drain, 20mm (3/4-inch) hose thread supplies shall be provided in standard manufactured recessed wall box with single-face plate. Boxes shall be constructed of plastic. Boxes shall be mounted a minimum of 865mm (2 feet-10 inches) above the finish floor. Electrical outlets for both washer and dryer shall also be provided. See Chapter 9 Unit Design – Electrical for additional information. Floor drains shall be provided in all laundry rooms.

8-6 Refrigerator Ice Maker Connection. Cold water supply shall be provided for GF refrigerator ice makers. Ice maker connection shall include an angle valve and a 1/4-inch hose thread supply, and shall be provided in standard manufactured recessed wall box with single-face plate (plastic or steel). Boxes shall be mounted a minimum 0.86m (2 feet-10 inches) above the finish floor.

8-7 Kitchen Appliances. Refrigerators and electric ranges shall be Government-furnished, Contractor-installed.

8.7.1 Dishwashers. Dishwashers shall conform to UL 749, Household Electric Dishwashers, and be UL listed, electric type, with air gap, racks, lift out utensil holder, spraying arms and detergent dispenser. Unit shall be listed as "Energy Star" compliant and shall bear the "Energy Star" label. The automatic controls shall cycle through the Wash, Rinse, Dry/Heat, and Stop phases, and shall be capable of rinse and hold cycle as well as a no heat drying feature. The unit shall contain instantaneous or in-line, water heater booster, with automatic thermostat set for 60 degrees C (140 degrees F). Rated energy use for standard capacity models shall not exceed 620 kWh/yr.

8-7.2 Range Hoods. Range hoods shall be stainless steel with length equal to range. The hood shall be equipped with NFPA approved wet chemical fire suppression system. The hood shall have separately switched light and exhaust fan and removable/washable filter. Kitchen range exhaust hoods shall be two-speed. Sound level shall not exceed 6 sones. Exhaust shall be ducted to the outside and shall have back draft protection and storm hood. The fan shall have a capacity of not less than 78.7L/s per linear meter of range hood (50 cubic feet per minute per linear foot of range hood).

8-7.3 Garbage Disposals. Garbage disposals shall conform to UL 430; Waste Disposers and ASSE 1008. Garbage disposals shall be continuous feed and shall have a minimum motor size of 370 watts (1/2 horsepower), stainless steel grinding elements, two 360-degree stainless steel swivel impellers, and manual motor reset. Sound level shall not exceed 10 sones. Strainer and plug shall be eliminated where garbage disposals are provided. Garbage disposal shall have switched receptacles. See Chapter 9 Unit Design – Electrical for additional information.

8-8 Hose Bibbs. Hose bibbs shall be provided at the front and rear of each unit, as a minimum requirement. Hose bibbs shall be frostproof, and shall be supplied with an integral vacuum breaker.

8-9 Piping Location. No water piping runs in exterior walls or the attic shall be allowed except for hose bibbs in exterior walls. All horizontal plumbing runs in two-story housing units shall be contained within an interstitial space between the first floor ceiling and the second floor structure of the units.

8-10 Cleanouts. Cleanouts shall be provided at each change in direction of sanitary sewer lines, at the intervals specified in the International Plumbing Code, and at the building service entrance. All cleanouts shall be permanently accessible. Ground cleanouts shall be installed in a 305mm by 305mm (12-inch by 12-inch) concrete pad, flush with grade.

8-11Water Heaters. Water heaters shall have round, glass-lined tanks, and shall be installed with an integral insulating wrap with a minimum R value of 5. Access shall be provided in the wrap for service and maintenance openings. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. Hot water piping for the first 3050 mm (10 ft) downstream of the water heater shall be insulated. The water heater relief drain shall be manufacturer approved, and shall be run to the outside and terminate so the discharge end is visible from the outside. Water heater shall be tied to heat pump de-superheater (refer to Chapter 10 of this STATEMENT OF WORK) for heat recovery during cooling season. Water heaters shall be sized in accordance with Table 8-1 for a 32 degrees C (90 degrees F) rise. Water heater energy factors shall meet or exceed the minimum requirements of 10 CFR 430. Additional consideration in the technical evaluation shall be given to designs that include water heaters that exceed the minimum energy efficiency requirements.

TABLE 8-1 - WATER HEATER SIZING

Requirements by Fuel Type	3 BR	4 BR	
	2 1/2 Bath	2 1/2 Bath	3 1/2 Bath
Electric:			
Storage (L (gal))	189(50)	189(50)	250 (66)
1 hour draw (L (gal))	273 (72)	273 (72)	333 (88)
Recovery (L/h (gph))	83 (22)	83 (22)	83 (22)

8-11.1 Electric water heaters shall comply with UL 174, Water Heaters, Household Electric Storage Tank Type, and shall have an Annual Energy Use (kWh) of 4,773 or less based on DOE test procedure 10 CFR430, Sub-Part B, Appendix E.

9. UNIT DESIGN - ELECTRICAL.

9-1 Conformance to Codes. The electrical system shall be designed in compliance with the rules and recommendations of the latest edition NFPA 70 (National Electrical Code (NEC) and applicable local codes, whichever is more stringent.

9-2 Service Entrances. Service entrances and exterior meters shall be enclosed or sight screened. Service feeders shall be underground with exterior meter bases. Load centers shall be painted galvanized steel and furnished with main breakers. Load center doors shall be flush one-piece fronts. Load centers may be surface or recessed mounted depending on their location. Offset back-to-back load centers a minimum of 400 mm (16 inches) horizontally. No recessed load centers are to be located in party walls and fire walls. Provide main circuit breaker in the load center for each housing unit, sized in accordance with the NEC. Minimum size of electrical service to the housing unit shall be 200 Amps at 240 Volts, 1 phase. Provide a separate electrical service and meter base for each housing unit. See Chapter 4 – Site Engineering for additional information. If portion of service conductors between meter base and load center, considered as “inside the building”, per NEC, is more than 1.83 m (6 feet) provide a separate exterior disconnect or a disconnect integral to the master base.

9-3 Load Center Locations. Housing unit load centers shall be located in the laundry room or attached garage.

9-4 Conductors. Conductors shall be copper. Minimum wire size shall be #12 AWG for all 20 amp branch circuits and #14 for all 15 amp branch circuits.

9-5 Outlet Circuits. Lighting and convenience outlets shall be on separate circuits. Convenience receptacle outlets and their circuits shall be 20 amps.

9-6 Exterior Lighting. The Contractor shall provide energy efficient high quality light fixtures that are aesthetically pleasing and durable for each housing unit. Light levels on the exterior of the housing units shall meet IESNA (Illuminating Engineering Society of North America) Handbook recommendations. The minimum efficiency standard for lighting is 50 lumens/watt. This efficiency can be achieved with fluorescent and compact fluorescent lighting. Lighting must also be color corrected with a Color Rendering Index (CRI) of 60 or better. Provide a minimum of one lighting fixture at each housing unit's entry, garage and patio area(s). Light fixtures at housing unit front entry and patio areas shall be provided with built-in photo cell and controlled by wall switch located inside the unit, adjacent to the nearest entry door. Lights at housing unit's entries and patio area shall be similar to WF Harris lighting #30-S-CP-BK-13PL-HPF-120-CW-WL-PC or approved equal. A security flood light with built-in motion sensor and photocell as specified in section 16510 2.5 shall be provided at the garage entry. Provide a security flood with built-in photocell only (similar in appearance to the one provided for garage entry) for the rear of the housing unit. This rear security flood light shall be controlled by a wall switch located inside the unit, adjacent to the nearest entry door. Exterior lights shall be mounted at no more than 3 meters (10 feet) above finished grade.

9-6.1 Design consideration should be given to providing all exterior light fixtures with the following qualities: enhanced aesthetics, increased durability, greater energy efficiency, longer warranty period, and better optical performance.

9-7 Interior Lighting and Switched Outlets.

9-7.1 Efficiency and Light Levels. Interior light levels shall meet IESNA Handbook recommendations. Interior lighting shall be both efficient and color corrected. Color Rendering Index (CRI) of 85 or better and a standard lighting color of 3500 K are required. Minimum efficiency standard for lighting are as follows:

9-7.1.1 Fluorescent tubes 1220mm (4 feet) and longer: 90 lumens/watt.

9-7.1.2 Compact fluorescent tubes less than 1220mm (4 feet): 80 lumens/watt.

9-7.1.3 Compact fluorescent and other lamps: 50 lumens/watt.

9-7.1.4 The Contractor shall provide energy efficient high quality light fixtures that are esthetically pleasing and durable for each housing unit.

9-7.1.4 Design consideration should be given to providing upgraded interior light fixtures with the following qualities: enhanced aesthetics, increased durability, greater energy efficiency, longer warranty period, and better optical performance.

9-7.2 Provide light fixtures operated by wall switches for all rooms. All light fixtures except for dining room fan/light combination shall be provided with compact fluorescent or linear fluorescent lamps. Provide one ceiling fan/light combination in living room, family room, all bedrooms and dining room. Ceiling fans shall be low profile 1050-1350mm (42-52 inch), four blade type. Motors shall be three speed reversible, with air volume range between 613 and 2832 LPs (1300 and 7000 CFM) and speeds between 75 and 225 rpm. Maximum power consumption shall be 80 watt. Fan and Lights shall be provided with separate wall mounted controls. The dining room lights shall be controlled via full-range, on-off type dimmer switch. Dining room fan/light combination shall be designed for incandescent use and do not have to meet the 50 lumens/watt requirement. The living and family rooms shall have a convenience outlet, half controlled by a wall switch, located at the room entrance. Wall-switch operated ceiling mounted lights shall be provided in walk-in closets, laundry room, interior storage room, mechanical room, exterior bulk storage room, halls, and kitchen. Additional light fixtures shall be provided in rooms as required for adequate lighting. Wall-switch operated light fixtures recessed in walls shall be provided for stair lighting. These lights shall be provided with impact resistant lens and shall be easy to re-lamp. Wall-switch operated wall-mounted lights shall be provided in bathrooms and half baths located above the mirror over the lavatory. Provide residential type fixtures above mirrors. Fixtures with acrylic lens shall not be provided. A minimum of one lighting fixture, ceiling or wall mounted, as appropriate, shall be provided in the garage. Where exterior bulk storage is located within the enclosed walls of a garage, each space shall be lighted separately. Garage lights shall be controlled by a switch (switches) located at each door opening into the garage.

9-7.2.1 The general lighting intensity in kitchens shall be 320 to 540 Lux (30 to 50 foot-candles). Supplementary lighting shall be provided at the sink and under one of the wall cabinets for a work center to produce a composite lighting level of 210 Lx (75 foot-candles) using either down-lights, surface fluorescent fixtures surface-mounted under wall cabinets, as appropriate. Kitchen range hood shall be provided with a light, fan, and switches.

9-7.2.2 The ceiling light fixtures boxes in living and family rooms, dining room, and all bedrooms shall be provided with a metallic fixture box suitably supported from the ceiling structure to support ceiling fan/light combination.

9-8 Outlets. Outlets shall be provided in all rooms in accordance with NEC. Provide outlets for washer, microwave, refrigerator and garage door opener. If space for resident-owned freezer is provided in the laundry room as a design consideration, provide an outlet behind the freezer. All outlets shall be specification grade and provided with metal face plates. In addition to the outlets required by NEC, provide at least one outlet in each of the following areas:

(a) Mechanical Room, Interior and Exterior Storage rooms.
(b) Hallways outside bedrooms.
(c) Garage, Patio and Housing unit entries: Outlets shall be weather proof and GFI type.
(d) Special Outlets. Provide 240 V electric outlets for electric dryer and electric range.

9-9 Air-vapor barrier boxes. Provide LESSCO or approved equal air–vapor barrier boxes for all electrical boxes installed on exterior walls. Air–vapor barrier boxes shall be installed per manufacturer's recommendations.

9-10 Wiring. Maximum use shall be made of non-metallic sheathed cable (NM cable) for 15 and 20 amp branch circuit wiring. Provide service entrance cable (SE cable) for circuits 30 amps or higher. Provide conductors installed in conduits for electrical service entrance and at locations required by NEC.Wires shall be run neatly and studs shall not be excessively drilled out for wiring. Contractor shall use nail plates wherever required

9-11 Branch Circuits and Conductors. Branch circuit conductors and over current devices shall be as rated by

NEC. Provide minimum of 25% spares in the load center for each housing unit. Individual circuits shall be provided for the washer, dryer (with outlets located behind the washer and dryer), dishwasher, garbage disposal, refrigerator, electric range, microwave oven, each heat pump, attic ventilation fan, and water heater. If space for occupant owned freezer is provided in the laundry room as a design consideration, provide an outlet located behind the freezer and a separate branch circuit. Provide an individual circuit and a receptacle in the garage ceiling for an occupant provided garage door opener. Provide an individual circuit and rough-in for a future radon ventilation fan in the attic. Location to be determined by the design team of the design/build contractor. Two utility circuits (20 amp) shall be provided in the kitchen area for the convenience outlets for small appliances serving the kitchen and dining area. Provide a separate 20 amp circuit for each bathroom outlet. Connect a maximum of 8 convenience receptacles on a single branch circuit. Provide Ground Fault Circuit Interrupter protection and Arc Fault Circuit Interrupter protection for all outlets/circuits as required by NEC.

9-12 Smoke Detectors. Provide hard-wired smoke detectors on a separate circuit in each housing unit in accordance with NFPA 72 and NFPA 101. Provide smoke detectors in each sleeping room, outside of each separate sleeping area in the immediate vicinity of the sleeping rooms and on each level of the housing unit. All smoke detectors within the housing unit shall be interconnected so that when any detector is activated, all alarm sounders shall operate. Provide smoke detectors as specified in Specification Section 16415A, Paragraph 2.17.

9-13 Audible/Visible Alarm. Provide audible/visible alarms in handicapped adaptable housing units, in accordance with Uniform Federal Accessibility Standards (UFAS) and the American Disabilities Act Accessibility Guidelines (ADA-AG).

9-14 Carbon Monoxide Alarms: CO alarms shall be provided as follows:

9-14.1 One CO alarm shall be located on each level of the housing unit. A required alarm shall be located in vicinity of the bedrooms, such as in the hall outside of the bedrooms. CO alarms are not required in garages.

9-14.2 Provide CO detector as specified in Specification Section 16415A, Paragraph 2.18. CO alarms shall be wall-mounted at the same height as the thermostat, approximately 52 inches off the floor. Mounting CO alarms in dead air spaces such as corners shall be avoided. Units may be powered from circuits powering smoke detectors. In all cases, manufacturer's guidelines and recommendations shall be followed.

9-14.3 CO alarms shall be equipped with an audible alarm, continuous digital display, peak level memory, test button, and test reset button and shall be UL listed by passing standard test UL 2034.

9-15 Telephone. Pre-wire housing units in accordance with Bell South's requirements. Point of contact at Bell South is Mr. Bob Kohler. See Chapter 4 Site Engineering, Paragraph 4-10 for full contact information. Provide minimum of one duplex jack outlet in dining room, family room, living room and all bedrooms of each housing unit. Provide single jack outlet in kitchen. Eight position modular jack connectors shall be provided at all outlets. The jacks provided in the kitchen, dining and family areas shall be for a wall-mounted phone. Wiring methods shall comply with EIA/TIA Standard 570, Residential and Light Commercial Telecommunications Wiring Standard. Cable and jacks shall be Category 5 per TIA/EIA 568A, Commercial Building Telecommunications Cabling Standard. All wiring shall terminate in a surface-mounted, weatherproof, protected telephone terminal located on an outside wall adjacent to the building meter equipment ("Demarcation Box"). The protected telephone terminal cover shall be provided with means for padlocking, shall be accessible from the outside, and shall be permanently labeled, "Telephone". Only one protected telephone terminal shall be required for each separate dwelling unit. A single #10, CU, green equipment grounding conductor shall be run in 1/2-inch non-metallic conduit from the building metering equipment to the protected telephone terminal box. Number of pairs and type of cable, type of modular jacks, and specification and size of protected telephone terminals and outlet boxes shall be meet the requirements of Bell South.

9-16 Television.

9-16.1 Commercial Cable Television. Cable Access Television (CATV) outlets shall be located in the living room,

family room, kitchen and bedrooms. Units shall be prewired in conformance with Insight Communication's requirements. Point of contact for Insight Communications is Mr. Danny Campbell. See Chapter 4 Site Engineering for full contact information. All wiring shall terminate in a surface-mounted, weatherproof, protected television terminal ("Demarcation Box") located on an outside wall adjacent to the protected telephone terminal. The protected television terminal cover shall be provided with means for padlocking, shall be accessible from outside and shall be permanently labeled "Television". Only one protected television terminal shall be required for each house. A single #10, CU, green equipment grounding conductor shall be run in 1/2-inch non-metallic conduit from the building metering equipment to the protected television terminal box. Type of cable, type of tapoffs, specifications, and sizes of protected television terminals and outlet boxes, shall meet the requirements of Insight Communications.

9-17 Door Bell. The front entrance to each housing unit shall be provided with a low voltage bell or buzzer.

10. UNIT DESIGN - HEATING, VENTILATING, AND AIR CONDITIONING.

10-1 Design. Heat gain and loss calculations shall be, as a minimum, in accordance with the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) and International Mechanical Code Residential Cooling Load Calculation methodology. Computer-generated load calculations shall be provided, and shall include complete input and output summaries. Design shall be based on the weather data shown in Table 10-1.

TABLE 10-1 – WEATHER DATA[1]

Type of Design / Design Information		
Weather Region: 7	Metric	Inch-pound
Heating		
Indoor Design Temperature	21 °C	70 °F
Outdoor Design Temperature	-14 °C	6 °F
Annual Heating Degree[2] Days	>4,616	>8,302
Largest Number of Monthly Heating Degree Days[2]	</=5,000	</=9,000
Cooling		
Indoor Design Temperature	24 °C	75 °F
Outdoor Design Dry Bulb Temperature	35 °C	95 °F
Outdoor Design Wet Bulb Temperature	26 °C	78 °F

Note[1]: Weather data from TM 5-785, Engineering Weather Data.

Note[2]: Metric data are based on Celsius degree days to a base of 18 degrees C. Inch-pound data are based on degree days Fahrenheit to a base of 65 degrees F.

10-1.1 Load calculations. Computer generated load calculations shall be performed for each possible orientation up to four representative orientations for each building type included in the project. Room air flow requirements shall be computed based on the individual room load. However, the minimum acceptable air flow shall be 2.5 $(L/s)/m^2$ (0.5 cfm/ft^2) for all spaces. The design for each individual housing unit shall be based on the heating and cooling loads as well as room airflow requirements computed for the building type and orientation that it most closely matches. Internal loads shall be included in the computerized load calculations in accordance with ASHRAE recommendations for residential analyses.

10-1.2 HVAC system sizes shall be calculated and based upon the 97.5% winter dry-bulb temperature, the 2.5% summer dry-bulb temperature and the 2.5% summer wet-bulb temperature for Fort Knox, Kentucky as given in the following criteria:

- ASHRAE Handbook, Fundamentals, 2001.
- The International Mechanical Code (2003 Edition).

10-1.3 Duct System Layout. For a given building type, a single duct layout may be used regardless of orientation,

provided that the system is sized to provide the required air flow for each room at its worst case orientation. Balancing dampers shall then be used to reduce air flow to the appropriate level as required. Permanent access to dampers shall be provided. Horizontal mechanical chases are prohibited. Horizontal mechanical duct work shall be contained within an interstitial space between the first floor ceiling and the second floor structure of the two-story housing units. HVAC supply and return air ductwork in the attic is prohibited in two-story housing units, but permitted in single story housing units.

10-1.4 Seismic Protection. Seismic restraints shall be provided in accordance with ASHRAE and International Mechanical Code requirements.

10-2 Equipment Safety and Efficiency. All materials and equipment shall be the standard cataloged product of manufacturer's regularly engaged in production of such materials and equipment, and shall be the manufacturer's latest standard design. Each major component of the heating and cooling systems shall have the manufacturer's information on a plate secured to the equipment.

10-2.1 All heating and cooling equipment proposed and installed in this contract shall bear the Energy Star Label.

10-2.2 Equipment shall comply with the requirements of American National Standards Institute (ANSI), Air Conditioning and Refrigeration Institute (ARI), American Society for Testing and Materials (ASTM), National Electric Manufacturers Association (NEMA), National Fire Protection Association (NFPA), Underwriters Laboratories, Inc. (UL) or other national trade associations, as applicable.

10-2.3 Equipment efficiencies as listed in Table 10-2 below are minimum acceptable levels. Energy conservation as it relates to equipment operating costs shall be considered in the evaluation process. Additional consideration in the technical evaluation shall be given to designs that include higher than minimum efficiency equipment.

TABLE 10-2 – Minimum Equipment Efficiency

	Electric heat pump (ground source)		Electric cooling equip (ground source)
	Size A[1]	Size B[1]	
HSPF	7.7	8.5	
SEER	17[2]	17[2]	17[2]

Note[1]: Size A heat pumps have a capacity of 5.9 kW (20,000 Btu/hr) or less. Size B heat pumps have a capacity of 5.9 to 13.5 kW (20,000 to 46,000 Btu/hr).

Note[2]: Efficiency is based on DOE test procedure 10CFR430, Sub-Part B, Appendix M.

10-3 Heating and Cooling Systems. Each housing unit shall be provided with central heating and air conditioning systems. Systems shall be designed, installed, balanced, and adjusted to distribute heat and cooling to all habitable rooms, as well as bathrooms, interior storage and laundry room in proportion to the calculated load requirements of these spaces. Fans in air handlers shall be multi-speed, direct drive type. System installation shall conform to SMACNA Installation Standards for Residential Heating and Air Conditioning Systems except as altered by this document. Design consideration should be given to systems utilizing modular components, plugged power, additional space in the utility room, and other features which contribute to ease of system maintenance.

Consideration should also be given to designs that provide measures beyond the minimum requirements of this STATEMENT OF WORK and RFP to increase energy conservation or occupant comfort.

10-3.1 Equipment sizes selected for installation shall not be oversized more than 115% of the calculated loads. Equipment shall be selected in accordance with ACCA Manual S HVAC equipment sizing guidelines, or EPA equipment sizing recommendations at http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/$file/RightSizedAC.pdf.

10-3.2 Utility Room. Utility room shall be provided to house all mechanical equipment and water heater. To avoid water leaks from second floor HVAC equipment, the utility space, water heater, and all HVAC equipment shall be located on ground level. All hydronic equipment shall have independent shut off valves. The utility room shall be separated from the house and garage and have restricted access. The utility room shall house the mechanical equipment and water heater. The mechanical equipment shall be arranged so that the filter can be changed by the occupant through an access wall panel without entering the utility room and so maintenance personnel can change the filter from within the utility room without disturbing the occupants. The arrangement of mechanical equipment shall allow access to three sides of all equipment and the manufacturer's recommended clearances for easy removal and replacement. Utility room shall not be accessible by the occupant(s) but configured so that the water shut-off is accessible to the occupants. Air conditioning/heating units shall be concrete pad-mounted. The utility room shall be provided with a light with wall switch, electrical receptacle, and floor drain.

10-3.3 Geothermal air conditioning/heat pump systems. All housing units at the Whole Neighborhood Renewal, Fort Knox, KY shall be served by geothermal air conditioning/heat pump systems. A separate heating and cooling unit shall be provided for each floor of two-story housing units; both heat pumps shall be located in the ground level utility room. Geothermal heat pump systems shall be provided in accordance with IGSHPA, (International Ground Source Heat Pump Association. Oklahoma State University, P.O. Box 1688, Stillwater, Oklahoma 74076-1688).

10-3.3.1 Geothermal air conditioning/heat pump system equipment shall consist of a water source air conditioning/heat pump unit with heat exchanger and evaporator/blower and ground source water loop. Refrigerants used shall have an Ozone Depletion Potential (ODP) of .05 or less. The water source air conditioning/heat pump unit shall contain, as a minimum, the features indicated in Table 10-3. Evaporator/blowers for water source air conditioner/heat pump units shall be provided complete with centrifugal fan, disposable filters, controls, and transformer. Fans shall be multi-speed, direct drive type. Each cooling/heating system shall provide conditioned outside air to the spaces served in accordance with ASHRAE 62.2P 2001. Outside air shall be ducted and connected to the return air duct upstream of the filter. Provisions shall be made to ensure no weather elements are drawn into the outside air intake. Equipment shall be sized to meet the total load determined by computer calculation. Equipment may be oversized to no more than 115% of the computer generated load

10.3.3.2 Ground Source Water Loop. The ground source water loop shall be provided complete with geothermal wells, redundant circulation pumps, reverse return under ground distribution piping, expansion tank, automatic air separator and automatic make-up water system. All underground ground source water loop piping outside the building perimeter shall be installed with the top of the pipe 1220mm (48 inches) below grade minimum. All underground distribution piping shall be traced with marker tape and tracer wire as specified in Paragraph 4-7. Provide heat trace for all piping subject to temperatures below 4.5 degrees C (40 degrees F). All geothermal well and ground source loop piping shall be hydrostatically tested in accordance with Specification Section 15741N. Contractor shall verify ground source water pumps operation and flow rates throughout the system. Contractor shall provide a logistics plan for the drilling of the geothermal walls.

10-3.3.3 The evaporator coil shall be provided with a liquid strainer, expansion device, pre-insulated housing, copper or aluminum coil, and insulated condensate drain pan. Coil face velocity shall be limited to 2.6 m/s (500 fpm).

10-3.3.4 Condensate drain piping from the evaporator coil shall be trapped in accordance with unit manufacturer's requirements and piped to the outside. Condensate drain pipe shall be 20mm (3/4-inch) type L copper tubing. Contractor shall provide insect screen at pipe discharge and make provisions to ensure that the condensate drains away from the housing unit and does not puddle.

10-3.3.5 The water source heat pump unit shall deliver a Seasonal Energy Efficiency Rating (SEER), consistent with the minimum requirements shown in Table 10-2.

10-3.3.6 Supplementary Electric Heat. Each water source air conditioning/heat pump unit shall be provided with supplementary electric resistance heat. Electric resistance heat shall be sized to provide 100% of the calculated heat loss of the particular housing unit. Electric resistance heaters in excess of 5 kw shall be staged by means of an indoor space thermostat. Indoor space thermostat shall be installed and operated in accordance with the water source air conditioning/heat pump unit manufacturer's instructions

10-3.3.7 Refrigerant Charge Verification. When water source air conditioning/heat pump systems are selected for installation, the Contractor shall check and calibrate refrigerant system following installation and start-up of the equipment. These tests shall be accomplished on the same 15% of the units that undergo blower door and duct tightness testing. If the tested units show a low or excessive refrigerant charge, all new systems shall be checked after start-up, but prior to acceptance by the Government.

TABLE 10-3 – GEOTHERMAL AIR CONDITIONING/HEAT PUMP FEATURES

High and low pressure compressor protection.
Filter-drier.
Hermetically sealed compressor with built-in overloads and locked rotor protection.
Electric crankcase heaters.
Start and run capacitors.
Anti-short-cycle timer. (factory installed)
Testing and charging refrigerant connections.
Compressor guaranteed for minimum service life of 5 years.
Accessory electric heat (as required).
Insulated casing.
Fan and coil guards.
Drain outlet.
Duct adapter as required for interface with supply and return ductwork.

10-3.4 Integrated Refrigerant De-Superheater and Hot Water Heating System. Manufacturer and Contracting Officer shall be consulted and agree that this type of system is acceptable.Units shall be provided with domestic hot water circulation loop with circulation pump, de-superheater , insulated piping and controls to interlock the system with the water source air conditioner. There shall be sufficient space to service and replace all controls and internal components from inside the utility room. The integral domestic water heating system shall be sized and installed in accordance with the water source air conditioning/heat pump unit manufacturer's requirements.

10-3.5 Unacceptable systems. Room unit heaters (see Note[1]); space heaters, room (window) air conditioning units; floor furnaces, gravity warm air systems, and electric resistance heaters (see Note[2]) are not permitted.

Note [1]: Room unit heaters shall be used where required by outdoor design conditions to maintain a minimum temperature of 4.5 degrees C (40 degrees F) in utility rooms.

Note [2]: Electric resistance heaters may be used for supplemental heat in heat pumps.

10-4 Air Distribution. Provide systems conforming to the recommendations of the ASHRAE Air Distribution Manual or the SMACNA Residential Comfort System Installation Standards Manual. Two-story housing units shall be provided with a separate heating and cooling unit and supply and return ducted system for each floor. Air conditioning/heating systems shall be designed with thorough air distribution and unrestricted return air flow paths.

10-4.1 Supply diffusers. Wall, ceiling, and/or baseboard supply diffusers shall be located to ensure that the air distribution shall completely cover all surfaces of exterior walls with a blanket of conditioned air or may be of a compact design so long as 'dead spots' within the units are avoided. At least one diffuser shall be provided in each habitable room. Registers shall have louvered faces with individually adjustable blades, and shall be provided with integral opposed blade damper. Diffusers shall be provided with air deflectors as required for proper air flow in the space. Plastic diffusers are prohibited. Core velocity shall be limited to 3 m/sec (600 fpm) maximum, with a maximum pressure drop of 0.82 Pa/m (0.1 inch water). Airflow from any single diffuser shall be limited to 94.4 L/s (200 cfm) maximum. Ceiling-mounted units shall have factory finish to match ceiling color, and be installed with rims tight against ceiling. Sponge-rubber gaskets shall be provided between ceiling or wall- and surface-mounted diffusers for air leakage control. Diffuser boots shall be sealed tight to the wall or ceiling they penetrate using duct mastic or caulking. Suitable trim shall be provided for flush-mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Wall supply registers shall be installed at least 150 mm (6 inches) below the ceiling.

10-4.2 Return and exhaust grilles. Grilles shall be fixed horizontal or vertical louver type similar in appearance to the supply diffuser face. Plastic units are prohibited. Core velocity shall be limited to 2 m/sec (400 fpm) maximum, with a maximum pressure drop of 0.5 Pa/m (0.06 inch water). Grilles shall be provided with sponge rubber gasket between flanges and wall or ceiling. Register/grille boots shall be sealed tight to the wall or ceiling they penetrate using duct mastic or caulking. Wall return grilles shall be located at least 150 mm (6 inches) above the floor. Return grilles shall be located in hallways or other normally unoccupied spaces to minimize the sound level in occupied spaces.

10-4.3 Ductwork. Ductwork shall be externally insulated sheet metal or flexible metal. Length of flexible duct shall be limited to 1.8 m (6 ft). Flexible ductwork shall not be spliced or joined and shall be a single continuous piece from diffuser boot to trunk/branch duct. Systems composed entirely of flexible ductwork with distribution boxes are prohibited. Sub-slab and intra-slab ductwork is also prohibited. Volume dampers shall be provided at each branch take-off. All ductwork shall be concealed. No portion of the building construction (such as joist space in a floor or ceiling, wall stud space, etc.) shall be used as a duct. The requirements for ductwork set forth below apply to all ductwork installed in the housing unit, supply systems, return systems, exhaust systems, ventilation systems, and outside air supply ductwork.

10-4.3.1 Maximum velocity in supply ducts shall be limited to 4.6 m/s (900 fpm) for mains and 3.1 m/s (600 fpm) for branches.

10-4.3.2 Ducts shall be airtight with no visible or audible leaks to ensure quiet, economical system performance Ductwork in conditioned spaces shall be constructed for a 250 Pa (1 inch) static pressure construction class with seal class C, as described in the SMACNA HVAC Duct Construction Standard, unless a higher pressure class and/or seal class is required by actual, system operating conditions. Ductwork in unconditioned spaces shall be constructed for a 500-Pa (2-inch) static pressure construction class with seal class C, unless a higher pressure class and/or seal class is required by actual, system operating conditions. All duct seams and joints shall be sealed using duct mastic. Tape shall not be used as a means for sealing ductwork.

10-4.3.3 For flexible ductwork, the inner core shall be mechanically fastened to all fittings, preferably using drawbands installed directly over the inner core and beaded fitting. If beaded fittings are not used, then the inner core

shall be fastened to the fitting using #8 screws equally spaced around the diameter of the duct, and installed to capture the wire coil of the inner liner (3 screws for ducts up to 300mm (12 inches) in diameter and 5 screws for ducts over 300mm (12 inches) in diameter). The inner core must be sealed to the fitting using mastic or tape. Tape used for sealing the inner core shall be applied with at least 25mm (1 inch) of tape on the duct lining and 25mm (1 inch) of tape on the fitting, and shall be wrapped at least three times. The outer sleeve (vapor barrier) must be sealed at connections with a drawband and three wraps of approved tape. The vapor barrier must be complete without any holes or rips, and seams shall be sealed with mastic or approved tape. Pressure sensitive tapes used in conjunction with flexible duct connections shall be as recommended by the duct manufacturer and shall be UL 181A listed and so indicated with a UL 181A mark or aluminum-backed butyl adhesive tape (15-mil minimum). Drawbands shall be stainless steel worm drive hose clamps or UV resistant nylon duct ties.

10-4.3.4 Provide a minimum of 51mm (2-inch) thick mineral fiber insulation (or other listed insulation with an equivalent R value) on the exterior of all ducts in unconditioned spaces. Exhaust ductwork does not require insulation. Insulation shall be faced with a vapor barrier material having a performance rating not to exceed 1.0 perm. Insulation, vapor barrier, and closure systems shall be non-combustible as defined in NFPA 255, with a flame-spread rating of not more than 25, and a smoke development rating of not more than 50, as defined in ASTM-E84.

10-4.3.5 Return, exhaust, and ventilation air ductwork shall be sized for a maximum velocity of 4.6 m/sec (900 fpm). Short runs of return air duct (1525mm (5 feet) or less) which directly precede the air handler shall be acoustically lined to minimize noise. Indicated duct sizes shall be clear inside of duct lining.

10-4.3.6 Duct runs under stairways shall not compromise fire stop assemblies.

10-4.4 Filtration. Provide a pleated 25mm (1-inch) panel filter, installed in the return air system. The mechanical equipment shall be arranged so that the filter can be changed by the occupant through an access panel without entering the utility room and so maintenance personnel can change the filter from within the utility room without disturbing the occupants. Filters shall be sized and installed in accordance with UL 900. Filter shall be rated for 25% efficiency as determined by ASHRAE 52, Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter. All filters shall be easily accessible for changing and maintenance. Kitchen exhaust hoods shall be provided with aluminum grease filters sized to fit the exhaust duct.

10-5 Thermostats. Thermostats shall be located on interior partitions, approximately 1530mm (5 feet) above the finished floor. Locating a thermostat on the wall adjacent to a stairway, on an exterior wall, or where it is subject to unrepresentative temperatures is unacceptable. Each heat pump/air conditioning unit shall be served by an individual thermostat.

10-5.1 Heat pump/air conditioning systems shall be equipped with wall mounted industry standard thermostats. Thermostat shall be non-programmable and operate on 24V control circuit. Thermostat shall have switched heating-off-cooling and fan auto-on control. Thermostat shall have bimetal coil and mercury switch design.

10-5.2 Design consideration should be given to programmable thermostats. Programmable thermostats would be Energy Star labeled, microprocessor-based, with built-in key pads for scheduling of day and night temperature settings. When out of the scheduling mode, thermostats would have continuous display of time, with AM and PM indicator and of room temperature. In the programmable mode, the display shall be used for setting occupied and unoccupied temperature set points. The thermostat shall store two temperature set points for heating and two temperature set points for cooling. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for one year in the event of a power outage. Maximum differential would be ±1 degree C (±2 degrees F). For a listing of Energy Star labeled thermostats see
http://www.epa.gov/appdstar/hvac/thermostats.html

10-6 Exhaust Fans. Exhaust fans shall be ducted to the outside. Exhaust fans shall not discharge near entry doors, patios or balconies, carports, or garages. All roof penetrations shall be located on the rear portion of the housing unit. Fans shall be tested and rated in accordance with AMCA 210, and shall operate with 120-volt, single-phase power supply. Exhaust fans shall be provided with backdraft damper and storm hood.

10-6.1 Bathroom Exhaust. Bathroom exhaust fans shall be ceiling-mounted and shall be sized to provide not less than 10 air changes per hour in the space served. Bathroom exhaust fans shall be switch separately from the bathroom lights. Maximum allowable noise level for bathroom exhaust fans shall be 2 sones as installed.

10-6.2 Attic Exhaust. Attic exhaust fans shall be roof mounted, provide not less than 6 air changes of attic air per hour and have industry standard thermostatic control. All roof penetrations shall be located on the rear portion of the housing unit. Attic exhaust fans shall be provided with backdraft damper and storm hood. Maximum allowable noise level for attic exhaust fans shall be 6 sones as installed.

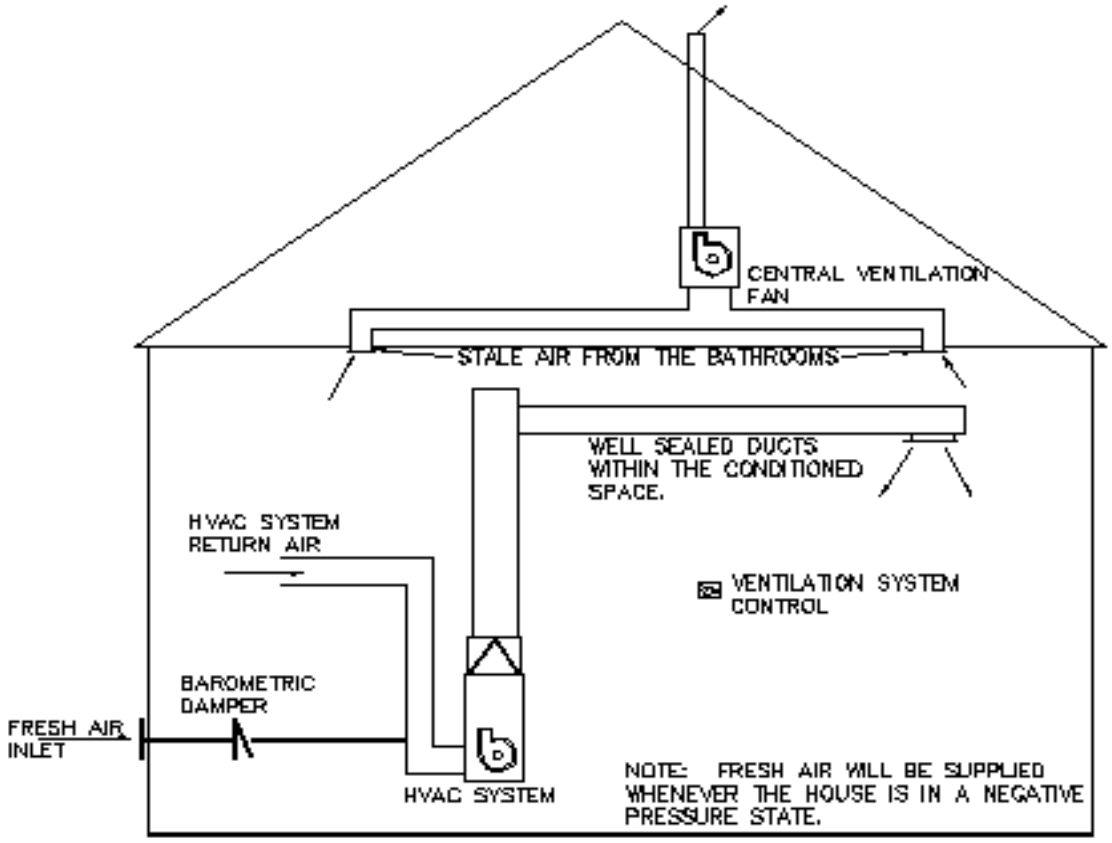
10-7 Dryer Vents. A 100mm (4-inch) diameter dryer vent shall discharge to the exterior and provide connection to occupant-owned dryer (one dryer per vent). The vents shall be rigid aluminum with exterior wall cap and backdraft damper. Vent pipes shall be a maximum of 6100 m (20 feet) long, with no more than three right angle elbows (with minimum radius of 150mm (6 inches)), and have a maximum vertical run of 3660mm (12 feet). Dryer vents shall not exhaust near entry doors, patios or balconies, or garages. Dryer vents shall not run through non-accessible spaces or garages.

10-8 Piping Requirements. Air conditioner condensate drains, refrigerant suction, and exterior refrigerant liquid lines shall be insulated with 25mm (1- inch) (minimum) thick cellular glass or unicellular foam pipe insulation or as recommended by equipment manufacturer. Condensate drain lines shall be one size larger than the drain pan connection, be properly trapped, and run to unpaved outside grade. Discharged condensate shall drain away from housing unit. Condensate drain lines shall not be directly connected to a sanitary sewer system.

10-9 Ceiling Fans. Refer to Chapter 9 Unit Design – Electrical, Paragraph 9-7.2 for ceiling fan requirements.

10-10 Active Ventilation Engineered Indoor Air Quality (IAQ) Enhancement. The IAQ exhausts, within each unit, shall all be ducted together to a common exhaust plenum equipped with a single long-life exhaust fan. IAQ exhaust discharge shall not allow entry of weather elements. The IAQ exhaust registers shall be installed in the bathrooms and storage rooms of the housing unit. The IAQ exhaust system shall be independent of the switched bathroom exhausts and attic exhaust. The IAQ exhaust fan shall be interlocked to operate when either heat pump/air conditioning unit operates. The fan shall be sized to provide the required exhaust rate in each bathroom space when operated at low speed. Control for this fan shall be accomplished from a wall-mounted switch, located in the linen closet, labeled HI-LOW-OFF. The OFF position of the switch shall illuminate a “RED” LED to indicate the off condition of the ventilation system. The supply ventilation portion of the system shall consist of a small duct providing a connection for fresh (outdoor) air to the air handler return duct. This duct shall contain a barometrically-controlled vent that shall admit outdoor air to the unit whenever the housing unit is experiencing a negative pressure. ASHRAE 62.2P-2001, “Ventilation for Acceptable Indoor Air Quality” recommends ventilation air supply rate at a minimum of 0.35 air changes per hour (ACH) but not less than 15 cfm per person. This is supplied by either natural infiltration or a combination of natural infiltration plus active ventilation. The fresh air supply duct shall be sized to provide no less than this minimum 0.35 Air Changes per hour ventilation rate (but in no case shall the ventilation air introduced into the unit from the combination of natural infiltration and active ventilation be less than recommended by ASHRAE 62.2P-2001 with consideration for two (2) occupants per bedroom). This system is a recommended “Energy Star Homes” approach for improving indoor air quality in residential construction. The Active Ventilation Engineered IAQ Enhancement described in this Paragraph is considered to be a minimum level compliance item (See Diagram below.) in weather regions 5 through 11. Contractors are encouraged to present and propose other systems/methods which are enhancements/improvements to the system described and can ensure adequate fresh ventilation air (0.35 AC/Hr Min) is provided to the interior spaces of the housing units. Contractors are encouraged to review “Energy Star” materials and information available to them through the EPA and/or by visiting the Energy Star Web page. See, for example:

http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/$file/BalancedVentSys.pdf and
http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/$file/SupplyVent.pdf



ACTIVE VENTILATION SYSTEM SCHEMATIC

10-10.1 In-Use IAQ Management Plan. To insure the effective management of facility air quality during its life, the Contractor shall:

- Develop an air quality action plan to include scheduled HVAC system cleaning.
- Develop an air quality action plan to include education of occupants and facility managers on indoor pollutants and their roles in preventing them.
- Provide an action plan for periodic system maintenance, monitoring, occupant/manager training.

10-11 Testing, Adjusting, and Balancing. Adjusting and balancing of each housing unit shall be the Contractor's responsibility. Following adjusting and balancing, testing of air and water systems shall be performed on 10% of the project buildings (not to exceed 10 buildings), that have been randomly selected by the Contracting Officer. If buildings are to be turned over in phases, testing shall be performed on 10% of the buildings completed in each phase (not to exceed 10 buildings per phase). No additional testing shall be required if at least 90% of the tested buildings pass the test requirements. If less than 90% of the tested buildings pass the test, an additional 10% of the project buildings (not to exceed 10 buildings) shall be tested. This process shall continue until 90% of the total number of tested buildings pass. The Contractor shall correct all housing units not found in compliance, and shall be responsible for all labor and materials required for this effort. NEBB 01, SMACNA-07 or ASHRAE 111 shall be used as the standard for providing testing of air and water systems. The selected standard shall be used throughout the project. Instrumentation accuracy shall be in accordance with the standard selected. Testing shall be accomplished by a firm certified for testing by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Where specific systems require special or additional procedures for testing, such procedures shall be in accordance with the standard selected. Approved detail drawings and all other data

required for each system and/or component to be tested shall be made available at the job site during the entire testing effort. Testing shall not commence until approved by the Contracting Officer. The housing unit shall be essentially complete with final ceiling, walls, windows, doors, and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems, hydronic systems, and exhaust fans shall be complete and operable. All data, including deficiencies encountered and corrective action taken, shall be recorded. Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices shall be permanently marked by the Contractor's balancing engineer so that adjustment can be restored if disturbed at any time.

10-12 Duct Tightness Testing Requirements. The installation of the supply and return ductwork within the units is an item of prime concern with respect to the energy efficient operation of the housing unit as a whole. With that consideration in mind, for heating and air conditioning designs which include ductwork outside of the conditioned envelope, the Contractor shall be required to test the proto-type units and all units which are blower door tested for tightness (see Paragraph 7.c.(2)) to ascertain the leakage levels from the ductwork in accordance with the following requirements.

10-12.1 Duct tightness testing shall ensure that the leakage rate from ductwork (where the ductwork system is not entirely within the conditioned envelop) shall not exceed 0.15 (L/s)/m^2 (0.03 cfm/ft^2). If the units tested fail to meet this requirement, the ductwork installation shall be examined, corrections made, and the test redone until the installation passes this requirement. No ductwork systems may be installed in other units until the proto-type units ductwork systems have been validated. Several methods to accomplish this testing are acceptable.

10-12.1.1 Testing may be done in accordance with ASTM Standard E 1554-94, “Determining External Air Leakage of Air Distribution Systems by Fan Pressurization”. This method describes the process and methodology required to accomplish basically a ‘blower door subtraction’ method of duct tightness testing.

10-12.1.2 Testing may also be accomplished utilizing “Duct Blaster” methodologies and pressurizing the ductwork to 25 Pascal (0.1 inch of water).

10-12.2 Commissioning. The Contractor shall implement all of the following best practice commissioning procedures:

- Engage a commissioning authority.
- Develop design intent and basis of design
- Include commissioning requirements in the construction documents.
- Develop and utilize a commissioning plan.
- Verify installation, functional performance, training and documentation.
- Complete a commissioning report.

10-12.3 The Contractor is advised that the EPA may test, or hire a consultant to test randomly selected housing units constructed in this project. These tests shall be completed without cost to the Contractor; however, the Contractor shall be required to coordinate access to the selected unit. If accomplished, this testing shall not interfere or delay the construction Contractor in any manner. Cooling season shading of glazed surfaces on the west and south elevations shall be considered.

10-12.4 Energy Optimization Model. The Contractor shall develop an energy optimization model for each type of housing unit. The model shall show reduction in design energy usage (DEU) compared to the energy use budget (EUB) in joules per square meter (Btu/square foot) per year for regulated energy components as described in the requirements of Chapter 11 of the TI 800-01 (Design Criteria), as demonstrated by a whole building simulation. One (1) Sustainability point shall be awarded for every reduction in design energy use of 2.5% for a maximum score of 20 points.

10-12.4.1 Sustainable Features. See Chapter 13 Sustainable Design Considerations for a list of items that contribute towards achieving a Gold SPiRiT rating.

11. ENERGY CONSERVATION.

11-1 Energy conservation techniques shall be considered as relative to site design, site engineering, unit design, and unit engineering. Techniques that conserve energy, improve livability, and are justified by life/cycle cost analysis, are encouraged. Integration of energy conservation systems such as from the inception of housing unit design, lighting, structure, mechanical systems, and aesthetics, is essential to facilitate livability and maximum energy savings. If an alternative energy generation method is intended for use as the project's primary energy source, documentation shall be submitted to the Contracting Officer, verifying the system's reliability and ability to meet the project's peak demand. The following paragraphs suggest energy conservation techniques that are considered desirable. The listing is not all inclusive, and the techniques suggested may not be cost effective for a given design. Additional consideration in the technical evaluation shall be given to designs that incorporate valid energy conservation techniques.

11-2 Passive Solar Applications. Passive solar architectural applications shall routinely be considered as a part of all project designs. Unique applications, such as attached sun spaces, solar chimneys, solar dehumidifiers, and other innovations, may be considered. Operational controls, such as shading and venting mechanisms, which control the amount of heat admitted into the housing unit during the day, reduce the amount of heat escaping from the housing unit at night, and provide for thermal comfort of the occupants.

11-2.1 Additional South Glazing. If used as part of the solar energy system, glazing shall be commercially available off-the-shelf type and shall face within 15 degrees of solar south. The glazing shall be architecturally compatible with the housing unit and the environment, face directly into the living space so that the walls, floors, ceiling, and other massive objects can absorb the entering solar energy, and shall have a whole-window U value less than 1.6 square meter-kelvin (K)/watt (0.28 ft^2-degrees F/BTUH). The optimum amounts of solar glazing that shall admit enough solar energy are shown below:

TABLE 11-1 – GLAZING

Average winter outdoor temperature	40° lat
Temperate climates	*GA/FA*
40°	0.14

Table: Sizing South facing Glazing, GA/FA = glazing area/floor area

Note: Window area on the other sides of the house should total no more than 5% of the floor area.

11-2.2 Storage Mass. If thermal performance calculations indicate a need for additional mass (beyond that provided by the housing unit structure) substantiating data shall be submitted. The storage mass shall be well integrated into the housing unit design. The thermal mass surface area in the space must be a minimum of three times the glazing area. Six to nine times the glazing area is recommended to control temperature swings. The surfaces to absorb solar energy shall not be more than 10% covered.

11-2.3 Shading. Movable window treatments are required. These can take the form of Venetian blinds to be drawn by the occupants at night and opened in the day. Cooling season shading of glazed surfaces on the west and south elevations shall be considered.

11-3 Geothermal. Geothermal energy sources such as ground coupled water loops are required. Each design utilizing geothermal sources shall address the project's environmental impact relating to noise emission, heat rejection, ground water contamination, land use, etc.

11-4 Condenser Heat Recovery. The installation of a heat exchanger to recover condenser heat and desuperheat for use in heating domestic water is required. A standard domestic water heater shall be provided in conjunction with this system to provide hot water during the heating season.

11-5 Energy Recovery Ventilator. Energy recovery ventilators shall be considered for use with systems designed to introduce outside ventilation air into the housing unit to address indoor air quality concerns. The increased cost and system complication associated with the introduction of outside air shall be carefully weighed against severity of indoor air quality deficiencies before the decision is made to supply outside air at the air handler. When utilized, energy recovery ventilators shall pre-condition outside air by permitting energy transfer from exhaust air. Units shall have easily accessible controls and filters.

11-6 Systems and techniques, which take advantage of the rebates andncentives offered by utility companies, are preferred.

12. CONTRACTOR PREPARED SPECIFICATIONS.

12-1 The successful Offeror shall prepare a specification for all work included in the scope of work. The specification shall be tailored to this job. Inapplicable materials shall be deleted. Any reference, description, procedure or other matter required to develop a complete, accurate and concise specification shall be provided. The specification shall include but is not limited to:

12-1.1 A description of the technical requirements

12-1.2 Criteria for determining whether the requirements are met

12-1.3 Quality control requirements and procedures

12-1.4 Submittal requirements – all submittals recommended by the master specification system chosen by the Contractor shall be included and submitted to the Government. See Section 01331 SUBMITTAL PROCEDURES FOR DESIGN BUILD.

12-2 The specifications may be any one of the major, well-known master guide specifications sources such as MASTERSPEC from the American Institute of Architects, SPECTEXT from Construction Specifications Institute or the Government's Unified Facilities Guide Specifications as modified by the Louisville District Corps of Engineers. Use only one source for the project. If the design is based on a specific product, the specifications shall consist of the salient features of the product. The specification shall be detailed enough that a another product meeting the specification could be substituted without adversely affecting the project.

12-3 Specifications for features of the work shall be organized into divisions and sections in accordance with Construction Specifications Institute (CSI), Master List of Titles and Numbers for the Construction Industry, latest edition. Individual specification sections shall be in the format of CSI, Section Format, A Recommended Format for Construction Specification Sections, latest edition. Exceptions are:

12-3.1 Measurement Procedures and Payment Procedures shall only be used in those section(s) where rock excavation is specified. No other sections shall contain these subparagraphs of the paragraph SUMMARY.

12-3.2 Except as otherwise noted in this Paragraph, CONTRACTOR PREPARED SPECIFICATIONS, the paragraph SUMMARY shall not be used.

12-3.3 Design and Submittal requirements, submittal procedures and quality control procedures, and construction operations shall be those contained in the Sections 01021, 01312, 01320, 01331, 01356, 01410, 01453, 01500, 01525, 01670 and 01800 (see Attachment 1 to the Statement of Work). These specification sections shall be incorporated into the Contractor prepared specification packages without editing and shall be coordinated with all other specification sections prepared by the Contractor.

12-3.4 Section 09900, Painting; shall establish a minimum level of quality for paints, stains, and varnishes to be used in this project.

12-4 Contractor prepared specifications shall be reviewed by the Contracting Officer or his designated representatives during the design portion of the project. Contractor shall incorporate all required changes, including addition of submittals, after resolution of comments and prior to work initiation on the next phase of the project.

12-5 Division Zero and One specifications – The Division Zero (00xxx) and Division One (01xxx) Specifications included in this RFP shall be included in the Contractor's final specifications without revision, unless such revision is approved in writing by the Government. Additional Division One specifications may be added by the Contractor if required.

12-6Technical Specifications

12-6.1 Some of the Division Two (02xxx) through Sixteen (16xxx) specifications in this RFP are provided in outline format. The Contractor's designers shall expand the outline specifications to provide comprehensive specifications in compliance with all requirements of this Paragraph 12, this Statement of Work and the RFP. All sections may not be used, and Contractor's designers shall provide additional sections if necessitated by their final design or RFP requirements. Requirements specifically included in the outline specifications shall be included in the final specifications.

12-6.2 Some of the Division Two (02xxx) through Sixteen (16xxx) specifications in this RFP are provided in prescriptive format. These represent the minimum requirements of the RFP and shall be used without revision, unless approved in writing by the Government. Such revisions will be allowed only if they reflect betterments or enhancements to the project. Contractor's designers shall take responsibility for the design and specification of the project, and shall satisfy themselves that the prescriptive specifications are complete and suitable for the final design.

13. SUSTAINABLE DESIGN CONSIDERATIONS.

13-1 Sustainable design techniques shall be considered as they relate to site design, site engineering, unit design, and unit engineering. Techniques that conserve energy, improve livability, and can be justified by life cycle cost analysis as cost effective are encouraged. Integration of energy conservation systems with the housing unit's design (lighting, structure, mechanical systems, and aesthetics) is essential to facilitate livability and maximum energy savings. The following paragraphs define the goals and general objectives for inclusion of sustainable design considerations in this project. This information is taken from US Army Corps of Engineers, TL 1110-3-491. The listing is not all inclusive, and the techniques suggested may not be cost effective at a given location or site. Additional consideration in the technical evaluation will be given to designs that incorporate and identify Sustainable Design techniques included in the proposal.

The Government has identified this project as a “showcase project” for sustainable design. The Contractor shall design and construct the project to achieve a “gold” rating using the SPiRiT rating system of TL 1110-3-491. A sample SPiRiT rating tool for the project has been prepared by the Government (see Attachment 13 to this Statement of Work) to demonstrate possible project design and construction measures toward achieving the gold rating. A blank SPiRiT rating tool is provided as Attachment 14 for Contractor’s use in developing his plan to achieve the rating.

13-2 Goals and Objectives of Sustainable Design.

13-2.1 The overall USACE goal of Sustainable Design is to be environmentally responsible in the delivery of facilities. The key traditional elements for decision making in the facility delivery process are cost, quality and time. These elements need to be expanded to include the ecological and human health impacts of all decisions.

13-2.2 Each project generates its own set of goals. However, sustainable design goals should apply to all projects. The goals for improving the environmental performance of facilities include: (a) use resources efficiently and minimize raw material resource consumption, including energy, water, land and materials, both during the construction process and throughout the life of the facility, (b) maximize resource reuse, while maintaining financial stewardship, (c) move away from fossil fuels towards renewable energy sources, (d) create a healthy and productive work environment for all who use the facility, (e) build facilities of long-term value, and (f) protect and, where appropriate, restore the natural environment.

13-3 Sustainable Design and Construction of the Built Environment. Design and construction of sustainable buildings should be in accordance with the following concepts:

13-3.1 Site Work and Planning--Environmentally sensitive planning looks beyond the boundary of the project site to evaluate linkages to transportation and infrastructure, ecosystems and wildlife habitat and community identification. Site planning evaluates solar and wind orientation, local microclimate, drainage patterns, utilities and existing site features to develop optimal siting and appropriate low maintenance landscape plant material.

13-3.2 Building Layout and Design--Optimize building size, and maintain an appropriate building scale for the environment and context of the building or a building component. Layout the rooms of a building for energy performance and comfort, and design for standard sizes to minimize material waste. Pay careful attention to the location of exterior windows. Avoid structural over-design and the resultant waste. Design components of the building environment for durability and for waste recycling.

13-3.3 Energy--Building orientation and massing, natural ventilation, day-lighting, shading and other passive strategies, can all lower a building's energy demand and increase the quality of the interior environment and the comfort and productivity of occupants.

13-3.4 Building Materials--Environmentally preferable building materials are durable and low maintenance. Within the parameters of performance, cost, aesthetics and availability, careful selection and specification can limit impacts on the environment and occupant health.

13-3.5 Indoor Air Quality--Indoor air quality is most effectively controlled through close coordination of architecture, interiors and mechanical, plumbing, and electrical design strategies that limit sources of contamination before they enter the building. Construction procedures for IAQ and post-occupancy user guides also contribute to good long-term IAQ.

13-3.6 Water Usage-- Site design strategies that maximize natural filtration of rainwater are desirable. Water conservation is enhanced by the use of low flow plumbing fixtures and water appropriate landscaping.

13-3.7 Recycling and Waste Management--Waste and inefficiency can be limited during construction by sorting and recycling demolition and construction waste, reuse of on-site materials and monitoring of material use and packaging. Accommodating recycling into building design reduces waste while generating revenues. The Base has a post-recycling target of 40%.

13-3.8 Building Commissioning, Operations and Management--Effective building commissioning is essential to ensure proper and efficient functioning of systems. Facilities operations benefit from energy and water saving practices, waste reduction and environmentally sensitive maintenance and procurement policies.

13-3.9 Mechanical Sustainable Design Features. Design consideration should be given to using the following items.

1. Ground coupled geothermal heat pump system (attain SEER 17).
2. Hot water de-super heater on heat pump (free hot water during cooling months).
3. Programmable thermostat. (for automatic night set back)
4. Attic ventilation fan on thermostat (reduces ceiling heat gain)
5. “Energy Star” rated refrigerator, range and dishwasher (high efficiency).
6. Low flow water closets and shower heads (conserves water).
7. Outside air percentage and high efficiency filters (optimizes indoor air quality (IAQ))
8. The above items along with other measures (high efficiency lights and high “R” values for example) can be entered into the overall energy analysis as required above.

13-3.10 Architectural Sustainable Design Features. Design consideration should be given to using the following items:

a. Forestry Stewardship Council wood and/or a rapidly renewable material such as bamboo may be used for flooring, as a sustainable design feature, in lieu of hardwood flooring. Design consideration should also be given to locally available hardwood flooring material.
b. Better sealing windows with higher insulated glazing as well as Energy Star qualified windows.
c. Providing a recycle bin area with the garbage area.
d. Use of sustainable features such as solid polymer counter tops (cabinets and counters should contain low VOC emitting glues and stains).
e. Privacy screening using reconstituted plastic screening instead of wood.

SECTION 02220

DEMOLITION
05/02

PART 1 GENERAL

1.1 REFERENCES

1.2 GENERAL REQUIREMENTS

1.3 SUBMITTALS

1.4 REGULATORY AND SAFETY REQUIREMENTS

1.4.1 Notifications

1.4.2 Receipts

1.5 DUST AND DEBRIS CONTROL

1.6 PROTECTION

1.6.1 Traffic Control Signs

1.6.2 Existing Work

1.6.3 Weather Protection

1.6.4 Trees

1.6.5 Facilities

1.6.6 Protection of Personnel

1.7 BURNING

1.8 Required Data

1.9 Environmental Protection

1.10 USE OF EXPLOSIVES

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Structures

3.1.2 Utilities and Related Equipment

3.1.3 Paving and Slabs

3.1.4 Roofing

3.1.5 Masonry

3.1.6 Concrete

3.1.7 Air Conditioning Equipment

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

3.2.2 Disposal of Ozone Depleting Substance (ODS)

3.2.2.1 Special Instructions

3.3 CLEANUP

3.3.1 Debris and Rubbish

-- End of Section --

SECTION 02231

CLEARING AND GRUBBING
07/02

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Materials Other Than Salable Timber; G

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

SD-04 Samples

Tree wound paint

Herbicide

Submit samples in cans with manufacturer's label.

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 TREE WOUND PAINT

Bituminous based paint of standard manufacture specially formulated for tree wounds.

2.2 HERBICIDE

Comply with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on contractor's licensing, certification and record keeping. Contact the command Pest Control Coordinator prior to starting work.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Trees, Shrubs, and Existing Facilities

Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01310N, ADMINISTRATIVE REQUIREMENTS for additional utility protection.

3.2 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of abandoned underground piping.

All clearing activities are prohibited between the dates of April 1 and October 14, due to the presence of endangered species. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches or more in diameter. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than in diameter shall be painted with an approved tree-wound paint. Apply herbicide in accordance with the manufacturer's label to the top surface of stumps designated not to be removed.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 PRUNING

Prune trees designated to be left standing within the cleared areas of dead branches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than in diameter with an approved tree wound paint.

3.5 GRUBBING

Grubbing shall consist of the removal and disposal of stumps, roots larger than in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.6 DISPOSAL OF MATERIALS

3.6.1 Usable Timber

Consider felled timber from which fuelwood can be produced as usable timber. Trim limbs and tops, and saw into lengths for fuelwood, and stockpile adjacent to the site. The stockpile timber will remain the property of the Government.

3.6.2 Nonusealeable Materials

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for useable timber, shall be disposed of in the designated waste disposal area, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed. Refuse to be burned shall be burned at specified locations and in a manner to prevent damage to existing structures and appurtenances, construction in progress, trees, and other vegetation. The Contractor shall be responsible for compliance with all Federal and State laws and regulations and with reasonable practice relative to the building of fires. Burning or other disposal of refuse and debris and any accidental loss or damage attendant thereto shall be the Contractor's responsibility.

-- End of Section --

SECTION 02300A

EARTHWORK
12/97

PART 1 GENERAL

1.1 REFERENCES

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

1.2.2 Unsatisfactory Materials

1.2.3 Cohesionless and Cohesive Materials

1.2.4 Degree of Compaction

1.3 SUBMITTALS

1.4 SUBSURFACE DATA

1.5 UTILIZATION OF EXCAVATED MATERIALS

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

3.2 GENERAL EXCAVATION

3.2.1 Ditches, Gutters, and Channel Changes

3.2.2 Drainage Structures

3.3 SELECTION OF BORROW MATERIAL

3.4 GRADING AREAS

3.5 BACKFILL

3.6 SUBGRADE PREPARATION

3.6.1 Construction

3.6.2 Compaction

3.6.2.1 Subgrade for Pavements

3.6.2.2 Subgrade for Shoulders

3.7 SHOULDER CONSTRUCTION

3.8 FINISHING

3.9 PLACING TOPSOIL

3.10 TESTING

3.10.1 Fill and Backfill Material Gradation

3.10.2 In-Place Densities

3.10.3 Moisture Contents

3.10.4 Optimum Moisture and Laboratory Maximum Density

3.10.5 Tolerance Tests for Subgrades

3.11 SUBGRADE AND EMBANKMENT PROTECTION

-- End of Section --

SECTION 02315A

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS
08/98

PART 1 GENERAL

1.1 REFERENCES

1.2 DEGREE OF COMPACTION

1.3 SUBMITTALS

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

2.1.2 Unsatisfactory Materials

2.1.3 Cohesionless and Cohesive Materials

2.1.4 Expansive Soils

2.1.5 Nonfrost Susceptible (NFS) Material

2.2 CAPILLARY WATER BARRIER

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

3.2 TOPSOIL

3.3 EXCAVATION

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

3.4.2 Dewatering

3.5 CLASSIFICATION OF EXCAVATION

3.6 UTILITY AND DRAIN TRENCHES

3.7 BORROW

3.8 EXCAVATED MATERIALS

3.9 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

3.10 SUBGRADE PREPARATION

3.11 FILLING AND BACKFILLING

3.12 TESTING

3.12.1 In-Place Densities

3.12.1.1 In-Place Density of Subgrades

3.12.1.2 In-Place Density of Fills and Backfills

3.12.2 Moisture Content

3.12.3 Optimum Moisture and Laboratory Maximum Density

3.13 CAPILLARY WATER BARRIER

3.14 GRADING

3.15 SPREADING TOPSOIL

3.16 PROTECTION

-- End of Section --

SECTION 02316A

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS
05/02

PART 1 GENERAL

1.1 REFERENCES

1.2 DEGREE OF COMPACTION

1.3 SUBMITTALS

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

2.1.2 Unsatisfactory Materials

2.1.3 Cohesionless and Cohesive Materials

2.1.4 Unyielding Material

2.1.5 Unstable Material

2.1.6 Select Granular Material

2.1.7 Initial Backfill Material

2.2 PLASTIC MARKING TAPE

2.3 Detection Wire For Non-Metalic Piping

PART 3 EXECUTION

3.1 EXCAVATION

3.1.1 Trench Excavation Requirements

3.1.1.1 Bottom Preparation

3.1.1.2 Removal of Unyielding Material

3.1.1.3 Removal of Unstable Material

3.1.1.4 Excavation for Appurtenances

3.1.1.5 Jacking, Boring, and Tunneling

3.1.2 Stockpiles

3.2 BACKFILLING AND COMPACTION

3.2.1 Trench Backfill

3.2.1.1 Replacement of Unyielding Material

3.2.1.2 Replacement of Unstable Material

3.2.1.3 Bedding and Initial Backfill

3.2.1.4 Final Backfill

3.2.2 Backfill for Appurtenances

3.3 SPECIAL REQUIREMENTS

3.3.1 Gas Distribution

3.3.2 Water Lines

3.3.3 Heat Distribution System

3.3.4 Electrical Distribution System

3.3.5 Plastic Marking Tape

3.4 TESTING

3.4.1 Testing Facilities

3.4.2 Testing of Backfill Materials

3.4.3 Field Density Tests

3.4.4 Displacement of Sewers

-- End of Section --

SECTION 02360

SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL
03/03

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 QUALIFICATIONS

1.4 SAFETY REQUIREMENTS

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.2 Storage

1.5.3 Handling

1.6 INSPECTION

1.7 WARRANTY

1.8 QUALITY ASSURANCE

PART 2 PRODUCTS

2.1 TERMITICIDES

PART 3 EXECUTION

3.1 TECHNICAL REPRESENTATIVE

3.2 SITE PREPARATION

3.2.1 Ground Preparation

3.2.2 Verification

3.2.3 Foundation Exterior

3.2.4 Utilities and Vents

3.3 SITE CONDITIONS

3.3.1 Soil Moisture

3.3.2 Runoff and Wind Drift

3.3.2.1 Vapor Barriers and Waterproof Membranes

3.3.2.2 Utilities and Vents

3.3.3 Placement of Concrete

3.4 TERMITICIDE TREATMENT

3.4.1 Equipment Calibration and Tank Measurement

3.4.2 Mixing and Application

3.4.3 Treatment Method

3.4.3.1 Surface Application

3.4.3.2 Rodding and Trenching

3.4.4 Sampling

3.5 VERIFICATION OF MEASUREMENT

3.6 CLEAN UP, DISPOSAL, AND PROTECTION

3.6.1 Clean Up

3.6.2 Disposal of Termiticide

3.6.3 Protection of Treated Area

3.7 CONDITIONS FOR SATISFACTORY TREATMENT

3.7.1 Equipment Calibrations and Measurements

3.7.2 Testing

3.7.3 Disturbance of Treated Soils

3.7.4 Termites Found Within the Warranty Period

3.8 RE-TREATMENT

-- End of Section --

SECTION 02510A

WATER DISTRIBUTION SYSTEM
05/02

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 basic designation only.

AMERICAN RAILWAY ENGINEERING & MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Manual	(1999) Manual for Railway Engineering (4 Vol.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997ael) Carbon Structural Steel
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 88M	(1996) Seamless Copper Water Tube (Metric)
ASTM C 76	(1999) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(1999a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM D 1599	(1999) Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1996b) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC)

	Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2774	(1994) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(1995) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3839	(1994a) Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe
ASTM D 4161	(1996) "Fiberglass"(Glass-Fiber-Reinforced Thermosetting Resin) Pipe Joints Using Elastomeric Seals
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 1483	(1998) Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings

ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B36.10M	(1996) Welded and Seamless Wrought Steel Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(1992) Hypochlorites
AWWA B301	(1992) Liquid Chlorine
AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1996) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153	(1994; Errata Nov 1996) Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm through 610 mm) and 54 In. through 64 In. (1,400 mm through 1,600 mm) for Water Service
AWWA C200	(1997) Steel Water Pipe - 6 In. (150 mm) and Larger
AWWA C203	(1997) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C205	(1995) Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied
AWWA C207	(1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm through 3,600 mm)
AWWA C208	(1996) Dimensions for Fabricated Steel Water Pipe Fittings

AWWA C300	(1997) Reinforced Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids
AWWA C301	(1992) Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids
AWWA C303	(1995) Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type
AWWA C500	(1993; C500a) Metal-Sealed Gate Valves for Water Supply Service
AWWA C502	(1994; C502a) Dry-Barrel Fire Hydrants
AWWA C503	(1997) Wet-Barrel Fire Hydrants
AWWA C504	(1994) Rubber-Seated Butterfly Valves
AWWA C509	(1994; Addendum 1995) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C651	(1992) Disinfecting Water Mains
AWWA C700	(1995) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(1988) Cold-Water Meters - Turbine Type, for Customer Service
AWWA C702	(1992) Cold-Water Meters - Compound Type
AWWA C703	(1996) Cold-Water Meters - Fire Service Type
AWWA C704	(1992) Propeller-Type Meters Waterworks Applications
AWWA C706	(1996) Direct-Reading, Remote-Registration Systems for Cold-Water Meters
AWWA C707	(1982; R 1992) Encoder-Type Remote-Registration Systems for Cold-Water Meters
AWWA C800	(1989) Underground Service Line Valves and Fittings

AWWA C900	(1997; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
AWWA C901	(1996) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service
AWWA C905	(1997) Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.
AWWA C909	(1998) Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 IN through 12 IN (100 mm through 300 mm), for Water Distribution
AWWA C950	(1995) Fiberglass Pressure Pipe
AWWA M23	(1980) Manual: PVC Pipe - Design and Installation

ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)

ACPPA 1344	(1988) Recommended Work Practices for A/C Pipe

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA TRD	(1997) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(1996) Identification of the Fire Hazards of Materials for Emergency Response
NFPA 1961	(1997) Fire Hose

NSF INTERNATIONAL (NSF)

NSF 14	(1998) Plastics Piping Components and Related Materials
NSF 61	(1999) Drinking Water System Components - Health Effects (Sections 1-9)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

1.2 PIPING

This section covers water distribution lines, and connections to building service at a point approximately 1.5 m (5 feet) outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Service Lines

Piping for water service lines less than 80 mm (3 inches) in diameter shall be gpolyvinyl chloride (PVC) plastic or copper tubing, unless otherwise shown or specified. Piping for water service lines 80 mm (3 inches) and larger shall be ductile iron or polyvinyl chloride (PVC) plastic, unless otherwise shown or specified.

1.2.2 Distribution Lines 80 mm (3 Inches) or Larger

Piping for water distribution lines 80 mm (3 inches) or larger shall be ductile iron, polyvinyl chloride (PVC) through 900 mm (36 inch) nominal diameter plastic, Oriented PVC plastic filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe, or reinforced concrete, unless otherwise shown or specified.

1.2.3 Supply Lines 80 mm (3 Inches) or Larger

Piping for water supply lines 80 mm (3 inches) or larger shall be ductile iron or polyvinyl chloride (PVC) plastic, through 900 mm (36 inch) nominal diameter, unless otherwise shown or specified.

1.2.4 Sprinkler Supply Lines

Piping for water lines supplying sprinkler systems for building fire protection shall conform to NFPA 24 from the point of connection with the water distribution system to the building 1.5 m (5 foot) line.

1.2.5 Potable Water Lines

Piping and components of potable water systems which come in contact with the potable water shall conform to NSF 61.

1.2.6 Plastic Piping System

Plastic piping system components intended for transportation of potable water shall comply with NSF 14 and be legibly marked with their symbol.

1.2.7 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-03 Product Data

Installation; G.

The manufacturer's recommendations for each material or procedure to be utilized.

Waste Water Disposal Method; G.

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation; G.

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications, and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-06 Test Reports

Bacteriological Disinfection; G.

Test results from commercial laboratory verifying disinfection.

SD-07 Certificates

Installation; G.

A statement signed by the manufacturer's field representative

certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

Meters; G.

Manufacturer's certificate stating that each meter furnished has been tested for accuracy of registration and compliance with the accuracy and capacity requirements of the appropriate AWWA standard.

1.4 HANDLING

Pipe and accessories shall be handled to ensure delivery to the trench in sound, undamaged condition, including no injury to the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor in a satisfactory manner, at no additional cost to the Government. No other pipe or material shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.4.1 Coated and Wrapped Steel Pipe

Coated and wrapped steel pipe shall be handled in conformance with AWWA C203.

1.4.2 Polyethylene (PE) Pipe Fittings and Accessories

PE pipe, fittings, and accessories shall be handled in conformance with AWWA C901.

1.4.3 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC), Reinforced Thermosetting Resin Pipe (RTRP), and Reinforced Plastic Mortar Pressure (RPMP) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PE Plastic Pipe

Pipe, tubing, and heat-fusion fittings shall conform to AWWA C901.

2.1.1.2 PVC Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

a. Pipe Less Than 100 mm (4 inch) Diameter:

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80, with joints meeting requirements of 1.03 MPa (150 psi) working pressure, 1.38 MPa (200 psi) hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings when used, shall be tested as required by ASTM D 2464.

(2) Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 1.03 MPa (150 psi) working pressure, 1.38 MPa (200 psi) hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D 2241, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure MPa	Minimum Hydrostatic Pressure MPa
26	0.689	0.917
21	0.827	1.103
17	1.034	1.379
13.5	1.379	1.834

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 1.03 MPa (150 psi) working pressure and 1.38 MPa (200 psi) hydrostatic test pressure.

b. Pipe 100 through 300 mm (4 through 12 inch) Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.

c. Pipe 350 through 900 mm (14 through 36 inch) Diameter: Pipe shall conform to AWWA C905 unless otherwise shown or specified.

2.1.2 Ductile-Iron Pipe

Ductile-iron pipe shall conform to AWWA C151, working pressure not less than 1.03 MPa (150 psi), unless otherwise shown or specified. Pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be

standard. When installed underground, pipe shall be coated in accordance with Section 13110 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE). Flanged ductile iron pipe with threaded flanges shall be in accordance with AWWA C115.

2.1.3 Copper Tubing

Copper tubing shall conform to ASTM B 88M , Type K, annealed.

2.2 FITTINGS AND SPECIALS

2.2.1 PVC Pipe System

a. For pipe less than 100 mm (4 inch) diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings; fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467; and fittings for elastomeric-gasket joint pipe shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.

b. For pipe 100 mm (4 inch) diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 1.03 MPa (150 psi) pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or fittings and specials may be of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153.

2.2.2 Ductile-Iron Pipe System

Fittings and specials shall be suitable for 1.03 MPa (150 psi) pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to AWWA C110. Fittings and specials for use with push-on joint pipe shall conform to AWWA C110 and AWWA C111. Fittings and specials for grooved and shouldered end pipe shall conform to AWWA C606. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Ductile iron compact fittings shall conform to AWWA C153.

2.2.3 Copper Tubing System

Fittings and specials shall be flared and conform to ASME B16.26.

2.3 JOINTS

2.3.1 Plastic Pipe Jointing

2.3.1.1 PE Pipe

Joints for pipe fittings and couplings shall be strong tight joints as specified for PE in Paragraph INSTALLATION. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation, and as approved by the Contracting Officer.

2.3.1.2 PVC Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer.

2.3.2 Ductile-Iron Pipe Jointing

a. Mechanical joints shall be of the stuffing box type and shall conform to AWWA C111.

b. Push-on joints shall conform to AWWA C111.

c. Rubber gaskets and lubricants shall conform to the applicable requirements of AWWA C111.

2.3.3 Copper Tubing Jointing

Joints shall be compression-pattern flared and shall be made with the specified fittings.

2.4 VALVES

2.4.1 Check Valves

Check valves shall be designed for a minimum working pressure of 1.03 MPa (150 psi) or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 50 mm (2 inches) and larger shall be outside lever and spring type.

a. Valves 50 mm (2 inches) and smaller shall be all bronze designed for screwed fittings, and shall conform to MSS SP-80, Class 150, Types 3 and 4 as suitable for the application.

b. Valves larger than 50 mm (2 inches) shall be iron body, bronze mounted, shall have flanged ends, and shall be the non-slam type. Flanges shall be the Class 125 type conforming to ASME B16.1.

2.4.2 Gate Valves

Gate valves shall be designed for a working pressure of not less than 1.03 MPa (150 psi). Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the

full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

a. Valves smaller than 80 mm (3 inches) shall be all bronze and shall conform to MSS SP-80, Type 1, Class 150.

b. Valves 80 mm (3 inches) and larger shall be iron body, bronze mounted, and shall conform to AWWA C500. Flanges shall not be buried. An approved pit shall be provided for all flanged connections.

c. Resilient-Seated Gate Valves: For valves 80 to 300 mm (3 to 12 inches) in size, resilient-seated gate valves shall conform to AWWA C509.

2.4.3 Rubber-Seated Butterfly Valves

Rubber-seated butterfly valves shall conform to the performance requirements of AWWA C504. Wafer type valves conforming to the performance requirements of AWWA C504 in all respects, but not meeting laying length requirements will be acceptable if supplied and installed with a spacer providing the specified laying length. All tests required by AWWA C504 shall be met. Flanged-end valves shall be installed in an approved pit and provided with a union or sleeve-type coupling in the pit to permit removal. Mechanical-end valves 80 through 250 mm (3 through 10 inches)in diameter may be direct burial if provided with a suitable valve box, means for manual operation, and an adjacent pipe joint to facilitate valve removal. Valve operators shall restrict closing to a rate requiring approximately 60 seconds, from fully open to fully closed.

2.4.4 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

2.4.5 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench which shall be attached to each post.

2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 5 mm (3/16 inch). Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box

length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

2.6 VALVE PITS

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 21 MPa (3000 psi)in accordance with Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE.

2.7 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least 125 mm (5 inches) in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 200 mm(8 inches)above the ground grade. Hydrants shall have a 150 mm (6 inch) bell connection, two 65 mm (2-1/2 inch) hose connections and one 115 mm (4-1/2 inch) pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be painted with 1 coat of red iron oxide, zinc oxide primer conforming to SSPC Paint 25 and 2 finish coats of silicone alkyd paint conforming to SSPC Paint 21, of the installation's standard colors or as directed by the Contracting Officer. Suitable bronze adapter for the 115 mm (4-1/2 inch) outlet, with caps, shall be furnished.

2.8 MISCELLANEOUS ITEMS

2.8.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.8.2 Corporation Stops

Corporation stops shall have standard corporation stop thread conforming to AWWA C800 on the inlet end, with flanged joints, compression pattern flared tube couplings, or wiped joints for connections to goosenecks.

2.8.3 Goosenecks

Copper tubing for gooseneck connections shall conform to the applicable requirements of ASTM B 88M , Type K, annealed. Length of cable requirement connections shall be in accordance with standard practice.

2.8.4 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round

flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 1.375 MPa (200 psi).

2.8.5 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 1.03 MPa (150 psi) . Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 67.8 Newton meters (50 foot-pound).

2.8.6 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.8.7 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

2.8.8 Meters

Meters shall be the type and size known as Harding County No. 1, normally used by Ft. Knox DBOS. Meters of each of the various types furnished and installed shall be supplied by one manufacturer.

2.8.8.1 Displacement Type

Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in cubic meters. Meters in sizes 13 through 25 mm (1/2 through 1 inch) shall be frost-protection design. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706. Meters shall comply with the accuracy and capacity requirements of AWWA C700.

2.8.8.2 Turbine Type

Turbine type meters shall conform to AWWA C701 Class I. The main casing shall be bronze with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

2.8.8.3 Compound Type

Compound type meters shall conform to AWWA C702 and shall be furnished with strainers. The main casing shall be bronze with stainless steel external fasteners. The main casing shall be tapped for field testing purposes. Registers shall be straight-reading type, shall be permanently sealed and shall read in gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706. Meters shall comply with the accuracy and capacity requirements of AWWA C702.

2.8.8.4 Fire Service Type

Fire service type meters shall be proportional type conforming to AWWA C703 and shall be furnished with strainers. The main casing shall be bronze with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706. Meters shall comply with the accuracy and capacity requirements of AWWA C703. When turbine type main line meters are used, the meter shall be supplied with a separate check valve, as a unit.

2.8.8.5 Propeller Type

Propeller type meters shall conform to AWWA C704. Registers shall be straight-reading type, shall be permanently sealed and shall read in gallons . Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706. Meters shall comply with the accuracy and capacity requirements of AWWA C703.

2.8.9 Meter Boxes

Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid. Boxes set in sidewalks, not subject to vehicular traffic, shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids shall be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the

meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

2.9 METER VAULTS

Large meters shall be installed in reinforced concrete vaults.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 3 m (10 feet) from a sewer except where the bottom of the water pipe will be at least 300 mm (12 inches) above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 1.8 m (6 feet) from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe, for a distance of at least 3 m (10 feet) each side of the crossing, shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 900 mm (36 inches) horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 600 mm (24 inches) above the sewer main. Joints in the sewer main, closer horizontally than 900 mm (36 inches) to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.2.3 Copper Tubing Lines

Copper tubing shall not be installed in the same trench with ferrous piping materials.

3.1.2.4 Nonferrous Metallic Pipe

Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 300 mm (12 inches)shall be maintained between pipes.

3.1.2.5 Casing Pipe

Water pipe shall be encased in a sleeve of rigid conduit when required. Where sleeves are required, in all other cases, the pipe sleeve shall be steel, manufactured in accordance with AWWA C200, or ASTM A 36/A 36M, with a minimum wall thickness as specified in AWWA M-11. A minimum clearance of at least 50 mm (2 inches) between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding or suitable pipe support shall be provided for the water pipe through the sleeve.

3.1.2.6 Structures

Where water pipe is required to be installed within 1 m (3 feet) of existing structures, the water pipe shall be sleeved as required in Paragraph "Casing Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.3 Joint Deflection

3.1.3.1 Allowable for Reinforced Concrete Pipe

Maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall be 5 degrees for reinforced concrete pipe unless a lesser amount is recommended by the manufacturer. Long radius curves in reinforced concrete pipe shall be formed by straight pipe in which spigot rings are placed on a bevel. Slight deflections may be made by straight pipe, provided that the maximum joint opening caused by such deflection does not exceed the maximum recommended by the pipe manufacturer. Short radius curves and closures shall be formed by shorter lengths of pipe, bevels, or fabricated specials specified.

3.1.3.2 Offset for Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.

3.1.3.3 Allowable for Ductile-Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Water-line materials shall not be dropped or dumped into the trench. Abrasion of the pipe coating shall be avoided. Except where necessary in making

connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by and at the Contractor's expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Plastic Pipe Installation

PVC pipe shall be installed in accordance with AWWA M23.

3.1.4.2 Piping Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA 1344.

3.1.4.3 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.5 Jointing

3.1.5.1 PVC Plastic Pipe Requirements

a. Pipe less than 100 mm (4 inch) diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with ASTM F 477 and as specified. Pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to ASTM D 2467. The solvent cement used shall meet the requirements of

ASTM D 2564; the joint assembly shall be made in accordance with ASTM D 2855 and the manufacturer's specific recommendations.

b. Pipe 100 through 300 mm (4 through 12 inches) diameter: Joints shall be elastomeric gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 100 mm (4 inch) diameter with configuration using elastomeric ring gasket.

c. Pipe 350 through 900 mm (14 inches) diameter: Joints shall be elastomeric gasket push-on joints made in accordance with AWWA M23.

3.1.5.2 Ductile-Iron Pipe Requirements

Mechanical and push-on type joints shall be installed in accordance with AWWA C600 for buried lines or AWWA C606 for grooved and shouldered pipe above ground or in pits.

3.1.5.3 Copper Tubing Requirements

Joints shall be made with flared fittings. The flared end tube shall be pulled tightly against the tapered part of the fitting by a nut which is part of the fitting, so there is metal-to-metal contact.

3.1.5.4 Bonded Joints Requirements

Bonded joints shall be installed in accordance with details specified for joints in paragraph JOINTS.

3.1.5.5 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 3 mm thickness of coal tar over all fitting surfaces.

3.1.5.6 Transition Fittings

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Installation of Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 1.5 m (5 feet) outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 1.5 m (5 feet) from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

3.1.6.1 Service Lines 50 mm (2 Inches) and Smaller

Service lines 50 mm (2 inches) and smaller shall be connected to the main by a directly-tapped corporation stop or by a service clamp. A corporation stop and a copper gooseneck shall be provided with either type of connection. Maximum sizes for directly-tapped corporation stops and for outlets with service clamps shall be as in TABLE I. Where 2 or more gooseneck connections to the main are required for an individual service, such connections shall be made with standard branch connections. The total clear area of the branches shall be at least equal to the clear area of the service which they are to supply.

TABLE I. SIZE OF CORPORATION STOPS AND OUTLET

Pipe Size mm	Corporation Stops, mm For Ductile-Iron Pipe	Outlets w/Service Clamps, mm Single & Double Strap
80	--	25
100	25	25
150	32	40
200	40	50
250	40	50
300 & larger	50	50

NOTE:

a. Service lines 40 mm (1-1/2 inches) and smaller shall have a service stop.

b. Service lines 50 mm (2 inches) in size shall have a gate valve.

3.1.6.2 Service Lines Larger than 50 mm (2 Inches)

Service lines larger than 50 mm (2 inches) shall be connected to the main by a tapped saddle, tapping sleeve and valve, service clamp or reducing tee, depending on the main diameter and the service line diameter, and shall have a gate valve. Lines 80 mm (3 inches) and larger may use rubber-seated butterfly valves as specified above, or gate valves.

3.1.6.3 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with NFPA 24.

3.1.7 Setting of Fire Hydrants, Meters, Valves and Valve Boxes

3.1.7.1 Location of Fire Hydrants

Each hydrant shall be connected to the main with a 150 mm (6 inch) branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 450 mm (18 inches) above the finished surrounding grade, and the operating nut not more than 1.2 m (4 feet) above the finished surrounding grade. Fire hydrants designated on the drawings as low profile shall have the lowest outlet not less than 450 mm (18 inches) above the finished surrounding grade, the top of the hydrant not more than 600 mm (24 inches) above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished grade immediately after installation to obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 100 mm (4 inches) thick and 400 mm (15 iches)square. Not less than 2 cubic meters (7 cubic feet) of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

3.1.7.2 Location of Meters

Meters and meter boxes shall be installed as required. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

3.1.7.3 Location of Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Check, pressure reducing, vacuum, and air relief valves shall be installed in valve pits. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be tamped around each valve box or pit to a distance of 1.2 m (4 feet) on all sides of the box, or the undisturbed trench face if less than 1.2 m (4 feet).

3.1.7.4 Location of Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.8 Tapped Tees and Crosses

Tapped tees and crosses for future connections shall be installed where shown.

3.1.9 Thrust Restraint

Plugs, caps, tees and bends deflecting 11.25 degrees or more, either vertically or horizontally, on waterlines 100 mm (4 inches) in diameter or

larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.9.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa (2000 psi) after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.9.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA TRD.

3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fittings or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa (200 psi). Water supply lines designated on the drawings shall be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa (200 psi). Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

a. Wet or unstable soil conditions in the trench.

b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would

require continuous surveillance to assure safe conditions.

c. Maintaining the trench in an open condition would delay completion of the project.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 1.38 MPa (200 psi) pressure. Water supply lines designated on the drawings shall be subjected to a pressure equal to 1.38 MPa (200 psi). Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure within 34.5 kPa (5 psi) of the specified leakage test pressure after the pipe has been filled with water and the air expelled. Piping installation will not be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

L = 0.0001351ND(P raised to 0.5 power)

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

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

3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be as specified. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

a. Pressure test and leakage test may be conducted concurrently.

b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.3 BACTERIAL DISINFECTION

3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651. From several points in the unit,personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory shall be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 02531

SANITARY SEWERS
07/02

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 CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	(1988) Concrete Pipe Handbook
ACPA 01-103	(1995) Concrete Pipe Installation Manual

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.5.2.1M	(1981; R 1995) Metric Round Head Short Square Neck Bolts

AMERICAN RAILWAY ENGINEERING & MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA 1-5	(2001) Pipelines

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2001a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 307	(2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 47	(1999) Ferritic Malleable Iron Castings **
ASTM A 47M	(1990; R 1996) Ferritic Malleable Iron Castings (Metric) **
ASTM A 48	(1994ae1) Gray Iron Castings **
ASTM A 48M	(1994e1) Gray Iron Castings (Metric) **
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM A 563M	(2001) Carbon and Alloy Steel Nuts (Metric)
ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings

ASTM A 746	(1999) Ductile Iron Gravity Sewer Pipe
ASTM C 12	(2002) Installing Vitrified Clay Pipe Lines
ASTM C 14	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 150	(2002) Portland Cement
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 270	(2001a) Mortar for Unit Masonry
ASTM C 33	(2001a) Concrete Aggregates
ASTM C 361	(1999) Reinforced Concrete Low-Head Pressure Pipe
ASTM C 361M	(1999) Reinforced Concrete Low-Head Pressure (Metric)
ASTM C 425	(2002) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(2001) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 443M	(2001) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 700	(2002) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 76	(2000) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(2000) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)

ASTM C 828	(2001) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 923	(2000) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C 923M	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals (Metric)
ASTM C 924	(1989; R 1997) Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 924M	(1989; R 1998) Testing Concrete Pipe Sewer Liner by Low-Pressure Air Test Method (Metric)
ASTM C 94	(1994) Ready-Mixed Concrete **
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM C 969	(2000) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 969M	(2000) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM C 972	(2000) Compression-Recovery of Tape Sealant
ASTM C 990	(2001a) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealers
ASTM C 990M	(2001a) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric)
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2235	(2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D 2321	(2000) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	(1996a) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2001) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2001) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2680	(2001) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 2996	(2001) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(2001) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3034	(2000) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3262	(2002) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
ASTM D 3350	(2002) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3753	(1999)Glass-Fiber-Reinforced Manholes
ASTM D 3840	(2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications

ASTM D 4101	(2002) Propylene Injection and Extrusion Materials
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 4161	(2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM D 624	(2000) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 405	(1997) Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 714	(2001) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 758	(1995; R 2000) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(2001a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105	(1999) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	(1998) Ductile-Iron and Gray-Iron

	Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) 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 C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153	(2000) Ductile-Iron Compact Fittings for Water Service
AWWA C302	(1995) Reinforced Concrete Pressure Pipe, Noncylinder Type
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C900	(1997) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA M23	(1980) Manual: PVC Pipe - Design and Installation
AWWA M9	(1995) Manual: Concrete Pressure Pipe

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
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts
ASME B18.5.2.2M	(1982; R 2000) Metric Round Head Square Neck Bolts

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2000) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings

for Sanitary and Storm Drain, Waste, and Vent Piping Applications

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-60005 (1998) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole ++

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

29 CFR 1910.27 Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3 (1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)

UBPPA UNI-B-6 (1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 1.5 m (5 feet) outside of building walls.

1.2.2 Sanitary Sewer Pressure Lines

Provide pressure lines of ductile iron pressure pipe or polyvinyl chloride (PVC) plastic pressure pipe at the Contractor's option.

1.3 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 1.5 m (5 feet) outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Force mains and inverted siphons are specified in Section 02532A FORCE MAINS AND INVERTED SIPHONS; SEWER. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and

any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast concrete manhole

Metal items

Frames, covers, and gratings

SD-03 Product Data

Pipeline materials including joints, fittings, and couplings

Submit manufacturer's standard drawings or catalog cuts.

SD-07 Certificates

Portland Cement; G

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

Joints; G

Certificates of compliance stating that the fittings or gaskets used for waste drains or lines are oil resistant.

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, 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 03300N, "Cast-In-Place Concrete."

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.

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 A 746, Thickness Class as appropriate for the depth of trench. 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.

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.

2.1.2 Ductile Iron Pressure Piping

2.1.2.1 Ductile Iron Pressure Pipe and Fittings

Ductile-iron pipe shall conform to AWWA C151, Thickness Class 52. Flanged pipe shall conform to AWWA C115. 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, for push-on joint. Fittings shall have pressure rating 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.

2.1.2.2 Ductile Iron Pressure Joints and Jointing Materials

a. Joints, general: Joints for pipe and fittings shall be push-on joints or mechanical joints except as otherwise specified in this paragraph. Joints made with sleeve-type mechanical coupling may be used in lieu of push-on joint.

b. Push-on joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to AWWA C111.

c. Mechanical joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.

d. Flanged joints: 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 A 536, Grade 65-45-12, and shall conform to the applicable requirements of ASME B16.1, Class 250. Setscrews for setscrewed flanges shall be 1310 MPa (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.

e. Joints made with sleeve-type mechanical couplings: Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat, two follower rings, two resilient tapered rubber gaskets, and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. Middle ring shall be of cast-iron, and the follower rings shall be of malleable iron or ductile iron. Cast iron shall conform to ASTM A 48M and shall be not less than Class 25. Malleable iron shall conform to ASTM A 47M. Ductile iron shall conform to ASTM A 536. Gaskets shall be designed for long life and resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111. Bolts shall be track-head type; bolts and nuts shall be either of the following: bolts conforming to the tensile requirements of ASTM A 307, Grade A, with nuts conforming to the tensile requirements of ASTM A 563M, Grade A; or round-head square-neck type bolts conforming to ANSI B18.5.2.1M and ASME B18.5.2.2M with hex nuts conforming to ASME B18.2.2. Bolts shall be 16 mm (5/8 inch) in diameter; minimum number of bolts for each

coupling shall be 4 for 100 mm (4 inch) pipe ,5 for 150 mm (6 inch) pipe, and 6 for 200 mm (8 inch) pipe. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Sleeve-type mechanical couplings shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint.

2.1.3 PVC Plastic Gravity Sewer Piping

2.1.3.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, or ASTM F 949 with ends suitable for elastomeric gasket joints.

2.1.3.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

2.1.4 PVC Plastic Pressure Pipe and Associated Fittings

2.1.4.1 PVC Plastic Pressure Pipe and Fittings

a. Pipe and Fittings Less Than 100 mm (4 inch) Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454B.

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785, Schedule 80, with joints meeting requirements of 1.03 Mpa (150 psi) working pressure, 1.38 Mpa (200 psi)hydrostatic test pressure, unless otherwise shown or specified. Fittings for threaded pipe shall conform to requirements of ASTM D 2464, 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 D 2464.

(2) Push-On Joint: ASTM D 3139, with ASTM F 477 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 D 1785 or ASTM D 2241 with joints meeting the requirements of 1.03 Mpa (150 psi)working pressure and 1.38 Mpa (200 psi) hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

b. Pipe and Fittings 100 mm (4 inch) Diameter to 300 mm (12 inch): Pipe shall conform to AWWA C900 and shall be plain end or gasket bell end, Pressure Class 150 (DR 18), with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110 or AWWA C153 and shall have cement-mortar lining conforming to AWWA C104, standard thickness.

Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with the PVC plastic pressure pipe specified in this paragraph.

2.1.4.2 PVC Plastic Pressure Joints and Jointing Material

Joints for pipe, 100 mm (4 inch) to 300 mm (12 inch) diameter, shall be push-on joints as specified in ASTM D 3139. Joints between pipe and fittings shall be push-on joints as specified in ASTM D 3139 or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D 3139 and AWWA C111. Each joint connection shall be provided with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical-joints for joint connections between pipe and fittings shall be as specified in AWWA C111, respectively, for push-on joints and mechanical-joints.

2.2 CONCRETE MATERIALS

2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II 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. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C 33, a cement containing less than 0.60 percent alkalies shall be used.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 28 MPa (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 17 MPa (2500 psi) minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.
Text

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manholes and Glass-Fiber-Reinforced Polyester Manholes.

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C 478M; base and first riser shall be monolithic.
Glass-Fiber-Reinforced Polyester Manholes shall conform to ASTM D 3753.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C 443M. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C 923M or ASTM C 990M.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Proplene Di Monomer (EPDM) rubber with a minimum thickness of 1.5 mm (60 mils). Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and valves are listed in the following tables:

Properties, Test Methods and Minimum Values for
Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl mastic
Tensile, kPa	ASTM D 412	12,684	15,132	-
Elogation percent	ASTM D 412	553	295	350
Tear Resistance, N/mm	ASTM D 624 (Die B)	49	28	-
Rebound, percent, 5 minutes	ASTM C 972 (mod.)	-	-	11
Rebound, percent, 2 hours	ASTM C 972	-	-	12

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

Frames and covers shall be cast iron, ductile iron or reinforced concrete. 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 181.4 kg (400 pounds). Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.4.2 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 D 4101, copolymer polypropylene. Rubber shall conform to ASTM C 443M, 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 less than 1.2 m (4 feet) deep.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 General Requirements for Installation of Pipelines

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 a point approximately 1.5 m (5 feet) from the building . Do not lay sewer line closer horizontally than 3 m (10 feet) to a water main or service line. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 0.60 m (2 feet) below bottom of water line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 3 m (10 feet) on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 0.9 m (3 feet), horizontal distance, to the water line.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02316.

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 7.50 m (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. Saddles for ABS and PVC composite pipe shall

conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

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.

b. Exterior protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet in accordance with AWWA C105, using Class A polyethylene film.

3.1.2.2 Installation of Ductile-Iron Pressure Lines

Unless otherwise specified, install pipe and 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, joint assembly, and valve-and-fitting installation.

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; 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.

b. Exterior protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet in accordance with AWWA C105, using Class A polyethylene film.

c. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C 94 having a minimum compressive strength of 13.80 MPa (2,000psi) 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 PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.2.4 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 UBPPA UNI-B-3 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 100 mm (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.

b. Pipe 100 mm (4 inch) Joints: Make push-on joints with the elastomeric gaskets specified for this type joint, using either

elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to fittings, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint and assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.

c. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C 94 having a minimum compressive strength of 13.80 MPa 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.

3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03300N, "Cast-In-Place Concrete."

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.4 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and 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 cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. 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.

Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. 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.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 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.

3.1.5.2 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.

b. Field painting: After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.1.6 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. 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.

3.2.2.1 Leakage Tests

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

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

b. Low-pressure air tests: Perform tests as follows:

(1) Clay pipelines: Test in accordance with ASTM C 828. Allowable pressure drop shall be as given in ASTM C 828. Make calculations in accordance with the Appendix to ASTM C 828.

(2) Concrete pipelines: Test in accordance with ASTM C 924M. Allowable pressure drop shall be as given in ASTM C 924M. Make calculations in accordance with the Appendix to ASTM C 924M.

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

(4) ABS composite plastic pipelines: Test in accordance with the applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

(5) PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D 2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

(1) A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

(2) Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 4 degrees C, and shall have a surface Brinell hardness of not less than 150.

(3) Center bored and through-bolted with a 6 mm (1/4 inch) minimum diameter steel shaft having a yield strength of not less than 483 MPa (70,000psi), with eyes or loops at each end for attaching pulling cables.

(4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.

c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

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 345 kPa in excess of the maximum working pressure of the system, but not less than 690 kPa, 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 ductile-iron pressure lines in accordance with the requirements of AWWA C600 for hydrostatic testing. Leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; allow no leakage at joints made by other methods.

-- End of Section --

SECTION 02532A

FORCE MAINS AND INVERTED SIPHONS; SEWER
07/98

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 basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D	(1994; Supple 1 Jun 1996; Supple 2 Dec 1997) Pipeline Valves (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2122	(1998) Determining Dimensions of Thermoplastic Pipe and Fittings
ASTM D 2241	(1996b) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings

ASTM D 2774	(1994) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3035	(1995) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(1997) PTFE Resin Skived Tape
ASTM D 3350	(1998a) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3754	(1996) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe
ASTM D 4101	(1999) Propylene Plastic Injection and Extrusion Materials
ASTM D 4161	(1996) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 1483	(1998) Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105	(1993) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other

	Liquids
AWWA C111	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1996) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C200	(1997) Steel Water Pipe - 6 In. (150 mm) and Larger
AWWA C203	(1997) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C207	(1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm through 3,600 mm)
AWWA C208	(1996) Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C210	(1997) Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C300	(1997) Reinforced Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids
AWWA C301	(1992) Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids
AWWA C303	(1995) Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type
AWWA C500	(1993; C500a) Metal-Seated Gate Valves for Water Supply Service
AWWA C508	(1993; C508a) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C600	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C900	(1997; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

AWWA C909	(1998) Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 IN through 12 IN (100 mm through 300 mm), for Water Distribution

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA TRD	(1997) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-78	(1998) Cast Iron Plug Valves, Flanged and Threaded Ends

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Hydrostatic Tests; G.

Copies of test results.

1.3 DELIVERY AND STORAGE

Pipe, fittings and accessories, and pipe coatings shall not be damaged during delivery, handling, and storage.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

Piping for force mains less than 100mm (4 inches) in diameter shall be polyvinyl chloride (PVC) plastic. Piping less than 100mm (4 inches) in diameter inside pump stations shall be galvanized steel. Piping for force mains 100mm (4 inches) in diameter and larger shall be ductile iron, or PVC plastic. Piping 100mm (4 inches) in diameter and larger inside pump stations shall be ductile iron pipe with bolted flange joints. Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PVC Pipe

a. PVC Pipe and Fittings Less Than 100mm (4 inches) Diameter: ASTM D 1785, Schedule 40, or ASTM D 2241, SDR 21, with screw joints,

push-on joints, or solvent weld joints.

b. PVC Pipe and Fittings 100mm (4 inches) Diameter and Larger: ASTM D 2241, SDR 21, or AWWA C900, Class 100, with push-on joints.

2.1.2 Ductile Iron Pipe

a. Ductile Iron Pipe: AWWA C151, working pressure not less than 1.38 mPa (150 psi) unless otherwise shown or specified.

c. Fittings, Mechanical: AWWA C110, rated for 1.38 mPa (150 psi)

d. Fittings, Push-On: AWWA C110 and AWWA C111, rated for 1.38 mPa (150 psi)

2.2 JOINTS

2.2.1 PVC Piping

a. Screw Joint Fittings: ASTM D 2464, Schedule 80.

b. Push-On Joint Fittings: ASTM D 3139, with ASTM F 477gaskets.

c. Solvent Cement: ASTM D 2564.

d. Couplings for use with plain end pipe shall have centering rings or stops to ensure the coupling is centered on the joint.

2.2.2 Ductile Iron Piping

a. Push-on Joints: AWWA C111.

b. Mechanical Joints: AWWA C111 as modified by AWWA C151.

c. Flanged Joints: AWWA C115.

2.3 VALVES

2.3.1 Gate Valves

Gate valves 75 mm (3 inches) and larger shall comply with AWWA C500. Valves for buried service shall be non-rising stem (NRS), square nut operated with joints applicable to the pipe or installation. Buried valves shall be furnished with extension stems comprising socket, extension stem and operating nut, and shall be of an appropriate length to bring operating nut to within 150mm (6 inches) of grade. One 1.2 m (4 foot) "T" handle valve wrench shall be furnished for each quantity of 6 buried valves. Gate valves that are exposed or installed inside shall be outside screw and yoke (OS&Y), handwheel operated with flange ends unless otherwise indicated. Gate valve operating nuts and handwheels shall have an arrow and the word "OPEN" cast in raised letters to indicate the direction of opening. Gate valves 100mm (4 inches) and larger shall be equipped with gearing to reduce operating effort. Gate valves 350 mm (14 inches) and larger installed in horizontal lines in horizontal position with stems horizontal shall be

equipped with bronze track, roller and scrapers to support the weight of the gate for its full length of travel. Gate valves and larger installed in vertical pipe lines with stems horizontal shall be fitted with slides to assist the travel of the gate assembly.

2.3.2 Check Valves

Check valves shall permit free flow of sewage forward and provide a positive check against backflow. Check valves shall be designed for a minimum working pressure of 1.38 mPa (150 psi) or as indicated. The body shall be iron. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body.

a. Ball Check Valves shall be iron body, shall have flanged ends, and shall be the non-slam type. Flanges shall be the 1.03 mPa (125 psi) type complying with ASME B16.1. Ball shall be stainless steel unless otherwise specified.

b. Swing Check Valves shall comply with AWWA C508 and shall be iron body, bronze mounted, and shall have flanged ends. Flanges shall be the 56Kg (125 pound) type complying with ASME B16.1.

2.3.3 Plug Valves

Cast iron valves shall comply with MSS SP-78. Steel plug valves shall comply with API Spec 6D.

2.3.4 Pinch Valves

Pinch valves shall be double acting, jam-proof type with unobstructed streamlined flows and built-in operator. The body shall be iron with a non-rising handwheel. The sleeve shall be of pure gum rubber, neoprene, Buna N or hypalon as required for service. The valve shall have flanged ends. Flanges shall be of the 56 Kg (125 pound) type complying with ASME B16.1.

2.3.5 Air Release Valves

Air release valves shall be designed to permit release of air from an empty pipe during filling and shall be capable of discharging accumulated air in the line while the line is in operation and under pressure. Valves shall be attached by means of threaded pipe connections. Valves shall be vented to the atmosphere.

a. Manual Air Release Valves: Manual air release valves shall consist of a 75mm (3 inch) gate valve and 75 mm (3 inch) ductile iron pipe and fittings. The valve shall be installed with its line of flow in the horizontal position.

b. Automatic Air Release Valve: Automatic air release valves shall be of the compound lever type capable of withstanding operating pressures of 1034 kPa (150 psi). The valves shall have a 13 mm (1/2 inch) outlet. The body and cover of the valve shall be of

iron with a stainless steel float. All internal parts shall be stainless steel or bronze. The valve shall be specifically adapted for use with sewage. Each valve shall be complete with hose and blow-off valves to permit backflushing without dismantling the valve.

2.4 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subject to vehicular traffic. Cast iron boxes shall be the extension type with slide type adjustment and with flared base. The minimum thickness of metal shall be 5 mm (3/16 inch). The box length shall be adaptable, without full extension, to the depth of cover over the pipe at the valve locations. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "SEWER" shall be cast in the cover.

2.5 VALVE VAULTS

Valve vaults shall be precast concrete units conforming to ASTM C 478M .

2.6 MISCELLANEOUS MATERIALS

Miscellaneous materials shall comply with the following requirements:

2.6.1 Pipe Coatings and Linings

a. Steel, interior: AWWA C203 or AWWA C210.

b. Steel, exterior, buried: AWWA C203.

c. Steel, exterior, exposed: AWWA C210.

2.6.2 Joint Lubricants

Joint lubricants shall be as recommended by the pipe manufacturer.

2.6.3 Bolts, Nuts and Glands

AWWA C111.

2.6.4 Joint Compound

A stiff mixture of graphite and oil or inert filler and oil.

2.6.5 Joint Tape

ASTM D 3308.

2.6.6 Bond Wire

Bond wire type RHW or USE, Size 1/0 AWG, neoprene jacketed copper conductor shaped to stand clear of the joint.

PART 3 EXECUTION

3.1 INSTALLATION

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and backfilling shall be as specified in Section 02316 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

3.1.1 Adjacent Facilities

Installation of force mains and inverted siphons near adjacent facilities shall be as specified in Section 02531 SANITARY SEWERS.

3.1.2 Cutting

Pipe shall be cut in a neat manner with mechanical cutters. Wheel cutters shall be used where practicable. Sharp and rough edges shall be ground smooth and loose material removed from the pipe before laying.

3.1.3 Laying

Except where otherwise authorized, pipe shall be laid with bells facing the direction of laying. Before lowering and while suspended, the pipe shall be inspected for defects. Defective material shall be rejected. Pipe shall be laid in compliance with the following:

a. Ductile Iron: AWWA C600.

d. Polyvinyl Chloride: Manufacturer's instructions.

3.1.4 Jointing

3.1.4.1 Joints for PVC Pipe

a. 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 joint 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.

b. 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. The gasket shall remain in proper position in the bell or coupling while the joint is made.

c. Solvent-weld joints shall comply with the manufacturer's instructions.

3.1.4.2 Joints for Ductile Iron Pipe

Installation of mechanical and push-on type joints shall comply with AWWA C600 and the manufacturer's instructions. Installation of flanged joints

shall comply with manufacturer's instructions.

3.1.5 Installation of Valves

Prior to installation, valves shall be cleaned of all foreign matter and inspected for damage. Valves shall be fully opened and closed to ensure that all parts are properly operating. Valves shall be installed with the stem in the vertical position.

3.1.6 Installation of Valve Boxes

Valve boxes shall be installed over each outside gate valve, unless otherwise indicated. Valve boxes shall be centered over the valve. Fill shall be carefully tamped around each valve box to a distance of on all sides or to undisturbed trench face, if less than

3.1.7 Installation of Valve Vaults

Valve vaults shall be installed as indicated.

3.1.8 Drain Lines

Drain lines shall be installed where indicated. The drain line shall consist of a tee in the main line with a diameter branch, a 100 mm (4 inch) diameter elbow, and a 100mm (4 inch) gate valve.

3.1.9 Thrust Restraint

Thrust Restraint shall be as specified in Section 02510 WATER DISTRIBUTION SYSTEM. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.9.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 1 after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.9.2 Restrained Joints

For ductile iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA TRD.

3.1.10 Grout

Grout for exterior joint protection on concrete pipes shall be a mix of 1 part portland cement, 2 parts sand, and of sufficient liquid consistency to flow into the joint recess beneath the diaper. Grout for interior joint protection shall be a mix of 1 part portland cement and 1 part sand. A polyurethane foam loop, impregnated with portland cement, may be substituted for grout for exterior joints.

3.1.11 Bonded Joints

Where indicated, a metallic bond shall be provided at each joint, including joints made with flexible couplings or rubber gaskets, of ferrous-metallic piping to effect continuous conductivity. The bond shall be of the thermal-weld type.

3.2 HYDROSTATIC TESTS

The pipeline shall be subjected to both a pressure test and a leakage test. The method proposed for disposal of waste water from hydrostatic tests shall be approved by the Contracting Officer. Testing shall be the responsibility of the Contractor. Testing shall be performed by an approved independent testing laboratory or by the Contractor subject to approval. The test may be witnessed by the Contracting Officer. The Contracting Officer shall be notified at least 7 days in advance of equipment tests. The final test report shall be delivered to the Contracting Officer within 30 days of the test.

3.2.1 Pressure Test

After the pipe has been installed, joints completed, thrust blocks have been in place for at least five days, and the trench has been partially backfilled, leaving the joints exposed for examination, the pipe shall be filled with water to expel all air. The pipeline shall be subjected to a test pressure of or 150 percent of the working pressure, whichever is greater, for a period of at least one hour. Each valve shall be opened and closed several times during the test. The exposed pipe, joints, fitting, and valves shall be examined for leaks. Visible leaks shall be stopped or the defective pipe, fitting, joints, or valve shall be replaced.

3.2.2 Leakage Test

The leakage test may be conducted subsequent to or concurrently with the pressure test. The amount of water permitted as leakage for the line shall be placed in a sealed container attached to the supply side of the test pump. No other source of supply will be permitted to be applied to the pump or line under test. The water shall be pumped into the line by the test pump as required to maintain the specified test pressure as described for pressure test for a 2 hour period. Exhaustion of the supply or the inability to maintain the required pressure will be considered test failure. The manufacturer shall be consulted prior to testing for special testing considerations. Allowable leakage shall be determined by the following I-P formula:

L = NDP/K Where:

L = Allowable leakage in gallons per hour.

N = Number of joints in length of pipeline tested.

D = Nominal diameter of the pipe in inches.

P = Square root of the test pressure in psig.

K = 7400 for pipe materials.

At the conclusion of the test, the amount of water remaining in the container shall be measured and the results recorded in the test report.

3.2.3 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted until the results of the tests are within specified allowances, without additional cost to the Government.

-- End of Section --

SECTION 02621A

FOUNDATION DRAINAGE SYSTEM
01/98

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY, STORAGE AND HANDLING

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Clay Pipe

2.1.2 Perforated Clay Pipe

2.1.3 Concrete Pipe

2.1.4 Perforated Concrete Pipe

2.1.5 Porous Concrete Pipe

2.1.6 Clay Drain Tile

2.1.7 Perforated Clay Drain Tile

2.1.8 Concrete Drain Tile

2.1.9 Plastic Pipe

2.1.9.1 Corrugated Polyethylene (PE) Drainage Pipe

2.1.9.2 Acrylonitrile-Butadiene-Styrene (ABS) Pipe

2.1.9.3 Polyvinyl Chloride (PVC) Pipe

2.1.9.4 Circular Perforations in Plastic Pipe

2.1.9.5 Slotted Perforations in Plastic Pipe

2.1.10 Fittings

2.1.11 Cleanouts and Piping Through Walls

2.1.12 Cover and Wrapping Materials for Open Joints in Drain Tile

2.1.13 Bedding and Pervious Backfill for Foundation Drains

2.1.14 Protective Covering for Pervious Backfill

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Extent

3.1.2 Outlet Connections

3.1.3 Drainage Lines

3.1.4 Outlet Lines

3.2 INSTALLATION

3.2.1 Trenching and Excavation

3.2.2 Bedding

3.2.3 Pipe Laying

3.2.4 Jointing

3.2.4.1 Perforated and Porous Pipes

3.2.4.2 Nonperforated Drain Tile

3.2.4.3 Joints of Concrete or Clay Sewer Pipe

3.2.4.4 Plain-End Perforated Clay

3.2.4.5 ABS Pipe

3.2.4.6 PVC Pipe

3.2.4.7 Corrugated Polyethylene

3.2.5 Outlet Lines

3.2.6 Backfilling

3.2.7 Cleanouts

-- End of Section --

SECTION 02630A

STORM-DRAINAGE SYSTEM
03/00

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

1.3.2 Handling

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

2.1.1 Concrete Pipe

2.1.1.1 Reinforced Arch Culvert and Storm Drainpipe

2.1.1.2 Reinforced Elliptical Culvert and Storm Drainpipe

2.1.2 Corrugated Steel Pipe

2.1.3 Corrugated Aluminum Alloy Pipe

2.1.3.1 Aluminum Fully Bituminous Coated

2.1.4 PVC Pipe

2.1.4.1 Type PSM PVC Pipe

2.1.4.2 Profile PVC Pipe

2.1.4.3 Smooth Wall PVC Pipe

2.1.4.4 Corrugated PVC Pipe

2.1.5 PE Pipe

2.1.5.1 Smooth Wall PE Pipe

2.1.5.2 Corrugated PE Pipe

2.1.5.3 Profile Wall PE Pipe

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

2.2.2 Precast Reinforced Concrete Box

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

2.3.2 Mortar

2.3.3 Precast Concrete Segmental Blocks

2.3.4 Brick

2.3.5 Precast Reinforced Concrete Manholes

2.3.6 Prefabricated Corrugated Metal Manholes

2.3.7 Frame and Cover for Gratings

2.3.8 Joints

2.3.8.1 Flexible Watertight Joints

2.3.8.2 External Sealing Bands

2.3.8.3 Flexible Watertight, Gasketed Joints

2.3.8.4 PVC Plastic Pipes

2.3.8.5 Smooth Wall PE Plastic Pipe

2.3.8.6 Corrugated PE Plastic Pipe

2.3.8.7 Profile Wall PE Plastic Pipe

2.3.8.8 Ductile Iron Pipe

2.4 STEEL LADDER

2.5 DOWNSPOUT BOOTS

2.6 RESILIENT CONNECTORS

2.7 HYDROSTATIC TEST ON WATERTIGHT JOINTS

2.7.1 Concrete, Clay, PVC and PE Pipe

2.7.2 Corrugated Steel and Aluminum Pipe

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

3.1.1 Trenching

3.1.2 Removal of Rock

3.1.3 Removal of Unstable Material

3.2 BEDDING

3.2.1 Concrete Pipe Requirements

3.2.2 Clay Pipe Requirements

3.2.3 Corrugated Metal Pipe

3.2.4 Ductile Iron Pipe

3.2.5 Plastic Pipe

3.3 PLACING PIPE

3.3.1 Concrete, Clay, PVC, Ribbed PVC and Ductile Iron Pipe

3.3.2 Elliptical and Elliptical Reinforced Concrete Pipe

3.3.3 Corrugated PE Pipe

3.3.4 Corrugated Metal Pipe and Pipe Arch

3.3.5 Multiple Culverts

3.3.6 Jacking Pipe Through Fills

3.4 JOINTING

3.4.1 Concrete and Clay Pipe

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

3.4.1.4 Cement-Mortar Tongue-and-Groove Joint

3.4.1.5 Cement-Mortar Diaper Joint for Tongue-and-Groove Pipe

3.4.1.6 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe

3.4.1.7 Flexible Watertight Joints

3.4.1.8 External Sealing Band Joint for Noncircular Pipe

3.4.2 Corrugated Metal Pipe

3.4.2.1 Field Joints

3.4.2.2 Flexible Watertight, Gasketed Joints

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

3.5.2 Walls and Headwalls

3.6 STEEL LADDER INSTALLATION

3.7 BACKFILLING

3.7.1 Backfilling Pipe in Trenches

3.7.2 Backfilling Pipe in Fill Sections

3.7.3 Movement of Construction Machinery

3.7.4 Compaction

3.7.4.1 General Requirements

3.7.4.2 Minimum Density

3.7.5 Determination of Density

3.8 PIPELINE TESTING

-- End of Section --

SECTION 02722A

AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE
05/01

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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop
AASHTO T 224	(1996) Correction for Coarse Particles in the Soil Compaction Test

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregates
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(1988; R 1993el) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(1997) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of

	Soils
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Graded-crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction. GCA is similar to ABC, but it has more stringent requirements and it produces a base course with higher strength and stability.

1.2.3 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools; G

List of proposed equipment to be used in performance of construction work, including descriptive data.

Waybills and Delivery Tickets; G

Copies of waybills and delivery tickets during the progress of the work. Before the final statement is allowed, the Contractor shall file certified waybills and certified delivery tickets for all aggregates actually used.

SD-06 Test Reports

Sampling and testing; G
Field Density Tests; G

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

1.4.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 2922. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 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 D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed.

1.4.2.5 Wear Test

Wear tests shall be made on ABC and GCA course material in conformance with ASTM C 131.

1.4.2.6 Soundness

Soundness tests shall be made on GCA in accordance with ASTM C 88.

1.4.3 Testing Frequency

1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

a. Sieve Analysis.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

1.4.3.2 In Place Tests

Each of the following tests shall be performed on samples taken from the placed and compacted ABC and GCA. Samples shall be taken and tested at the rates indicated.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square meters (250 square yards), or portion thereof, of completed area.

b. Sieve Analysis shall be performed for every 500 metric tons (500 tons), or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

1.4.4 Approval of Material

The source of the material shall be selected 10 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted ABC and GCA.

1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. (35 degrees F.) When the temperature falls below 2 degrees C (35 degrees F.), the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 AGGREGATES

The ABC and GCA shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, crushed recycled concrete, angular

sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. GCA shall be free of silt and clay as defined by ASTM D 2487, organic matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm (No. 4) sieve shall be known as coarse aggregate; that portion passing the 4.75 mm (No.4) sieve shall be known as fine aggregate.

2.1.1 Coarse Aggregate

Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.

c. Crushed Recycled Concrete: Crushed recycled concrete shall consist of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. The recycled material shall be free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and shall be crushed and processed to meet the required gradations for coarse aggregate. Crushed recycled concrete shall meet all other applicable requirements specified below.

2.1.1.1 Aggregate Base Course

ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

2.1.1.2 Graded-Crushed Aggregate Base Course

GCA coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. GCA coarse aggregate shall not exhibit a loss greater than 40 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The amount of flat and elongated particles shall not exceed 20 percent for the fraction retained on the 12.5 mm (1/2 inch) sieve nor 20 percent for the fraction passing the 12.5 mm (1/2 inch) sieve. A flat particle is one having a ratio of width to

thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

2.1.2.1 Aggregate Base Course

ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.2.2 Graded-Crushed Aggregate Base Course

GCA fine aggregate shall consist of angular particles produced by crushing stone, slag, recycled concrete, or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate.

2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 18 mm (3/4 inch) and shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E 11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
50.0 mm	100	----	----
37.5 mm	70-100	100	----
25.0 mm	45-80	60-100	100
12.5 mm	30-60	30-65	40-70
4.75 mm	20-50	20-50	20-50
2.00 mm	15-40	15-40	15-40
0.425 mm	5-25	5-25	5-25
0.075 mm	0-8	0-8	0-8

NOTE 1: Particles having diameters less than 0.02 mm (0.0008 inch) shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the 0.425 mm (NO. 40) sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC or GCA is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from offsite sources.

3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the ABC and GCA, the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the ABC and GCA, the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified

compaction and surface tolerances. The underlying course shall conform to Section 02300 EARTHWORK. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the ABC and GCA. Stabilization shall be accomplished by mixing ABC or GCA into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the ABC and GCA is placed.

3.5 INSTALLATION

3.5.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make adjustments in mixing procedures or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory ABC and GCA meeting all requirements of this specification.

3.5.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm (6 inches) or less than 75mm (3 inches) when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the ABC and GCA is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable ABC and GCA.

3.5.3 Grade Control

The finished and completed ABC and GCA shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required ABC and GCA thickness so that the finished ABC and GCA with the subsequent surface course will meet the designated grades.

3.5.4 Edges of Base Course

The ABC and GCA shall be placed so that the completed section will be a minimum of 1.5 m (5 feet) wider, on all sides, than the next layer that will be placed above it. Additionally, approved fill material shall be placed along the outer edges of ABC and GCA in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 600 mm (2 foot) width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of ABC and GCA. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

3.5.5 Compaction

Each layer of the ABC and GCA shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 100 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory ABC and GCA. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.5.6 Thickness

Compacted thickness of the aggregate course shall be as indicated. No individual layer shall exceed 150 mm (6 inches) nor be less than 75 mm (3 inches) in compacted thickness. The total compacted thickness of the ABC and GCA course shall be within 13 mm (1/2 inch) of the thickness indicated. Where the measured thickness is more than 13 mm (1/2 inch) deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 13 mm (1/2 inch) thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 6 mm (1/4 inch) of the thickness indicated. The total thickness of the ABC and GCA course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square meters (yards) of base course. Measurements shall be made in 75 mm (3 inch) diameter test holes penetrating the base course.

3.5.7 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of 30 coverages with a heavy pneumatic-tired roller having four or more tires, each loaded to a minimum of 13,600 kg (30,000 pounds) and inflated to a minimum of 1035 kPa(150 psi). In areas designated, proof rolling shall be applied to the top of the underlying material on which ABC and GCA is laid and to each layer of ABC and GCA. Water content of the underlying material shall be maintained at optimum or at the percentage directed from start of compaction to completion of proof rolling of that layer. Water content of each layer of the ABC and GCA shall be maintained at the optimum percentage directed from start of compaction to completion of proof rolling. Any ABC and GCA materials or any underlying materials that produce unsatisfactory results by proof rolling shall be removed and replaced with satisfactory materials, recompacted and proof rolled to meet these specifications.

3.5.8 Finishing

The surface of the top layer of ABC and GCA shall be finished after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of ABC and GCA is 13 mm (1/2 inch) or more below grade, then the top layer should be scarified to a depth of at least 75 mm (3 inches) and new material shall be blended in, compacted and proof rolled to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

3.5.9 Smoothness

The surface of the top layer shall show no deviations in excess of 10 mm (3/8 inch) when tested with a 3.05 meter (10 foot) straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 15 meter (50 foot) intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.6 TRAFFIC

Traffic shall not be allowed on the completed ABC and GCA course.

3.7 MAINTENANCE

The ABC and GCA shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any ABC and GCA that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of ABC and

GCA that is damaged shall be reworked or replaced as necessary to comply with this specification.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of in waste disposal areas indicated. No additional payments will be made for materials that must be replaced.

-- End of Section --

SECTION 02741A

HOT-MIX ASPHALT (HMA) FOR ROADS
09/99

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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO MP 1	(1998)Provisional Specification for Performance Graded Asphalt Binder
AASHTO MP 2	(1998; Interim 1999) Superpave Volumetric Mix Design
AASHTO TP53	(1998; Interim 1999) Determining Asphalt Content of Hot Mix Asphalt by the Ignition Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregates
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 566	(1997) Evaporable Total Moisture Content of Aggregate by Drying
ASTM C 1252	(1998) Uncompacted Void Content of Fine Aggregate (as Influenced by Particle

	Shape, Surface Texture, and Grading)
ASTM D 140	(1998) Sampling Bituminous Materials
ASTM D 242	(1995) Mineral Filler for Bituminous Paving Mixtures
ASTM D 946	(1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 995	(1995b) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
ASTM D 1461	(1985)) Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2041	(1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2419	(1995) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2489	(1984; R 1994el) Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D 2726	(1996el) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture
ASTM D 2950	(1997) Density of Bituminous Concrete in Place by Nuclear Method
ASTM D 3381	(1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3665	(1999) Random Sampling of Construction Materials
ASTM D 3666	(1998) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 4125	(1994el)Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4791	(1999) Flat Particles, Elongated

	Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4867/D 4867M	(1996) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate
ASTM D 6307	(1998) Asphalt Content of Hot Mix Asphalt by Ignition Method

ASPHALT INSTITUTE (AI)

AI MS-02	(1997) Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types
AI MS-22	(1998; 2nd Edition) Construction of Hot-Mix Asphalt Pavements

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

CDT Test 526	(1978) Operation of California Profilograph and Evaluation of Profiles

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 171	(1995) Test Method for Determining Percentage of Crushed Particles in Aggregate

1.2 DESCRIPTION OF WORK

The work shall consist of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design; G.

Proposed JMF.

Contractor Quality Control; G.

Quality control plan.

Material Acceptance and Percent Payment; G.

Acceptance test results and pay calculations.

SD-04 Samples

Asphalt Cement Binder; G.

(20 L)(sample for mix design verification.

SD-06 Test Reports

Aggregates; G.
QC Monitoring; G.

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder; G.

Copies of certified test data.

Testing Laboratory; G.

Certification of compliance.

Plant Scale Calibration Certification

1.4 ASPHALT MIXING PLANT

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of ASTM D 995 with the following changes:

a. Truck Scales. The asphalt mixture shall be weighed on approved certified scales at the Contractor's expense. Scales shall be inspected and sealed at least annually by an approved calibration laboratory.

b. Testing Facilities. The Contractor shall provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

c. Inspection of Plant. The Contracting Officer shall have access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. The Contractor shall provide assistance as requested, for the Government to procure any desired samples.

d. Storage Bins. Use of storage bins for temporary storage of hot-mix asphalt will be permitted as follows:

(1) The asphalt mixture may be stored in non-insulated storage bins for a period of time not exceeding 3 hours.

(2) The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 8 hours. The mix drawn from bins shall meet the same requirements as mix loaded directly into trucks.

1.5 HAULING EQUIPMENT

Trucks used for hauling hot-mix asphalt shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

1.6 ASPHALT PAVERS

Asphalt pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1.6.1 Receiving Hopper

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

1.6.2 Automatic Grade Controls

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A transverse slope controller shall not be used to control grade. The controls shall be capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 9.14 m (30 feet) in length.

b. Taut stringline set to grade.

c. Short ski or shoe for joint matching.

d. Laser control.

1.7 ROLLERS

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Equipment which causes excessive crushing of the aggregate shall not be used.

1.8 WEATHER LIMITATIONS

The hot-mix asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 1. Surface Temperature Limitations of Underlying Course

Mat Thickness, mm	Degrees C
75 or greater	4
Less than 75	7

PART 2 PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The portion of material retained on the 4.75 mm (No. 4) sieve is coarse aggregate. The portion of material passing the 4.75 mm (No. 4) sieve and retained on the 0.075 mm (No. 200) sieve is fine aggregate. The portion passing the 0.075 mm (No. 200) sieve is defined as mineral filler. All aggregate test results and samples shall be submitted to the Contracting Officer at least 14 days prior to start of construction.

2.1.1 Coarse Aggregate

Coarse aggregate shall consist of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. All individual coarse aggregate sources shall meet the following requirements:

a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C 131.

b. The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C 88 using magnesium sulfate.

c. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.

d. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20% percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D 4791.

e. Slag shall be air-cooled, blast furnace slag, and shall have a compacted weight of not less than 1200 kg/cubic meter (75 lb/cu ft) when tested in accordance with ASTM C 29/C 29M.

2.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles. The aggregate particles shall be free from coatings of clay, silt, or any objectionable material and shall contain no clay balls. All individual fine aggregate sources shall have a sand equivalent value not less than 45 when tested in accordance with ASTM D 2419.

The fine aggregate portion of the blended aggregate shall have an uncompacted void content not less than 43.0 percent when tested in accordance with ASTM C 1252 Method A.

2.1.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D 242.

2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table 2, when tested in accordance with ASTM C 136 and ASTM C 117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

Table 2. Aggregate Gradations

Sieve Size, mm	Gradation 1 Percent Passing by Mass	Gradation 2 Percent Passing by Mass	Gradation 3 Percent Passing
25.0	100	---	---
19.0	76-96	100	---
12.5	68-88	76-96	100

Table 2. Aggregate Gradations

Sieve Size, mm	Gradation 1 Percent Passing by Mass	Gradation 2 Percent Passing by Mass	Gradation 3 Percent Passing
9.5	60-82	69-89	76-96
4.75	45-67	53-73	58-78
2.36	32-54	38-60	40-60
1.18	22-44	26-48	28-48
0.60	15-35	18-38	18-38
0.30	9-25	11-27	11-27
0.15	6-18	6-18	6-18
0.075	3-6	3-6	3-6

2.2 ASPHALT CEMENT BINDER

Asphalt cement binder shall conform to ASTM D 3381 Table 2. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Contracting Officer. The supplier is defined as the last source of any modification to the binder. The Contracting Officer may sample and test the binder at the mix plant at any time before or during mix production. Samples for this verification testing shall be obtained by the Contractor in accordance with ASTM D 140 and in the presence of the Contracting Officer. These samples shall be furnished to the Contracting Officer for the verification testing, which shall be at no cost to the Contractor. Samples of the asphalt cement specified shall be submitted for approval not less than 14 days before start of the test section.

2.3 MIX DESIGN

The Contractor shall develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). No hot-mix asphalt for payment shall be produced until a JMF has been approved. The hot-mix asphalt shall be designed using procedures contained in AI MS-02 and the criteria shown in Table 3. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867/D 4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. If an antistrip agent is required, it shall be provided by the Contractor at no additional cost. Sufficient materials to produce 90 kg (200 pound) of blended mixture shall be provided to the Contracting Officer for verification of mix design at least 14 days prior to construction of test section.

At the option of the contractor a currently used DOT superpave hot mix may be used in lieu of developing a new hot mix design study as described herein. The superpave volumetric mix shall be designed in accordance with

AASHTO MP 2.

2.3.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

a. Percent passing each sieve size.

b. Percent of asphalt cement.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt viscosity grade, penetration grade, or performance grade.

e. Number of blows of hammer per side of molded specimen.

f. Laboratory mixing temperature.

g. Lab compaction temperature.

h. Temperature-viscosity relationship of the asphalt cement.

i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-02.

k. Specific gravity and absorption of each aggregate.

l. Percent natural sand.

m. Percent particles with 2 or more fractured faces (in coarse aggregate).

n. Fine aggregate angularity.

o. Percent flat or elongated particles (in coarse aggregate).

p. Tensile Strength Ratio(TSR).

q. Antistrip agent (if required) and amount.

r. List of all modifiers and amount.

s. Percentage and properties (asphalt content, binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) in accordance with paragraph RECYCLED HOT-MIX ASPHALT, if RAP is used.

Table 3. Marshall Design Criteria

Test Property	75 Blow Mix	50 Blow Mix
Stability, newtons minimum	*8000	*4450
Flow, 0.25 mm	8-16	8-18
Air voids, percent	3-5	3-5
Percent Voids in mineral aggregate (VMA), (minimum)		
Gradation 1	13.0	13.0
Gradation 2	14.0	14.0
Gradation 3	15.0	15.0
TSR, minimum percent	75	75

* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.
** Calculate VMA in accordance with AI MS-02, based on ASTM D 2726 bulk specific gravity for the aggregate.

2.3.2 Adjustments to Field JMF

The Laboratory JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new laboratory jmf design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the Laboratory JMF within the limits specified below to optimize mix volumetric properties with the approval of the Contracting Officer. Adjustments to the Laboratory JMF shall be applied to the field (plant) established JMF and limited to those values as shown. Adjustments shall be targeted to produce or nearly produce 4 percent voids total mix (VTM).

TABLE 4. Field (Plant) Established JMF Tolerances

Sieves	Adjustments (plus or minus), percent
12.5 mm	3
4.75 mm	3
2.36 mm	3
0.075 mm	1
Binder Content	0.4

If adjustments are needed that exceed these limits, a new mix design shall

be developed. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 2; while not desirable, this is acceptable.

2.4 RECYCLED HOT MIX ASPHALT

Recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 50 mm (2 inches). The recycled HMA mix shall be designed using procedures contained in AI MS-02 and AI MS-22. The job mix shall meet the requirements of paragraph MIX DESIGN. The amount of RAP shall not exceed 30 percent.

2.4.1 RAP Aggregates and Asphalt Cement

The blend of aggregates used in the recycled mix shall meet the requirements of paragraph AGGREGATES. The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D 2172 using the appropriate dust correction procedure.

2.4.2 RAP Mix

The blend of new asphalt cement and the RAP asphalt binder shall meet the viscosity requirements in paragraph ASPHALT CEMENT BINDER. The virgin asphalt cement shall not be more than two standard asphalt material grades different than that specified in paragraph ASPHALT CEMENT BINDER.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

The asphalt cement material shall be heated avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 160 degrees C when added to the aggregates. Modified asphalts shall be no more than 174 degrees C when added to the aggregates.

3.2 PREPARATION OF MINERAL AGGREGATE

The aggregate for the mixture shall be heated and dried prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 175 degrees C (350 degrees F) when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of

asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D 1461.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, the underlying course shall be cleaned of dust and debris. A prime coat and/or tack coat shall be applied in accordance with the contract specifications.

3.5 TEST SECTION

Prior to full production, the Contractor shall place a test section for each JMF used. The contractor shall construct a test section 75 - 150 m (250-500 feet) long and two paver passes wide placed for two lanes, with a longitudinal cold joint. The test section shall be of the same depth as the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment and personnel used in construction of the test section shall be the same equipment to be used on the remainder of the course represented by the test section. The test section shall be placed as part of the project pavement as approved by the Contracting Officer.

3.5.1 Sampling and Testing for Test Section

One random sample shall be taken at the plant, triplicate specimens compacted, and tested for stability, flow, and laboratory air voids. A portion of the same sample shall be tested for aggregate gradation and asphalt content. Four randomly selected cores shall be taken from the finished pavement mat, and four from the longitudinal joint, and tested for density. Random sampling shall be in accordance with procedures contained in ASTM D 3665. The test results shall be within the tolerances shown in Table 5 for work to continue. If all test results meet the specified requirements, the test section shall remain as part of the project pavement. If test results exceed the tolerances shown, the test section shall be removed and replaced at no cost to the Government and another test section shall be constructed. The test section shall be paid for with the first lot of paving

Table 5. Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	

Table 5. Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
4.75 mm and larger	JMF plus or minus 8
2.36, 1.18, 0.60, and 0.30 mm	JMF plus or minus 6
0.15 and 0.075 mm	JMF plus or minus 2.0
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	13 minimum
Stability, newtons (Average of 3 specimens)	4450 minimum
Flow, 0.25 mm (Average of 3 specimens)	8 - 16
Mat Density, Percent of Marshall (Average of 4 Random Cores)	97.0 - 100.5
Joint Density, Percent of Marshall (Average of 4 Random Cores)	95.5 - 100.5

3.5.2 Additional Test Sections

If the initial test section should prove to be unacceptable, the necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Full production shall not begin until an acceptable section has been constructed and accepted.

3.6 TESTING LABORATORY

The laboratory used to develop the JMF shall meet the requirements of ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The certification shall contain as a minimum:

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

d. Evidence of participation in the AASHTO Materials Reference

Laboratory (AMRL) program.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

The hot-mix asphalt shall be transported from the mixing plant to the site in clean, tight vehicles. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 60 degrees C (140 degrees F). To deliver mix to the paver, the Contractor shall use a material transfer vehicle which shall be operated to produce continuous forward motion of the paver.

3.7.2 Placing

The mix shall be placed and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, the mixture shall be placed to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 3 m. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 300 mm; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 3 m (10 feet) from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 3 m (10 feet). On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.8 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be compacted as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly

compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.9 JOINTS

The formation of joints shall be made ensuring a continuous bond between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

The roller shall not pass over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing material at the joint . The cutback material shall be removed from the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Longitudinal joints which are irregular, damaged, uncompacted, cold (less than 80 degrees C (175 degrees F) at the time of placing adjacent lanes), or otherwise defective, shall be cut back a minimum of 50 mm from the edge with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All contact surfaces shall be given a light tack coat of asphalt material prior to placing any fresh mixture against the joint. The Contractor will be allowed to use an alternate method if it can be demonstrated that density, smoothness, and texture can be met.

3.10 CONTRACTOR QUALITY CONTROL

3.10.1 General Quality Control Requirements

The Contractor shall develop an approved Quality Control Plan. Hot-mix asphalt for payment shall not be produced until the quality control plan has been approved. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction

l.Surface Smoothness

3.10.2 Testing Laboratory

The Contractor shall provide a fully equipped asphalt laboratory located at the plant or job site. The laboratory shall meet the requirements as required in ASTM D 3666. The effective working area of the laboratory shall be a minimum of 14 square meters with a ceiling height of not less than 2.3 m (7.5 feet). Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 24 degrees C plus or minus 2.3 degrees C (75 degrees plus or minus 5 degrees F). Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The Contracting Officer shall be permitted unrestricted access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

3.10.3 Quality Control Testing

The Contractor shall perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow, in-place density, grade and smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

3.10.3.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot (a lot is defined in paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT) by one of the following methods: the extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53or ASTM D 6307, or the nuclear method in accordance with ASTM D

4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

3.10.3.2 Gradation

Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

3.10.3.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.10.3.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

3.10.3.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per lot in accordance with ASTM D 1461 or an approved alternate procedure.

3.10.3.6 Laboratory Air Voids, Marshall Stability and Flow

Mixture samples shall be taken at least four times per lot and compacted into specimens, using 50 blows per side with the Marshall hammer as described in ASTM D 1559. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

3.10.3.7 In-Place Density

The Contractor shall conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D 2950.

3.10.3.8 Grade and Smoothness

The Contractor shall conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT.

3.10.3.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.10.3.10 QC Monitoring

The Contractor shall submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.10.4 Sampling

When directed by the Contracting Officer, the Contractor shall sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.10.5 Control Charts

For process control, the Contractor shall establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 6, as a minimum. These control charts shall be posted as directed by the Contracting Officer and shall be kept current at all times. The control charts shall identify the project number, the test parameter being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 6 applicable to the test parameter being plotted, and the Contractor's test results. Target values from the JMF shall also be shown on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, the Contractor shall take immediate steps to bring the process back in control. When the test results exceed either applicable Suspension Limit, the Contractor shall halt production until the problem is solved. The Contractor shall use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Decisions concerning mix modifications shall be made based on analysis of the results provided in the control charts. The Quality Control Plan shall indicate the appropriate action which shall be taken to bring the process into control when certain parameters exceed their Action Limits.

(Table 6. Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

Parameter to be Plotted	Running Average of Individual Samples		Last Four Samples	
	Action Limit	Suspension Limit	Action Limit	Suspension Limit
4.75 mm sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	6	8	4	5
0.6 mm sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	4	6	3	4
0.075 mm sieve, Cumulative % Passing, deviation from JMF target; plus or minus values	1.4	2.0	1.1	1.5
Stability, newtons (minimum)				
75 Blow JMF	8000	7560	8440	8000
50 Blow JMF	4450	4000	4900	4450
Flow, 0.25 mm				
75 Blow JMF	8 min. 16 max.	7 min. 17 max.	9 min. 15 max.	8 min. 16 max.
50 Blow JMF	8 min. 18 max.	7 min. 19 max.	9 min. 17 max.	8 min. 18 max
Asphalt content, % deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, % deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Mat Density, % of Marshall density	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, % of Marshall density	No specific action and suspension limits set since this parameter is used to determine percent payment)			

3.11 MATERIAL ACCEPTANCE AND PERCENT PAYMENT

Testing for acceptability of work will be performed by an independent laboratory hired by the Contractor. Test results and payment calculations

shall be forwarded daily to the Contracting Officer. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. A standard lot for all requirements will be equal to 2000 metric tons (2000 TONS) . Where appropriate, adjustment in payment for individual lots of hot-mix asphalt will be made based on in-place density, laboratory air voids, grade and smoothness in accordance with the following paragraphs. Grade and surface smoothness determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus grade and smoothness measurements for the entire lot cannot be made. In order to evaluate laboratory air voids and in-place (field) density, each lot will be divided into four equal sublots.

3.11.1 Percent Payment

When a lot of material fails to meet the specification requirements for 100 percent pay as outlined in the following paragraphs, that lot shall be removed and replaced, or accepted at a reduced price which will be computed by multiplying the unit price by the lot's pay factor. The lot pay factor is determined by taking the lowest computed pay factor based on either laboratory air voids, in-place density, grade or smoothness (each discussed below). At the end of the project, an average of all lot pay factors will be calculated. If this average lot pay factor exceeds 95.0 percent, then the percent payment for the entire project will be 100 percent of the unit bid price. If the average lot pay factor is less than 95.0 percent, then each lot will be paid for at the unit price multiplied by the lot's pay factor. For any lots which are less than 2000 metric tons (2000 tons) , a weighted lot pay factor will be used to calculate the average lot pay factor.

3.11.2 Sublot Sampling

One random mixture sample for determining laboratory air voids, theoretical maximum density, and for any additional testing the Contracting Officer desires, will be taken from a loaded truck delivering mixture to each sublot, or other appropriate location for each sublot. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D 3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D 1559. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

3.11.3 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.11.4 Laboratory Air Voids

Laboratory air voids will be calculated by determining the Marshall density of each lab compacted specimen using ASTM D 2726 and determining the theoretical maximum density of every other sublot sample using ASTM D 2041. Laboratory air void calculations for each sublot will use the latest theoretical maximum density values obtained, either for that sublot or the previous sublot. The mean absolute deviation of the four laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated and a pay factor determined from Table 7. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot.

3.11.5 Mean Absolute Deviation

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 random samples of a lot (where 3 specimens were compacted from each sample). The average laboratory air voids for each sublot sample are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

Mean Absolute Deviation = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 - 4.0|/4

= (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen from Table 7 that the lot's pay factor based on laboratory air voids, is 100 percent.

Table 7. Pay Factor Based on Laboratory Air Voids

Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, %
O.60 or less	100
0.61 - 0.80	98
0.81 - 1.00	95
1.01 - 1.20	90
Above 1.20	reject (0)

3.11.6 In-place Density

3.11.6.1 General Density Requirements

For determining in-place density, one random core will be taken by the Government from the mat (interior of the lane) of each sublot, and one random core will be taken from the joint (immediately over joint) of each sublot. Each random core will be full thickness of the layer being placed. When the random core is less than 25 mm (1 inch) thick, it will not be included in the analysis. In this case, another random core will be taken. After air drying to a constant weight, cores obtained from the mat and from the joints will be used for in-place density determination.

3.11.6.2 Mat and Joint Densities

The average in-place mat and joint densities are expressed as a percentage of the average Marshall density for the lot. The Marshall density for each lot will be determined as the average Marshall density of the four random samples (3 specimens compacted per sample). The average in-place mat density and joint density for a lot are determined and compared with Table 8 to calculate a single pay factor per lot based on in-place density, as described below. First, a pay factor for both mat density and joint density are determined from Table 8. The area associated with the joint is then determined and will be considered to be 3 m (10 feet) wide times the length of completed longitudinal construction joint in the lot. This area will not exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of hot-mix asphalt pavement, either an adjacent freshly paved lane or one paved at any time previously. The area associated with the joint is expressed as a percentage of the total lot area. A weighted pay factor for the joint is determined based on this percentage (see example below). The pay factor for mat density and the weighted pay factor for joint density is compared and the lowest selected. This selected pay factor is the pay factor based on density for the lot. When the Marshall density on both sides of a longitudinal joint is different, the average of these two densities will be used as the Marshall density needed to calculate the percent joint density. All density results for a lot will be completed and reported within 24 hours after the construction of that lot.

Table 8. Pay Factor Based on In-place Density

Average Mat Density (4 Cores)	Pay Factor, %	Average Joint Density (4 Cores)
97.9 or 100	100.0	96.4 or above
97.8 or 100.1	99.9	96.3
97.7	99.8	96.2
97.6 or100.2	99.6	96.1
97.5	99.4	96.0
97.4 or 100.3	99.1	95.9
97.3	98.7	95.8
97.2 or 100.4	98.3	95.7
97.1	97.8	95.6
97.0 or 100.5	97.3	95.5
96.9	96.3	95.4
96.8 or 100.6	94.1	95.3
96.7	92.2	95.2
96.6 or 100.7	90.3	95.1
96.5	87.9	95.0
96.4 or 100.8	85.7	94.9
96.3	83.3	94.8
96.2 or 100.9	80.6	94.7
96.1	78.0	94.6
96.0 or 101.0	75.0	94.5
below 96.0or above 101.0	0.0 (reject)	below 94.5

3.11.6.3 Pay Factor Based on In-place Density

An example of the computation of a pay factor (in I-P units only) based on in-place density, is as follows: Assume the following test results for field density made on the lot: (1) Average mat density = 97.2 percent (of lab density). (2) Average joint density = 95.5 percent (of lab density). (3) Total area of lot = 30,000 square feet. (4) Length of completed longitudinal construction joint = 2000 feet.

a. Step 1: Determine pay factor based on mat density and on joint density, using Table 8:

Mat density of 97.2 percent = 98.3 pay factor.

Joint density of 95.5 percent = 97.3 pay factor.

b. Step 2: Determine ratio of joint area (length of longitudinal joint x 10 ft) to mat area (total paved area in the lot): Multiply the length of completed longitudinal construction joint by the specified 10 ft. width and divide by the mat area (total paved area in the lot).

(2000 ft. x 10 ft.)/30000 sq.ft. = 0.6667 ratio of joint area to mat area (ratio).

c. Step 3: Weighted pay factor (wpf) for joint is determined as indicated below:

wpf = joint pay factor + (100 - joint pay factor) (1 - ratio)
wpf = 97.3 + (100-97.3) (1-.6667) = 98.2%

d. Step 4: Compare weighted pay factor for joint density to pay factor for mat density and select the smaller:

Pay factor for mat density: 98.3%. Weighted pay factor for joint density: 98.2%

Select the smaller of the two values as pay factor based on density: 98.2%

3.11.7 Grade

The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 15 mm (0.05 foot) from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The final wearing surface of the pavement will be tested for conformance with specified plan grade requirements. The grade will be determined by running lines of levels at intervals of 7.6 m , or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular lot incorporating the final wearing surface, the Contracting Officer will inform the Contractor in writing, of the results of the grade-conformance tests. When more than 5 percent of all measurements made

within a lot are outside the 15 mm (0.05 foot) tolerance, the pay factor based on grade for that lot will be 95 percent. In areas where the grade exceeds the tolerance by more than 50 percent, the Contractor shall remove the surface lift full depth; the Contractor shall then replace the lift with hot-mix asphalt to meet specification requirements, at no additional cost to the Government. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

3.11.8 Surface Smoothness

The Contractor shall use one of the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all longitudinal and transverse testing, except where the runs would be less than 60 m (200 feet) in length and the ends where the straightedge shall be used. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

3.11.8.1 Smoothness Requirements

a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 6 mm (1/4 foot) or more, and all pavements shall be within the tolerances specified in Table 9 when checked with an approved 4 m straightedge.

Table 9. Straightedge Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Tolerance, mm
All paved areas	Longitudinal	6
	Transverse	6

b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 3 mm (1/8 inch) or more, and all pavement shall have a Profile Index not greater than specified in Table 10 when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 60 m (200 feet) , that direction shall be tested by the straightedge method and shall meet requirements specified above.

Table 10. Profilograph Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Maximum Specified Profile Index (mm/km)
All Paved Areas	Longitudinal	140

3.11.8.2 Testing Method

After the final rolling, but not later than 24 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 8 m (25 feet) or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lines less than 6.1 m (20 feet) and at the third points for lanes 6.1 m (20 feet) or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints.

a. Straightedge Testing. 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 freestanding (unleveled) 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.

b. Profilograph Testing. Profilograph testing shall be performed using approved equipment and procedures described in CDT Test 526. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. The "blanking band" shall be 5 mm (0.2 inches) wide and the "bump template" shall span 25 mm (1 inch) with an offset of 10 mm (0.4 inch). The profilograph shall be operated by an approved, factory-trained operator on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing.

3.11.8.3 Payment Adjustment for Smoothness

a. Straightedge Testing. Location and deviation from straightedge for all measurements shall be recorded. When between 5.0 and 10.0 percent of all measurements made within a lot exceed the tolerance specified in paragraph Smoothness Requirements above, after any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness, will be 95 percent. When more than 10.0 percent of all measurements exceed the tolerance, the computed pay factor will be 90 percent. When between 15.0 and 20.0 percent of all measurements exceed the tolerance, the computed pay factor will be 75 percent. When 20.0 percent or more of the measurements exceed the tolerance, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent, shall be corrected by diamond grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

b. Profilograph Testing. Location and data from all profilograph measurements shall be recorded. When the Profile Index of a lot exceeds the tolerance specified in paragraph Smoothness Requirements above by 16 mm/km (1.0 inch/mile) , but less than 32 mm/km (2.0 inches/mile), after

any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness will be 95 percent. When the Profile Index exceeds the tolerance by 32 mm/km (, but less than 47 mm/km (3.0 inches/mile), the computed pay factor will be 90 percent. When the Profile Index exceeds the tolerance by 47 mm/km(3.0 inches/mile) , but less than 63 mm/km (4.0 inches/mile), the computed pay factor will be 75 percent. When the Profile Index exceeds the tolerance by 63 mm/km (4.0 inches/mile) or more, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 79 mm/km (5.0 inches/mile) or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

c. Bumps ("Must Grind" Areas). Any bumps ("must grind" areas) shown on the profilograph trace which exceed 10 mm (0.4 inch) in height shall be reduced by diamond grinding until they do not exceed 7.5 mm (0.3 inch) when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. The following will not be permitted: (1) skin patching for correcting low areas, (2) planing or milling for correcting high areas. At the Contractor's option, pavement areas, including ground areas, may be rechecked with the profilograph in order to record a lower Profile Index.

-- End of Section --

SECTION 02754A

CONCRETE PAVEMENTS FOR SMALL PROJECTS
07/01

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 basic designation only.

ACI INTERNATIONAL (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	(1999) Standard Specifications for Structural Concrete
ACI 305R	(1999) Hot Weather Concreting

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 184/A 184M	(1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 615/A 615M	(2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 31/C 31M	(2000) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999ael) Concrete Aggregates
ASTM C 39/C 39M	(1999) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94/C 94M	(2000) Ready-Mixed Concrete
ASTM C 123	(1998) Lightweight Particles in Aggregate
ASTM C 143/C 143M	(2000) Slump of Hydraulic Cement Concrete
ASTM C 150	(1999a) Portland Cement
ASTM C 192/C 192M	(2000) Making and Curing Concrete Test Specimens in the Laboratory

ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2000) Air-Entraining Admixtures for Concrete
ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete
ASTM C 595	(2000a) Blended Hydraulic Cements
ASTM C 618	(2000) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 666	(1997) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 989	(1999) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100 (1996) Concrete Plant Standards

1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) fixtures. However, where the construction covered herein interfaces with other sections, the construction at each interface shall conform to the requirements of both this section and the other section, including tolerances for both.

1.3 ACCEPTABILITY OF WORK

The installation will be accepted on the basis of tests made by the Government and by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. Concrete samples shall be taken by the Contractor at the placement to determine the slump, air content, and strength of the concrete. Test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which installations may be placed into service. All air content measurements shall be determined in accordance with ASTM C 231. All slump tests shall be made in accordance with ASTM C 143/C 143M. All test cylinders shall be 150 by 300 mm cylinders and shall be fabricated in accordance with ASTM C 192/C 192M, using only steel molds, cured in accordance with ASTM C 31/C 31M, and tested in accordance with ASTM C 39/C 39M. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

1.3.1 Evaluation Sampling

Sampling, testing, and mixture proportioning shall be performed by a commercial Testing Laboratory, conforming with ASTM C 1077. The individuals who sample and test concrete and concrete constituents shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II. All mix design, weekly quality control reports, smoothness reports, and project certification reports shall be signed by a Registered Engineer.

1.3.2 Surface Testing

Surface testing for surface smoothness and plan grade shall be performed as indicated below by the Testing Laboratory. The measurements shall be properly referenced in accordance with location identification and stationing, and a report given to the Government within 24 hours after measurement is made. A final report of surface testing, signed by a Registered Engineer, containing all surface measurements and a description of all actions taken to correct deficiencies, shall be provided to the Government upon conclusion of surface testing.

1.3.2.1 Surface Smoothness Requirements

The finished surfaces of the the concrete shall have no abrupt change of 3 mm (1/8 inch) or more, and all concrete shall be within the tolerances specified in Table 1 when checked with the straightedge.

TABLE 1
STRAIGHTEDGE SURFACE SMOOTHNESS

Pavement Category	Direction of Testing	Tolerances mm
Roads and Streets	Longitudinal	5
	Transverse	6.5
Sidewalks, Parking Areas, Open Storage Areas	Longitudinal	6.5
	Transverse	6.5

1.3.2.2 Surface Smoothness Testing Method

The surface of the concrete shall be tested with the straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the concrete shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 4.5 (15 feet) m 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 concrete 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 concrete surface, in the area between these two high points.

1.3.3 Edge Slump Testing and Conformance

When slip-form paving is used, not more than 15 percent of the total free edge of the slipformed portion of the concrete, shall have an edge slump exceeding 6 mm (1/4 inch) and no slab shall have an edge slump exceeding 9 mm (3/8 inch). Edge slump shall be determined as above for surface smoothness, at each free edge of each slipformed paving lane constructed. Measurements shall be made at 1.5 to 4.5 m (5 to 15 foot) spacings, and as directed. When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

1.3.4 Plan Grade Testing and Conformance

The finished surface of the concrete shall conform, within the tolerances shown in Table 1, to the lines, grades, and cross sections shown. The

finished surface of new abutting pavements shall coincide at their juncture. The surfaces of pavements shall vary not more than 18 mm (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.

1.4 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples. Aggregates shall be sampled and tested by the Test Laboratory and shall be representative of the materials to be used for the project. Test results, signed by a Registered Engineer, shall be submitted 45 days before commencing paving. No aggregate shall be used unless test results show that it meets all requirements of these specifications, including compliance with ASTM C 33 and deleterious materials limitations.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G

Manufacturer's literature on the concrete plant; mixing equipment; hauling equipment; placing and finishing, and curing equipment; at least 7 days prior to start of paving.

Paving; G

Paving Schedules at least 7 days prior to start of paving.

Mixture Proportions; G

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

1.6 EQUIPMENT

1.6.1 Batching and Mixing

The batching plant shall conform to NRMCA CPMB 100, the equipment requirements in ASTM C 94/C 94M, and as specified. Water shall not be weighed or measured cumulatively with another ingredient. All concrete

materials batching shall meet ASTM C 94/C 94M requirements. Mixers shall be stationary mixers. Truck mixers shall not be used for mixing paving concrete. Batching, mixers, mixing time, permitted reduction of mixing time, and concrete uniformity shall meet the requirements of ASTM C 94/C 94M, and shall be documented in the initial weekly QC Report.

1.6.2 Transporting Equipment

Transporting equipment shall be in conformance with ASTM C 94/C 94M and as specified herein. Concrete shall be transported to the paving site in rear-dump trucks, in truck mixers designed with extra large blading and rear opening specifically for low slump concrete, or in agitators. Bottom-dump trucks shall not be used for delivery of concrete.

1.6.3 Delivery Equipment

When concrete transport equipment cannot operate on the paving lane, side-delivery transport equipment consisting of self-propelled moving conveyors shall be used to deliver concrete from the transport equipment and discharge it in front of the paver. Front-end loaders, dozers, or similar equipment shall not be used to distribute the concrete.

1.6.4 Curing Equipment

Equipment for curing is specified in paragraph CURING.

1.6.5 Texturing Equipment

Texturing equipment shall be as specified below.

1.6.5.1 Fabric Drag

A fabric drag shall consist of a piece of fabric material as wide as the pouring width securely attached to a separate wheel mounted frame spanning the paving or to one of the other similar pieces of equipment. The material shall be wide enough to provide 300 to 450 mm (12 to 18 inches) dragging flat on the concrete surface.

1.6.5.2 Deep Texturing Equipment

Texturing equipment shall consist of a stiff bristled broom, a comb with spring wire tines, or spring strips which will produce true, even grooves forming a drag at least 1.2 m (4 feet) long. This drag shall be mounted in a wheeled frame spanning the paving and constructed to mechanically pull the drag in a straight line across the paving lane perpendicular to the centerline.

1.6.6 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-tip-bladed concrete saws mounted on a wheeled chassis.

1.6.7 Straightedge

The Contractor shall furnish and maintain at the job site one 4 m straightedge for testing concrete surface smoothness. The straightedge shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the concrete.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement and shall conform to appropriate specifications listed below.

2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150 Type II, low-alkali.

2.1.2 High-Early-Strength Portland Cement

High-early-strength cement shall conform to ASTM C 150 Type III, with C3A limited to 5 percent, low-alkali.

2.1.3 Blended Cements

Blended cement shall conform to ASTM C 595 Type IP.

2.1.4 Pozzolan (Fly Ash)

Fly ash shall conform to ASTM C 618 Class F, including all the supplementary optional physical requirements. Fly ash shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.2 AGGREGATES

Aggregates shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33, including deleterious materials, abrasion loss and soundness requirements of ASTM C 33, and other requirements specified herein.

2.2.1 Coarse Aggregate

Coarse aggregate shall consist of crushed or uncrushed gravel, crushed stone, or a combination thereof. The nominal maximum size of the coarse aggregate shall be 19.0 mm (3/4 inches). When the nominal maximum size is greater than 25.0 mm (1 inch), the aggregates shall be furnished in two ASTM C 33 size groups, No. 67 and No. 4. The amount of deleterious material in each size of coarse aggregate shall not exceed the limits shown in ASTM C 33 Class 1N, 4M or 4S, depending on the weathering region, and the following limits:

a. Lightweight particles 1.0 max. percent by mass (ASTM C 123).

b. Other soft particles 2.0 max. percent by mass (COE CRD-C 130).

c. Total of all deleterious 5.0 max. percent by mass (substances listed in ASTM C 33 and above, exclusive of material finer than 0.075 mm sieve).

d. The separation medium for lightweight particles shall have a density of 2.0 Mg/cubic meters (Sp Gr of 2.0).

2.2.2 Fine Aggregate

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. All fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33 and the requirements herein. The amount of deleterious material in the fine aggregate shall not exceed the limits in ASTM C 33and shall not exceed the following limits:

a. Lightweight particles (ASTM C 123) 1.0 percent max. by mass using a medium with a density of 2.0 Mg/cubic meter (Sp Gr of 2.0).

b. The total of all deleterious material types, listed in ASTM C 33 and above, shall not exceed 3.0 percent of the mass of the fine aggregate.

2.3 CHEMICAL ADMIXTURES

Air-entraining admixture shall conform to ASTM C 260. An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494/C 494M Type C. Calcium chloride and admixtures containing calcium chloride shall not be used. A water-reducing or retarding admixture shall meet the requirements of ASTM C 494/C 494M. Type G or H admixtures are not allowed.

2.4 CURING MATERIALS

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300. Burlap shall be new or shall be clean material never used for anything other than curing concrete.

2.5 WATER

Water for mixing and curing shall be clean, potable, and free of injurious amounts of oil, acid, salt, or alkali.

2.6 JOINT MATERIALS

2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1751. Expansion joint filler shall be 20 mm (3/4 inch) thick.

2.6.2 Slip Joint Material

Slip joint material shall be 6 mm (1/4 inch) thick expansion joint filler conforming to ASTM D 1751 or ASTM D 1752.

2.6.3 Contraction Joint Inserts

Sawable contraction joint inserts shall conform to COE CRD-C 540. No metal inserts of any kind shall be used.

2.7 REINFORCING

2.7.1 General

Reinforcing bars shall conform to ASTM A 615/A 615M Grade 60. Bar mats shall conform to ASTM A 184/A 184M. Reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

2.7.2 Steel Fiber Reinforcing

Minimum ultimate tensile strength of the fibers shall be 345 MPa (50,000 psi). The maximum aspect ratio (length divided by diameter) shall not exceed 100. Fibers longer than 60 mm 2-1/2 inches) shall not be used. The fibers shall be deformed and shall be furnished in small bundles adhered with water soluble glue.

2.8 DOWELS AND TIE BARS

2.8.1 Dowels

Dowels shall be single piece, plain (non-deformed) steel bars conforming to ASTM A 615/A 615M Grade 60 or higher. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight.

2.8.2 Tie Bars

Tie bars shall be deformed steel bars conforming to ASTM A 615/A 615M. Grade 60 or higher shall not be used for bars that are bent and straightened during construction.

2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to ASTM C 881, 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 for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.

c. Material for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed portland cement concrete, mortar, or freshly mixed epoxy resin concrete to hardened concrete shall be Type V, Grade as approved.

2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

Specified compressive strength, f'c, for concrete is 21 MPa (3000 psi) at 28 days. Maximum allowable water-cementitious material ratio is 0.45. The water-cementitious material ratio is based on absolute volume equivalency, where the ratio is determined using the weight of cement for a cement only mix, or using the total volume of cement plus pozzolan converted to an equivalent weight of cement by the absolute volume equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of 6 plus or minus 1 percent. The maximum allowable slump of the concrete shall be 75 mm (3 inches) for pavement constructed with fixed forms. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 3.5 MPa (500 psi). Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

2.11 MIXTURE PROPORTIONS

2.11.1 Composition Concrete

Composition concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. Fly ash, if used, shall be used only at a rate between 15 and 35 percent by mass of the total cementitious material. Admixtures shall consist of air entraining admixture. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

2.11.2 Concrete Mixture Proportioning Studies

Trial design batches, mixture proportioning studies, and testing shall be the responsibility of the Contractor, and shall be performed by the Test Laboratory and signed by a Registered Engineer. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions. All materials used in mixture proportioning studies shall be representative of those proposed for use on the project. If there is a change in materials, additional mixture design studies shall be made using the new materials. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1. At least three different water-cementitious ratios, which will produce a range of strength encompassing that required on the project, shall be used. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content. Maximum sand content shall be 40 percent of the total aggregate SSD weight. Aggregate quantities shall be based on

the mass in a saturated surface dry condition.

2.11.3 Mixture Proportioning Procedure

The Contractor shall perform the following:

a. Fabricate, cure and test 6 test cylinders per age for each mixture at 7 and 28 days.

b. Using the average strength for each w/(c+p), plot the results from each of the three mixtures on separate graphs for w/(c+p) versus 28-day strength.

c. From the graphs select a w/(c+p) which will produce a mixture giving a 28-day strength equal to the required strength determined in accordance with the following paragraph.

2.11.4 Average Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified, the mixture proportions selected shall produce a required average strength, f'cr, exceeding the specified strength, f'c, in accordance with procedures in Chapter 3 of ACI 301, "Proportioning."

PART 3 EXECUTION

3.1 CONDITIONING OF UNDERLYING MATERIAL

Underlying material, base course, upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon.

3.2 WEATHER LIMITATIONS

3.2.1 Hot Weather Paving

The temperature of concrete shall not exceed 32 degrees C 90 degrees F). Steel forms, dowels and reinforcing shall be cooled prior to concrete placement when steel temperatures are greater than 49 degrees C (120 degrees F).

3.2.2 Cold Weather Paving

The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 5 degrees C. The temperature of the concrete when placed shall be not less than 10 degrees C (50 degrees F). Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, chemical admixture conforming to ASTM C 494/C 494M Type C or E may be used provided it contains no calcium chloride. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10 degrees C (50

degrees F) for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph, REPAIR, REMOVAL, AND REPLACEMENT OF SLABS.

3.3 CONCRETE PRODUCTION

3.3.1 General Requirements

Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 32 degrees C (90 degrees F), the time shall be reduced to 30 minutes. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall show at least the mass, or volume, of all ingredients in each batch delivered, the water meter and revolution meter reading on truck mixers and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government daily.

3.3.2 Transporting and Transfer-Spreading Operations

Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes. Equipment shall be allowed to operate on the underlying material only if no damage is done to the underlying material and its degree of compaction. Any disturbance to the underlying material that does occur shall be corrected before the paver-finisher reaches the location of the disturbance and the equipment shall be replaced or procedures changed to prevent any future damage. Additional water may be added to truck mixers to bring the slump within the specified range provided the mixture water-cement ratio is not exceeded.

3.4 PAVING

Pavement shall be constructed with paving and finishing equipment utilizing fixed forms or slipforms.

3.4.1 Consolidation

The paver vibrators shall be inserted into the concrete not closer to the underlying material than 50 mm (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 200 mm (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 45 m (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 200 mm (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, or may be placed on an initial layer of consolidated concrete, with the subsequent layer placed within 30 minutes of the first layer placement.

3.4.7 Placing Dowels and Tie Bars

Dowels shall be installed with alignment not greater than 1 mm per 100 mm 1/8 inch per ft). Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 15 mm (5/8 inch)

and a vertical tolerance of plus or minus 5 mm 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 and tie bars in joints shall be omitted when the center of the dowel or tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness.

3.4.7.1 Contraction Joints

Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal basket assemblies. The dowels and tie bars 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.

3.4.7.2 Construction Joints-Fixed Form Paving

Installation of dowels and tie bars shall be by the bonded-in-place method, supported by means of devices fastened to the forms. Installation by removing and replacing in preformed holes will not be permitted.

3.4.7.3 Dowels Installed in Hardened Concrete

Installation shall be by bonding the dowels into holes drilled into the hardened concrete. Holes approximately 3 mm (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.

3.4.7.4 Expansion Joints

Dowels in expansion joints shall be installed by the bonded-in-place method or by bonding into holes drilled in hardened concrete, using procedures specified above.

3.5 FINISHING

Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment shall not be permitted. The sequence of machine operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Hand finishing shall be used only infrequently and only on isolated areas of odd

slab shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 3 to 4 m (10 to 12 feet) cutting straightedges; only very sparing use of bull floats shall be allowed. At no time shall water be added to the surface of the slab in any way, except for fog (mist) sprays to prevent plastic shrinkage cracking.

3.5.1 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

3.5.2 Machine Finishing With Slipform Pavers

If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be immediately removed. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

3.5.3 Surface Correction

While the concrete is still plastic, irregularities and marks in the pavement surface shall be eliminated by means of cutting straightedges, 3 to 4 m in length. Depressions shall be filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. Long-handled, flat "bull floats" shall be used sparingly and only as necessary to correct minor, scattered surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished.

3.5.4 Hand Finishing

Hand finishing operations shall be used only for those unusual slabs as specified previously. Grate tampers (jitterbugs) shall not be used. As soon as placed and vibrated, the concrete shall be struck off and screeded. The surface shall be tamped with a strike-off and tamping screed, or vibratory screed. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally. Long-handled, flat bull floats shall be used sparingly and only as necessary to correct surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished. No water shall be added to the pavement during finishing operations.

3.5.5 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, Contracting Officer representative, and a representative of the Using Agency 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.

3.5.5.1 Fabric-Drag Surface Finish

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with a moist fabric drag. The dragging shall produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.5.5.2 Broom Texturing

Surface texture shall be applied using a mechanical stiff bristle broom drag of a type that will uniformly score the surface transverse to the pavement center line. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. The scores should be uniform in appearance and approximately 1.5 mm in depth but not more than 3 mm (1/8 inch) in depth. Hand brooming will be permitted only on isolated odd shaped slabs or slabs where hand finishing is permitted.

3.5.5.3 Wire-Comb Texturing

Surface texture transverse to the pavement center line shall be applied using a mechanical wire comb drag. The comb shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the comb shall be overlapped the minimum necessary to obtain a continuous and uniformly textured surface. The scores shall be 2 to 5 mm (1/16 to 3/16 inch) deep, 1.5 to 3 mm (1/16 to 3/16 inch) wide, and spaced 10 mm (3/8 inch) apart.

3.5.5.4 Surface Grooving

The areas indicated on the drawings shall be grooved with a spring tine drag producing individual grooves 6 mm (1/4 inch) deep and 6 mm (1/4 inch) wide at a spacing between groove centerlines of 50 mm. These grooves shall be cut perpendicular to the centerline. Before grooving begins, the concrete shall be allowed to stiffen sufficiently to prevent dislodging of aggregate. Grooves shall not be cut within 150 mm (6 inches) of a transverse joint or crack.

3.5.6 Edging

After texturing has been completed, the edge of the slabs along the forms

shall be carefully finished with an edging tool to form a smooth rounded surface of 3 mm (1/8 inch) radius. No water shall be added to the surface during edging.

3.6 CURING

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. During hot weather with low humidity and/or wind, the Contractor shall institute measures to prevent plastic shrinkage cracks from developing. ACI 305R contains means of predicting plastic shrinkage cracking and preventative measures. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry. Curing shall be accomplished by one of the following methods.

3.6.1 Membrane Curing

A uniform coating of white-pigmented membrane-forming curing compound shall be applied to the entire exposed surface of the concrete including pavement edges as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs. Curing compound shall then be immediately applied. Curing compound shall be applied to the finished surfaces by means of a self-propelled automatic spraying machine, equipped with multiple spraying nozzles with wind shields, spaning the newly paved lane. The curing compound shall be applied at a maximum application rate of 5 square meters per L (200 square feet per gallon). The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. Areas where the curing compound develops the above defects or is damaged by heavy rainfall, sawing or other construction operations within the curing period, shall be immediately resprayed.

3.6.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Impervious sheet curing shall not be used.

3.7 JOINTS

No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Design District Pavement or Geotechnical Engineer. 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 13

mm (1/2 inch).

3.7.1 Longitudinal Construction Joints

Dowels shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated.

3.7.2 Transverse Construction Joints

Transverse construction joints shall be installed at a planned transverse joint, at the end of each day's placing operations and when concrete placement is interrupted. Transverse construction joints shall be constructed either by utilizing headers and hand placement and finishing techniques, or by placing concrete beyond the transverse construction joint location and then saw cutting full depth and removing concrete back to the transverse construction joint location. For the latter case, dowels shall be installed using methods for dowels installed in hardened concrete described above. All transverse construction joints shall be dowelled.

3.7.3 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 to form a recess at the pavement surface to be filled with joint sealant. Expansion joints shall be constructed with dowels for load transfer.

3.7.4 Slip Joints

Slip joints shall be installed the full depth of the slab using expansion joint preformed joint filler material attached to the face of the original concrete placement. A reservoir for joint sealant shall be constructed at the top of the joint. Edges of the joint face shall be edged.

3.7.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type. 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.

3.7.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing a groove in the concrete with a 3 mm (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. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord or backer rod before the concrete in the region of the joint is resprayed with curing compound.

3.7.5.2 Insert-Type Joints

Insert-type joints shall not be used for slipformed pavements. Insert-type non-metallic contraction joints shall be constructed by installing a preformed insert in the plastic concrete to form a weakened plane to induce cracking. Inserts shall be installed using a machine equipped with a vibrating bar for cutting a groove in the plastic concrete for placement of the insert or for vibrating the insert into place at the prescribed joint location. The installed insert shall be perpendicular to the finished grade of the pavement, with the top of the insert not more than 3 mm below the pavement surface.

3.7.6 Thickened Edge Joints

Underlying material in the transition area shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.7.7 Special Joints

Special joints (undercut joints) shall be constructed adjacent to existing pavement as indicated. The concrete shall be worked under the edge of the existing pavement to completely fill the void and shall be thoroughly consolidated by the use of hand-held vibrators.

3.8 REPAIR, REMOVAL, AND REPLACEMENT OF SLABS

New pavement slabs that contain full-depth cracks shall be removed and replaced, as specified herein at no cost to the Government. Removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be from each original transverse joint . The Contracting Officer will determine whether cracks extend full depth of the pavement and may require minimum 150 mm (6 inch) diameter cores to be drilled on the crack to determine depth of cracking. Cores shall be drilled and the hole later filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin. Drilling of cores and refilling holes shall be at no expense to the Government. Cracks that do not extend full depth of slab shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1. The Contractor shall ensure that the crack is not widened during epoxy resin injection. Where a full depth crack intersects the original transverse joint, the slab(s) containing the crack shall be removed and replaced, with dowels installed, as required below. Spalls along joints shall be repaired as specified.

3.8.1 Removal and Replacement of Full Slabs

Unless there are keys or dowels present, all edges of the slab shall be sawcut full depth. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 150 mm (6 inches) from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 25 mm (1 inch) of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. The narrow strips along keyed or doweled edges shall be carefully broken up and removed. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. Protruding portions of dowels shall be painted and lightly oiled. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset. If underbreak occurs at any point along any edge, the area shall be hand-filled with concrete, producing an even joint face from top to bottom, before replacing the removed slab. If underbreak over 100 mm (4 inches) deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, 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. Original damaged dowels or tie bars shall be cut off flush with the joint face. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Prior to placement of new concrete, the underlying material shall be graded and recompacted, 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. Placement of concrete shall be as specified for original construction. The resulting joints around the new slab shall be prepared and sealed as specified.

3.8.2 Repairing Spalls Along Joints

Spalls along joints and cracks shall be repaired by first making a vertical saw cut at least 25 mm (1 inch) outside the spalled area and to a depth of at least 50 mm (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. The cavity shall be thoroughly cleaned with high pressure water jets supplemented with 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 cavity shall be filled with low slump portland cement concrete or mortar, or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 0.009 cubic meter (1/3 cu. ft.) in size after removal operations; portland cement mortar shall be used for spalls between 0.00085 and 0.009 cubic meter (0.03 and 1/3 cu.ft.); and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.00085 cubic meter (0.03 cu.ft.) in size after removal operations. Portland cement concretes and mortars shall

be very low slump mixtures, proportioned, mixed, placed, tamped, and cured. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions, mixing, placing, tamping and curing procedures as recommended by the manufacturer. 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 or 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.

3.8.3 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 6 mm (1/4 inch). All pavement areas requiring plan grade or surface smoothness corrections in excess of the specified limits, shall be removed and replaced. In pavement areas given a wire comb or tined texture, areas exceeding 2 square meters (25 square feet) that have been corrected by rubbing or grinding shall be retextured by grooving machine sawn grooves meeting the requirements for the wire comb or tined texture. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

3.9 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Existing concrete pavement shall be removed as indicated and as specified in Section 02220 DEMOLITION modified, and expanded as specified herein. Removal, repair and replacement shall be made as indicated and as specified in paragraph REPAIR, REMOVAL, AND REPLACEMENT OR SLABS.

3.10 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work. Traffic shall be excluded from the new pavement. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean. Special cleaning and care shall be used where Contractor's traffic uses or crosses active airfield pavement.

3.11 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL (CQC)

Paragraph ACCEPTABILITY OF WORK contains additional CQC requirements. The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and submit reports as specified. When, in the opinion of

the Contracting Officer, the paving operation is out of control, concrete placement shall cease.

3.11.1 Batch Plant Control

A daily report shall be prepared indicating checks made for scale accuracy with test weights, checks of batching accuracy, and corrective action taken prior to and during placement for weighing or batching, type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water masses per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic meter (yd) for each class of concrete batched during each day's plant operation.

3.11.2 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Whenever air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.

b. Slump Testing. Slump tests shall be made when test specimens are fabricated. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate, without exceeding the maximum w/(c+p). When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until adjustments have been made and slump is again within the limit.

c. Temperature. The temperature of the concrete shall be measured when strength specimens are fabricated.

d. Concrete Strength Testing. Four (4) cylinders from the same batch shall be fabricated, cured and tested for compressive strength, testing two cylinders at 7-day and two cylinders at 28-day age. A minimum of one set of four (4) cylinders shall be fabricated, cured and tested for each shift of concrete placement. Control charts for strength, showing the 7-day and 28-day CQC compressive strengths, and the 28-day required compressive strength, shall be maintained and submitted with weekly CQC Reports.

3.11.3 Inspection Before Placing

Underlying materials, joint locations and types, construction joint faces,

forms, reinforcing, dowels, and embedded items shall be inspected by a Registered Engineer in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing, and the certification signed by the Registered Engineer, prior to each days' paving.

3.11.4 Paving Operations

The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown, shall insure that the concrete is consolidated full depth and that finishing is performed as specified. The placing foreman shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.

3.11.5 Curing Inspection

a. Moist Curing Inspections. Each day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.

b. Membrane Curing Inspection. At the end of each day's placement, the CQC Representative shall determine the quantity of compound used by measurement of the container; shall determine the area of concrete surface covered; shall then compute the rate of coverage in square meters per L (square feet per gallon) and shall also note whether or not coverage is uniform. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

3.11.6 Cold-Weather Protection

At least once per day, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.11.7 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report, signed by a registered engineer, shall be prepared for the updating of control charts and test data, and all CQC inspections and actions covering the entire period from the start of the construction through the current week. Reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all CQC records. A copy of weekly reports shall be faxed to the Design District Pavement or Geotechnical Engineer. At the completion of concrete placement, a certification report shall be prepared containing mix designs,

all updated control charts and concrete test data, quality control reports, smoothness reports, and other pertinent data on the concrete, with a certification by a registered engineer that the concrete placed meets all specification requirements. A copy of the certification report shall be mailed to the Design District pavement or Geotechnical Engineer.

-- End of Section --

SECTION 02791

PLAYGROUND PROTECTIVE SURFACING
06/01

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 412	(1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 648	(2000) Deflection Temperature of Plastics Under Flexural Load
ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2047	(1999) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM D 2261	(1996) Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant Rate-of-Extension Tensile Testing Machine)
ASTM D 6112	(1997) Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes
ASTM E 1912	(1998) Standard Guide for Accelerated Site Characterization for Confirmed or Suspected Petroleum Releases
ASTM F 1015	(1986; R 1999) Relative Abrasiveness of Synthetic Turf Playing Surfaces
ASTM F 1292	(1999) Impact Attenuation of Surface Systems Under and Around Playground Equipment

ASTM F 1487	(1998) Standard Consumer Safety Performance Specification for Playground Equipment for Public Use

CONSUMER PRODUCT SAFETY COMMISSION (CPSC)

CPSC Pub No 325	(1994) Handbook for Public Playground Safety

1.2 DEFINITIONS

Critical Height: The fall height at which the protective surfacing meets the requirements of ASTM F 1292.

Designated Play Surface: Any elevated surface for standing, walking, sitting, or climbing; or a flat surface a minimum 50 mm wide having up to a maximum 30 degree angle from horizontal. In some play events the platform surface will be the same as the designated play surface. However, the terms should not be interchanged as they do not define the same point of measurement according to ASTM F 1487.

Head Injury Criteria (HIC): A measure of impact severity that considers the duration over which the most critical section of the deceleration pulse persists as well as the peak level of that deceleration. Head impact injuries are not believed to be life threatening if the HIC does not exceed a value of 1,000.

Impact Attenuation: The ability of protective surfacing to reduce and dissipate the energy of an impacting body.

Loose Fill: Consisting of small independent movable components such as sand, gravel, or wood chip. The percent of fine material in the loose fill affects its compression properties from rainfall.

Maximum Equipment Height: The highest point on the equipment (i.e.: roof ridge, top of support pole.

Play Event: A piece of manufactured playground equipment that supports one or more play activities.

1.3 CHILD SAFETY AND ACCESSIBILITY STANDARDS

The perimeters of the play event use zone shall be measured in accordance with the requirements of Section 02882 PLAYGROUND EQUIPMENT.

1.3.1 CHILD SAFETY

Synthetic surfacing and loose-fill surfacing systems installed in the use zones shall meet or exceed the impact attenuating performance requirements as follows. The surfacing critical height value shall yield up to both a maximum 200 G's peak deceleration, and a maximum 1,000 Head Injury Criteria (HIC) value for a head-first fall from the play event in accordance with CPSC Pub No 325 and ASTM F 1292. The protective surfacing should have a

minimum critical height value equal to the height of the highest designated play surface. Measuring fall heights for play events is defined in paragraph FALL HEIGHT. Sand, gravel, and wood products shall not be installed over a concrete or bituminous subsurface per CPSC Pub No 325.

1.3.2 CHILD ACCESSIBILITY

The accessibility requirement in accordance with ASTM F 1487 includes the following: When the play event use zone consists of a protective surfacing rated as unaccessible, at least one accessible route shall be provided from the use zone perimeter to the play event. When there is more than one of the same play activity provided, only one shall meet accessibility requirements i.e.: one swing seat or one spring rocking play event). When the access and egress points are not the same for a play event, an accessible route shall be provided to both. The accessible route shall access all accessible play events and elements. The protective surfacings that meet accessibility are synthetic surfacing and engineered wood fiber per ASTM E 1912. When the accessible surface is within the use zone, it shall meet the requirements of paragraph CHILD SAFETY

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;

Scale drawings defining the revised use zone configuration.

Finished Grade and Underground Utilities;

Finished grade, underground utilities, storm-drainage system and irrigation system status; and location of underground utilities and facilities.

SD-03 Product Data

Manufacturer's descriptive data; catalogue cuts; and the latest edition of ASTM F 1487 and CPSC Pub No 325.

Manufacturer's specifications, handling and storage requirements, installation procedures, and safety data sheets to include warnings and critical height performance standards for synthetic surfacing and loose fill surfacing.

A list to include part numbers of furnished protective surfacing materials and components for synthetic surfacing and loose fill surfacing

Delivery schedule and manufacturer name for synthetic surfacing and loose fill surfacing plus delivery, storage and handling information.

Impact attenuation and critical height performance for each thickness of synthetic surfacing and loose fill surfacing provided.

Manufacturer's Qualification;

Name of the owner or user; service or preventive maintenance provider; date of the installation; point of contact and telephone number; and address for 10 sites.

Wood;

Wood components obtained from managed forests.

Site Preparation;

Playground equipment and site furnishings installed.

Temperature Limitation;

Temperature limitation for applying adhesive.

Wood By-Products;

Composition, source; particle size; free from toxic chemicals; poisonous plant material; protrusions; or hazardous material.

Wood Treatment;

Wood treatment chemical content, toxicity level, and life-cycle durability.

Adhesive;

EPA registered uses, toxicity levels, and application hazards.

Color;

[Two] color charts displaying surfacing colors, color granule percentages and finishes.

SD-04 Samples

Synthetic Surfacing;
Loose Fill Surfacing;

a. Synthetic Surfacing: A minimum 50 by 50 mm sample.
b. Loose Fill Surfacing: A minimum 0.003 cu. m sample.

SD-06 Test Reports

Percolation Test;

A certified report of inspection, test method used and compliance with recognized test standard shall be described.

Recycled Plastic;

Individual component and assembled unit structural integrity test; creep tolerance; deflection tolerance; and vertical load test results. The estimated percentage of recovered material content in the material and components. Life-cycle durability.

Synthetic Surfacing;

Chemical composition, color granule percentage, and test results to which material has been subjected; identifying each material and component containing recycled materials and showing the estimated percentage of recovered material content. Freezing temperature life-cycle durability.

Sand;
Gravel;

Sieve test results. Sand shall be uniformly graded.

SD-07 Certificates

Materials;

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include composition and tests to which the material has been subjected.

Manufacturer's Qualification;

Certificate of Insurance AA rated for a minimum one million dollars.

Manufacturer's Representative;

The individual's name, company name and address, and playground safety training certificate.

Installer's Qualification;

The installer's company name and address, and training and experience certification.

Substitution;

Technical representative's written approval.

Child Safety and Accessibility Evaluation;

Record of measurements and findings by the certified playground safety inspector. Verification that installed protective surfacing meets manufacturer's recommendations and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

SD-10 Operation and Maintenance Data

Maintenance Instruction;

[Two] bound copies of manufacturer's operation and maintenance manuals. The Contractor shall include manufacturer supplied spare parts.

1.5 DELIVERY, STORAGE, AND HANDLING

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery. Protective surfacing material shall be delivered, handled, and stored in accordance with the manufacturer's recommendations. The storage area shall be as designated. The materials shall be stored in a dry, covered area until installed.

1.6 INSPECTION

Protective surfacing material shall be inspected upon arrival at the job site for meeting specified quality. Unacceptable materials shall be removed from the job site.

1.7 MANUFACTURER'S QUALIFICATION

Protective surfacing should have been installed in a minimum 10 sites and been in successful service for a minimum 5 year calendar period. The manufacturer shall provide a Certificate of Insurance AA rated for a minimum one million dollars covering both product and general liability.

1.8 INSTALLER'S QUALIFICATION

The installer shall be certified by the manufacturer for training and experience installing the protective surfacing.

1.9 WARRANTY

Furnished protective surfacing shall have a minimum 1 year calendar period warranty.

1.10 TECHNICAL REPRESENTATIVE

1.10.1 Playground Areas Other Than Child Development Centers (CDC)

The technical representative for outdoor play areas on sites other than CDCs shall be the Director of Public Works or designated representative. The design of these outdoor play areas shall be based on the play program and the age groups to be accommodated as determined by the play area committee.

1.10.2 Child Development Centers (CDC)

The technical representative for outdoor play areas at CDC shall be the installation Child Development Services (CDS) Coordinator. The design of the CDC outdoor play area shall be based on the developmental play program for the age groups accommodated at the CDC. The play area is designed to support the CDC program and to provide a stage set for creative play. Developmental activities are selected which promote the intellectual, social, emotional and physical growth of the children. The developmental play program is developed by the MACOM CDS Director, installation CDS Coordinator and CDC Director. They are responsible for the developmental play program, child safety and accessibility to meet that program. Refer to Section 02882 PLAYGROUND EQUIPMENT for Child Development Center (CDC) requirements for review and involvement.

1.11 MANUFACTURER'S REPRESENTATIVE

The manufacturer's certified playground safety inspector or the manufacturer's designated certified playground safety representative shall supervise the installation and adjustment of the protective surfacing to verify the installation meets the requirements of the manufacturer, this specification, and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be the standard products of a manufacturer regularly engaged in the manufacture of protective surfacing and shall be similar to surfacing in satisfactory use a minimum 5 year calendar period. Protective surfacing consists of two systems; synthetic surfacing and loose fill surfacing.

2.2 SYNTHETIC SURFACING

Synthetic surfacing includes the following: poured-in-place system; tile system; and combination system. The synthetic surfacing consists of either impact attenuating substrate covered by a wear surface bonded to produce a unified system; a shredded rubber or aggregate substrate covered by a polyethylene plastic woven sheet wear surface; or a uniform material manufactured in such a way that the top portion meets the requirements specified for wear surface. Synthetic surface shall contain no less than 60% post-consumer recycled rubber/plastic and be UV stable.

2.2.1 Subbase

The subbase for synthetic surfacing is to be reinforced 101.6mm concrete.

2.2.1.1 Concrete Subbase

Concrete material shall conform to Section 02754 CONCRETE PAVEMENTS FOR SMALL PROJECTS.

2.2.1.2 Bituminous Subbase

Bituminous material shall conform to Section 02741 HOT MIX ASPHALT FOR ROADS.

2.2.1.3 Aggregate Subbase

Aggregate material shall conform to Section 02722 AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE.

2.2.2 Impact Attenuating Substrate

The substrate shall be compatible with the wear surface, and shall consist of modular units; poured-in-place; or loose fill. Recycled materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.2.2.1 Poured-In-Place Substrate

Poured-in-place substrate shall consist of a [100] percent recycled shredded styrene butadiene rubber (SBR) adhered with a 100 percent solid polyurethane binder to form a resilient, porous material or shredded rubber. Strands of SBR may vary from a minimum 0.5 mm to a maximum 2 mm thickness; by a minimum 3 mm to a maximum 20 mm length. Binder shall be between a minimum 12 percent and a maximum 16 percent of the total weight of the mixture of rubber and urethane; and shall provide 100 percent coating of the particles. Foam rubber will not be accepted in the substrate.

2.2.2.2 Loose Fill Substrate

The loose fill substrate shall consist of [100] percent recycled shredded rubber produced from recycled vehicle tires without non-steel belts. Loose-fill strands may vary from a minimum 3 mm to a maximum 6 mm thickness; a minimum 3 mm to a maximum 13 mm width; and a minimum 13 mm to a maximum 50 mm length.

2.2.3 Wear Surface

Wear surfaces consist of the following: a poured-in-place durable, weather-resistant, ultraviolet stable, water permeable material top-coat; an integral component of a tile system; synthetic turf wear surface; rubber sheet wear surface; or a polyethylene woven plastic sheet wear surface. The wear surface shall meet requirements of ASTM D 2047 for a minimum 0.8 coefficient of friction.

2.2.3.1 Poured-in-Place Wear Surface

Poured-in-place wear surface shall consist of ethylene propylene diene monomer (EPDM) particles adhered with a polyurethane binder formulated to produce an even, uniform surface. Particles of EPDM shall meet ASTM D 412 for tensile strength and elongation, and contain a minimum 25 percent of rubber hydrocarbons. Particles of EPDM shall be peroxide or sulfur cured in accordance with the manufacturer. Size of rubber particles shall be

between a minimum 1 mm and a maximum 3 mm diameter. Binder shall be between a minimum 16 percent and a maximum 21 percent total weight of rubber used in the wear surface, and shall provide 100 percent coating of the particles. Wear surface shall be a minimum 10 mm thick. The wear surface shall be porous and UV stable.

2.2.3.2 Synthetic Turf Wear Surface

Synthetic turf wear surface shall consist of nylon fibers a minimum 500 denier, or heavy face weight polypropylene fiber a minimum 5,000 denier; and tufted construction conforming to ASTM F 1015. Fibers in each roll shall be from the same dye lot.

2.2.3.3 Rubber Sheet Wear Surface

Rubber sheet wear surface shall consist of a smooth, uniform formulation of EPDM rubber granules bonded under pressure in the factory with polyurethane to form a continuous sheet, and shall be a minimum 10 mm thick. Up to a maximum 80 percent of the rubber may consist of SBR particles. Particle size shall vary from a minimum 1 mm to a maximum 5 mm diameter.

2.2.3.4 Polyethylene Plastic Woven Sheet Wear Surface

Polyethylene plastic woven sheet wear surface shall be lockstitched and meet the tear resistance test, ASTM D 2261 and shall have an accelerated ultra-violet degradation protection feature.

2.2.4 Synthetic Tile

Synthetic tile shall be sized [as indicated]. Synthetic tile shall be a factory-molded unit consisting of the following: combining impact attenuating substrate and wear surface meeting requirements specified for substrate and wear surface; or a dual-density, uniform material, the top portion of which shall conform to wear surface requirements specified.

2.2.5 Color

An EPDM wear surface is preferred for color retention. Black or the following dark colored SBR wear surfaces retain heat and are not acceptable: color combinations containing more than 10 percent black; or color combinations averaging more than 10 percent dark colors.

2.2.6 Sealant

Sealant for tile or combined protective surface systems shall be compatible with the protective surfacing, and shall match the color of the wear surface.

2.2.7 Hardware

Hardware, anchors or fasteners shall be corrosion resistant stainless steel or galvanized steel to anchor the surfacing system securely, in accordance with manufacturer's instructions. Hardware shall provide or be recessed to provide a flat surface and shall be covered by the required depth of

protective surfacing.

2.2.8 Binder

Binder for synthetic surfacing shall be nontoxic, weather-resistant, ultraviolet stable, non-hardening, and retaining impact-attenuating performance. It shall be 100 percent solids containing polyurethane, methylene diphenel isocyanate (MDI), or as recommended by the manufacturer. A maximum 2 percent of toluene diphenel isocyanate (TDI) shall be used. Weight of polyurethane shall be between a minimum 1.02 kg/L and a maximum 1.14 kg/L . Coloring pigments shall be inorganic oxides.

2.2.9 Adhesive

Adhesive shall be a two component polyurethane providing extremely high impact resistant bond and shall be installed as recommended by the manufacturer. The adhesive shall be non-toxic, resistant to ultraviolet light, and safe for children.

2.2.10 Containment Curbs

Containment curbs include the following: treated wood, concrete, recycled plastic, or recycled plastic molded as lumber. Containment curbs shall provide a smooth and hazard-free transition from the protective surfacing to the adjacent surface. Curbs shall be free of sharp vertical edges, protruding elements and trip hazards. Curbs shall be as recommended by the manufacturer. All edges should be provided with a minimum 13 mm radius.

2.2.11 Transition Edge

The transition edge shall be designed to maintain the protective surfacing performance, support the surfacing between changes of material, and shall be concrete in accordance with paragraph CONCRETE CURB. The face of the edge to the subgrade shall be covered with the impact attenuating surface and meet the requirements of paragraph CHILD SAFETY.

2.2.12 Combination System

Combination systems shall consist of combined protective surfacing materials specified. Each component is a part of a manufactured surfacing system. Wear surface shall be of the materials specified.

2.3 LOOSE-FILL SURFACING

Loose-fill surfacing installed in the use zone shall consist of sand, gravel or fire-retardant wood by-products.

2.3.1 Sand

Sand shall be uniformly graded, washed, free of dust, clay, dirt, hazardous substances, or foreign objects. Sand particles shall be rounded naturally or by mechanical means and sieved in accordance with ASTM C 136 to be in the following gradation range.

SIEVE SIZE	PERCENT PASSING
2.36 mm	100 percent
1.18 mm	80-100 percent
0.6 mm	40-75 percent
0.3 mm	0-25 percent
0.15 mm	less than 2 percent

2.3.2 Gravel

Gravel shall be washed, free of dust, clay, dirt, hazardous substances or foreign objects. Gravel particles shall be rounded naturally or by mechanical means and sieved in accordance with ASTM C 136 to be in the following gradation range.

SIEVE SIZE	PERCENT PASSING
12.5 mm	100 percent
9.5 mm	75-85 percent

2.3.3 Wood By-Products

Wood by-products include wood mulch and engineered wood fiber. Wood by-products shall be free of sharp or foreign objects or toxic chemicals. Wood by-products manufactured from recycled pallets or lumber containing nails or metal fasteners shall be rejected.

2.3.3.1 Wood Mulch

Wood mulch shall be untreated chipped bark and/or untreated chipped tree prunings a maximum 40 mm long and shall be free of twigs, leaves, branches, thorns, dirt, grass, yard clippings, soil, or poisonous plants.

2.3.3.2 Engineered Wood Fiber

Engineered wood fiber manufactured for the purpose of protective surfacing shall consist of particles varying from a minimum 3 mm wide to a maximum 13 mm thick; and a minimum 25 mm wide to a maximum 75 mm long.

2.4 GEOTEXTILE FABRIC

Geotextile fabric consists of the following: nonwoven polypropylene sheet; nonwoven 100 percent polyester sheet; or nonwoven needle punched polyester sheet composed of recycled polyester resins.

2.5 RECYCLED PLASTIC

Recycled plastic shall contain a minimum [85]percent of recycled post-consumer product and shall conform to EPA requirements in accordance

with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.5.1 High Density Polyethylene

The material shall be molded of ultraviolet (UV) and color stabilized polyethylene; and consist of a minimum 75% plastic profile of high-density polyethylene, low-density polyethylene, and polypropylene raw material. The material shall be non-toxic and have no discernible contaminates such as paper, foil, or wood. The material shall contain a maximum 3 percent air voids. The material shall be free of splinters, chips, peels, buckling, and cracks. Material shall be resistant to deformation from solar heat gain. Material shall have factory-drilled holes. Components with extra holes not filled by hardware or covered by other components shall be rejected. The material shall not be painted.

2.5.2 Structural Component

Recycled plastic materials will not be used as load bearing structural members.

2.5.3 Recycled Plastic Molded As Lumber

The component shall deflect a maximum 1/360 of the span of the frame when exposed to a uniform live load of 585 N/m , ASTM D 648. The product shall meet the structural integrity test requirements set forth in ASTM F 1487 and ASTM D 6112.

2.6 CURBS

2.6.1 Concrete Curb

Concrete curbs shall conform to Section 02770 CONCRETE SIDEWALKS AND CURBS AND GUTTERS

2.6.2 Wood

2.6.2.1 Wood Components

Wood components shall be exterior premium grade and free of knots. Identify wood components obtained from managed forests. Wood components shall have factory-drilled holes. Components with extra holes not filled by hardware or covered by other components shall be rejected.

2.6.2.2 Wood Treatment

Wood components that are not naturally rot and insect resistant shall be treated to resist rot and insect attack by using standard treatment procedures. Any wood placed up to a maximum 150 mm above, or any portion below the top elevation of the protective surfacing, shall be treated after fabrication. Creosote, pentachlorophenol, and tributyl tin oxide are prohibited according to ASTM F 1487.

PART 3 EXECUTION

3.1 SITE PREPARATION

Prior to installing the protective surfacing, verify the playground equipment and site furnishings are installed in accordance with Section 02882 PLAYGROUND EQUIPMENT, and Section 02870 SITE FURNISHINGS.

3.1.1 Finished Grade and Underground Utilities

The Contractor shall verify that finished grades are as indicated; the smooth grading has been completed in accordance with Section 02300 EARTHWORK; installation of the underground utilities through the area has been completed in accordance with Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS; installation of the storm-drainage system through the area has been completed in accordance with Section 02630 STORM-DRAINAGE SYSTEM. The location of underground utilities and facilities in the area of the operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.1.2 Layout

The layout of the entire use zone perimeter shall be staked before excavation begins. The location of all elements shall be staked to include the following: All play event configuration access and egress points; and use zone perimeters.

3.1.2.1 Use Zone

The use zone is defined as the area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around equipment; and on whose surface it is predicted that a user would land when falling from or exiting the equipment. Also, the use zone is associated with the following terms; "Clear Area," and "Fall Zone". The use zone shall be free of hard surfaces, objects or obstacles that a child could run into or fall on top of and be injured. Use zone perimeters shall not overlap hard surfaces. The use zone perimeter shall meet or exceed the requirements of paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS. Use zone perimeters shall not overlap except for certain play events as defined in ASTM F 1487.

3.1.2.2 Shop Drawings

When the use zone perimeter and play event configuration conflict with the requirements and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS, shop drawings defining corrective measures shall be submitted to include the following: Adjustment to the play event with the use zone perimeter; use zone perimeter overlaps; fall height and critical height value.

3.1.3 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments shall be provided.

3.1.4 Percolation Test

A test for percolation shall be done to determine positive drainage, to include the lowest elevation of the subgrade in the areas containing the following: sand; gravel; wood by-products; or synthetic surfacing installed over a pervious base. A positive percolation shall consist of a minimum 25 mm per 3 hour period. When a negative percolation test occurs, a shop drawing shall be provided to indicate the corrective measures.

3.1.5 Substitution

Under no circumstances are substitutions to be allowed or protective surfacing to be selected without written approval from the technical representative. Evaluate manufacturer substitutions for the critical height value with meeting the site conditions and paragraph FALL HEIGHT.

3.1.6 Subgrade

Subgrade irregularities shall be corrected to ensure the required depth of protective surfacing is provided. The subgrade elevation shall be as required by the manufacturer.

3.1.7 Subsurface

The subsurface shall be installed in a true, even plane, and sloped to provide positive drainage as indicated.

3.1.8 Subbase

Tolerance of the concrete or bituminous subbase shall be within a maximum 6 mm in 3 m . Tolerance of aggregate subbase shall be within a maximum similar to 6 mm in 3 m .. Aggregate subbase shall be compacted to a maximum 95 percent, ASTM D 1557. The compaction shall be completed in accordance with Section 02300 EARTHWORK. Sand, gravel, and wood products shall not be installed over a concrete, aggregate, or bituminous subbase, per paragraph CHILD SAFETY.

3.1.9 Concrete or Bituminous Curing

Bituminous or concrete subbase shall be cured [a minimum of 7 days] [in accordance with the manufacturer's requirements]. Curing compounds and other deleterious substances that adversely affect adhesion shall be removed. Surface shall be clean and dry.

3.1.10 Fall Height

3.1.10.1 General Requirements

The fall height is defined as the vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it. For some play events the fall height and platform height are the same, while for other play events the fall height and maximum equipment height are the same, Section 02882 PLAYGROUND EQUIPMENT. When the furnished play event fall height varies from the play event shown, shop drawings shall be provided defining the revised depth or type of protective surfacing to meet or exceed the requirements of

paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

3.1.10.2 Measuring Fall Height

EQUIPMENT	MEASURING FALL HEIGHT
Composite Equipment Structure:	For a platform surrounded by protective barriers, measure from the platform finished elevation. For a platform surrounded by guardrails, measure from the guardrail top elevation.
Infant Crawl Area:	A maximum 600 mm height, measured from the crawl wall or barrier finished elevation.
Playhouse, Nonclimbable:	Measure from the designated play surface finished elevation.
Spring Rocking Equipment:	Measure from the seat top elevation.
Stationary Equipment, Climbable:	Measure from the maximum equipment height finished elevation.
Stationary Equipment, Nonclimbable:	Measure from the designated play surface finished elevation.
Swing:	Measure from the bottom of the pivot point.

3.2 INSTALLING SYNTHETIC SURFACING SYSTEM

Surfacing edges shall fully adhere to the subsurface. Fully cover the subsurface to ensure no hard surfaces are exposed through displacement of loose fill. Rolled or beveled containment curb or transition edges shall maintain the full thickness required to meet paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS. Material shall cover foundation and cutouts around elements penetrating the surface. Seams shall be the minimum necessary and shall be tight.

3.2 Temperature Limitation

Temperature limitation for applying adhesive shall be provided.

3.3 Poured-in-Place System

Components of the poured-in-place system shall be mixed mechanically on site in accordance with manufacturer's recommendations. Hand-mixing is prohibited. Installation of poured-in-place surfacing shall be seamless

and completely bonded to subsurface. Material shall cover foundations and shall be tight around elements penetrating the surface. Add a minimum 2 mm depth to the required surfacing depth to ensure the full depth of material is installed to meet paragraph CHILD SAFETY.

3.3.1 Geotextile Fabric for Poured-In-Place

Geotextile fabric shall be installed over a compacted aggregate base as indicated. Fabric shall cover the entire area and shall be lapped a minimum 100 mm width at the seams. Seams shall be adhered in accordance with manufacturer's recommendations. The aggregate base shall be free of ruts or protruding objects. The fabric shall be installed smooth; and free of tensile stresses, folds, and wrinkles. The fabric shall be protected from clogging, tears, or other damage. Damaged fabric shall be repaired or replaced as directed.

3.3.2 Poured-in-Place Substrate

The substrate layer of the poured-in-place system shall be installed in one continuous pour on the same day. When a second pour is required, the edge of the previous work shall be fully coated with polyurethane binder to ensure 100 percent bond with new work. Adhesive shall be applied in small quantities so that new substrate can be placed before the adhesive dries.

3.3.3 Poured-in-Place Wear Surface

Wear surface shall be bonded to substrate. Adhesive shall be applied to substrate in small quantities so that wear surface can be applied before adhesive dries. Surface shall be hand troweled to a smooth, even finish. When wear surface is composed of different color patterns, pour shall be continuous and seamless. When seams are required due to color change or field conditions, the adjacent wear surface shall be placed as soon as possible, before initial pour has cured. The edge of initial pour shall be coated with adhesive and wear surface mixture shall be immediately applied.

3.4 Tile System

Tile shall be laid out to ensure that end cuts are equal. Tile shall be installed in accordance with manufacturer's instructions. Hardware shall be as recommended by the manufacturer. Tile shall be bonded to the subsurface with an adhesive approved by the manufacturer. Cutouts shall be filled with sealant according to manufacturer's instructions to eliminate voids at equipment. Sealant shall be the minimum amount necessary, shall not exceed a maximum 10 mm width. Where excessive voids occur at cutouts, tile shall be removed and refitted. The tile system shall be installed throughout the play equipment use zone with the proper thickness.

3.2.4 Combination System

The combination system shall consist of [modular impact attenuating substrate units, adhered to form a unified system], [shredded rubber tires over a gravel substrate 15cm deep. The substrate shall be covered with a wear surface as specified. Cutouts around equipment shall be properly filled and sealed according to manufacturer's instructions to eliminate

voids. Sealant shall be the minimum amount necessary, shall not exceed a maximum 10 mm width. Where excessive voids occur at cutouts, the modular substrate shall be removed and refitted. Construction methods shall be employed to ensure full depth installation of specified surfacing material and the finished wear surface.

3.5 Geotextile Fabric for Combination System

Geotextile fabric shall be installed where a modular or shredded rubber substrate is installed over an aggregate base. It should be installed with poured-in-place wear surface or polyethylene plastic woven sheet wear surface installed over substrate. Fabric shall cover the entire area to receive the tile system and shall be lapped a minimum 100 mm width at the seams. Seams shall be adhered in accordance with manufacturer's recommendations.

3.6 Modular Substrate for Combination System

Modular substrate shall be laid out to minimize small end pieces. The substrate shall be installed in accordance with manufacturer's instructions.

3.7 Poured-in-Place Substrate for Combination System

Same as paragraph POURED-IN-PLACE SYSTEM.

3.8 Synthetic Turf Wear Surface for Combination System

Wear surface shall be bonded to substrate with 100 percent solids polyurethane adhesive. Surface irregularities and wrinkles shall be corrected. Seams shall be secured in accordance with manufacturer's recommendations. Wear surface roll width shall be as wide as practical for the installation.

3.9 Rubber Sheet Wear Surface for Combination System

Wear surface shall be bonded to substrate with 100 percent solids polyurethane adhesive. Surface irregularities and wrinkles shall be corrected. Seams shall be secured in accordance with manufacturer's recommendations. Wear surface roll width shall be as wide as practical for the installation.

3.10 Poured-in-Place Wear Surface for Combination System

Same as paragraph POURED-IN-PLACE SYSTEM.

3.2.4.7 Polyethylene Plastic Woven Sheet Wear Surface for Combination System

Wear surface shall be securely anchored to a perimeter containment material with hardware in accordance with the manufacturer's instructions. Hardware shall be appropriate for the type of system and secured to eliminate protrusions.

3.11 RESTORATION AND CLEAN UP

When the operation has been completed, the Contractor shall clean up and protect the site. Existing areas that have been damaged from the operation shall be restored to original condition at the Contractor's expense.

3.11.1 Clean Up

The site and play events shall be cleaned of all materials associated with the operation. Play events and surfaces shall be cleaned of dirt, stains, filings, and other blemishes occurring from shipment and installation. Cleaning methods and agents shall be as recommended by the manufacturer.

3.11.2 Protection

The area shall be protected as required or directed by providing barricades and signage. Signage shall be in accordance with Section 10430 EXTERIOR SIGNAGE

3.11.3 Disposal of Materials

Excess and waste material shall be removed and disposed of off Government property.

3.12 PROTECTIVE SURFACING ACCEPTANCE

3.12.1 Child Safety and Accessibility Evaluation

When the protective surfacing is installed, the play events and protective surfacing shall be thoroughly inspected and measured to verify the playground meets manufacturer's recommendations, paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS, and paragraph FALL HEIGHT as follows: 1) secure anchoring; 2) all hardware and connectors are tight and below the wear surface; 3) sharp points, edges, and protrusions; 4) entanglement; and 5) pinch, crush, and shear points. Measure use zone distances to determine the area is free of hard surfaces, objects or obstacles. Determine exceptions to use zone overlaps occur in accordance with ASTM F 1487. Measure play event fall height and compare to critical height value for the thickness of installed synthetic surfacing. Measure play event fall height and depth of loose fill protective surfacing. Ensure installed chopped tire material is free from steel belts. Ensure the slide exit region has the required clear zone. Swing seat clearances are measured while occupied by a maximum user for the age group using the equipment. The finished installation shall have the appearance of a single covering. Protective surfacing that does not comply shall be reinstalled. Hardware that does not comply shall be replaced. Ensure positive drainage for the area and the lowest elevation of protective surfacing subgrade has been provided. A written report describing the results of the evaluation shall be provided.

3.12.2 Spare Parts

Protective surfacing spare parts provided by the manufacturer shall be furnished.

3.12.3 Maintenance Instruction

The manufacturer's operation and maintenance manual describing the recommended preventive maintenance, inspection frequency and techniques, periodic adjustments, lubricants, and cleaning requirements shall be furnished.

3.13 RE-INSTALLATION

When re-installation is required, the following shall be accomplished. Re-install the product as specified. Provide new replacement materials supplied by the manufacturer (material acquisition of replacement parts is the responsibility of the Contractor). Damage caused by the failed installation shall be repaired at the Contractor's expense.

-- End of Section --

SECTION 02821A

FENCING
02/02

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 APPROVAL OF POLYVINYL CHLORIDE-COATED FENCE MATERIALS

PART 2 PRODUCTS

2.1 FENCE FABRIC

2.2 GATES

2.3 POSTS

2.3.1 Metal Posts for Chain Link Fence

2.4 BRACES AND RAILS

2.5 WIRE

2.6 ACCESSORIES

2.7 CONCRETE

PART 3 EXECUTION

3.1 INSTALLATION
3.2 EXCAVATION

3.3 POST INSTALLATION

3.4 RAILS

3.4.1 Top Rail

3.4.2 Bottom Rail

3.5 BRACES AND TRUSS RODS

3.6 TENSION WIRES

3.7 CHAIN LINK FABRIC

3.8 GATE INSTALLATION

-- End of Section --

SECTION 02870A

SITE FURNISHINGS
06/01

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2000) Carbon Structural Steel
ASTM A 48	(1994ael) Gray Iron Castings
ASTM A 48M	(1994el) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1999) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 615/A 615M	(2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM B 26/B 26M	(1999) Aluminum-Alloy Sand Castings
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 108	(1999) Aluminum-Alloy Permanent Mold Castings
ASTM C 150	(1999a) Portland Cement
ASTM D 648	(2000) Deflection Temperature of Plastics Under Flexural Load
ASTM D 2990	(1995) Tensile, Compressive, and Flexural

	Creep and Creep-Rupture of Plastics
ASTM F 1487	(1998) Standard Consumer Safety Performance Specification for Playground Equipment for Public Use

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings.

Site Furnishing Standards;

Drawings showing scaled details of proposed site furnishings, elevations for each type of site furnishing; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction.

SD-03 Product Data

Site Furnishings;

Manufacturer's descriptive data and catalog cuts.

Installation;

Manufacturer's installation and maintenance instructions.

Materials;

A listing indicating the furnishings provided have been in proven satisfactory use for at least 2 years.

SD-04 Samples

Finish;

Two sets of color data for each furnishing displaying manufacturer's color selections and finishes, and identifying those colors and finishes proposed for use.

SD-06 Test Reports

Recycled Material;

A report of site furnishing parts consisting of recycled materials. Product specification data, providing test information for deflection and creep in accordance with ASTM D 648 and ASTM D 2990 for site furnishings which use plastic lumber as a component,

shall be submitted. The data shall provide a comparison of deflection and creep measurements to other comparable materials.

Testing;

A report of post-installation test results.

1.3 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered, handled, and stored in accordance with the manufacturer's recommendations. The storage area shall be as designated. The materials shall be stored in a dry, covered area until installed.

1.4 INSPECTION

Site furnishings shall be inspected upon arrival at the job site for conformity to specifications and quality in accordance with paragraph MATERIALS. Unacceptable items shall be removed from the job site.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. The materials provided shall be of a type with proven satisfactory use for at least 2 years.

2.1.1 Concrete

Portland cement shall conform to ASTM C 150 Types I, II, or III.

2.1.1.1 Cast-in-Place Concrete

Cast-in-place concrete materials and products shall conform to Section 02754A CONCRETE PAVEMENTS FOR SMALL PROJECTS.

2.1.2 Masonry

Masonry material and products shall conform to Section 04200 MASONRY.

2.1.3 Metal

Metallic materials and products shall conform to Section 05500 MISCELLANEOUS METAL. Metal components shall be furnished with factory drilled holes. Components shall be free of excess weld and spatter. Metal components with holes that will not be filled by hardware or hidden by other components will be rejected. All metal is to have a factory painted finish.

2.1.3.1 Steel

Structural steel products shall conform to ASTM A 36/A 36M, ASTM A 500 and ASTM A 501.

2.1.3.2 Reinforcing Steel

Steel used for reinforcement shall be deformed billet steel . Steel shall conform to ASTM A 615/A 615M.

2.1.3.3 Cast Iron

Cast iron shall conform to ASTM A 48M Class 35 or better. The Contractor shall provide castings manufactured true to pattern and component parts that fit together in a satisfactory manner. Castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. Smooth castings shall be well-cleaned by sand or shot blasting. All iron is to be factoy primed and painted. Rust coated or rusting metal will not be accepted.

2.1.3.4 Cast Aluminum

Cast aluminum shall conform to ASTM B 26/B 26M and ASTM B 108. The Contractor shall provide castings manufactured true to pattern and component parts that fit together in a satisfactory manner. Castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects. Smooth castings shall be well-cleaned by sand or shot blasting.

2.1.3.5 Bronze, Copper and Other Ounce Metals

Bronze, copper, and other ounce metals shall conform to ASTM B 62.

2.1.4 Wood

The Contractor shall provide premium grade wood free of knots; boards with eased edges and ends; and wood components with factory drilled holes. Components with holes that will not be filled by hardware or hidden by other components will be rejected.

2.1.4.1 Treatment

Wood that is not naturally rot and insect resistant shall be treated with standard procedures. Creosote, pentachlorophenol, tributyl tin oxide shall not be used in conformance with ASTM F 1487. Ammonium Copper Quat (ACQ) shall not be used for surfaces likely to contact the skin of small children.

2.1.4.2 Selection

Wood products shall be selected to withstand the climatic conditions of the region in which the site is located.

2.1.5 Recycled Material

2.1.5.1 General Requirements

Recycled materials shall contain a minimum 85 percent recycled post-consumer product and shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Recycled materials

shall be constructed or manufactured with a maximum 6 mm deflection or creep in any member in conformance with ASTM D 648 and ASTM D 2990.

2.1.5.2 High Density Polyethylene

The Contractor shall provide panels and components molded of ultraviolet (UV) and color stabilized polyethylene, with minimum 6 mm wall thickness; exposed edges shall be smoothed, rounded, and free of burrs and points; and the material shall be resistant to fading, cracking, fogging, and shattering. The material shall be non-toxic and have no discernible contaminates such as paper, foil, or wood. The material shall contain no more than 3 percent air voids. Material shall be resistant to deformation from solar radiation heat gain.

2.1.5.3 Structural Component

Recycled materials to include plastic lumber will not be used as structural components of site furnishings.

2.1.6 Fiberglass

Fiberglass shall consist of at least 3 laminations of chopped glass fibers impregnated with polyester resin, with colors and textures molded into all exposed surfaces so that colors resist fading. Fiberglass shall be resistant to cleaners, fertilizers, high power spray and salt.

2.2 HARDWARE

Hardware shall be stainless steel in accordance with ASTM A 153/A 153M and compatible with the material to which applied. All exposed hardware shall match in color and finish. Mounting hardware shall be concealed, recessed, and plugged.

2.3 ANCHORS

Anchors shall be provided, where necessary, for fastening site furnishings securely in place and in accordance with approved manufacturer's instructions. Anchoring devices that may be used, when no anchors are otherwise specified or indicated, include anchor bolts, slotted inserts, expansion shields for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; and lag bolts and screws for wood.

2.4 FINISH

Finish shall be as specified by the manufacturer or as indicated. Exposed surfaces and edges shall be rounded, polished, or sanded. Finish shall be non-toxic, non-glare, and resistant to corrosion. Exposed surfaces shall be smooth and splinter-free exposed surfaces.

2.4.1 Coatings

2.4.1.1 Galvanizing

Galvanized components shall be hot-dipped in zinc after fabrication in

accordance with ASTM A 123/A 123M. Tailings and sharp protrusions formed as a result of the hot-dip process shall be removed and exposed edges burnished.

2.4.1.2 Polyester Powder

Powder-coated surfaces shall receive electrostatic zinc coating prior to painting. Powder coating shall be electrostatically applied and oven cured. Polyester powder coating shall be resistant to ultraviolet (UV) light.

2.4.1.3 Polyvinyl-chloride (PVC)

PVC coating shall be primed with a clear acrylic thermosetting solution. The primed parts shall be preheated prior to dipping. The liquid polyvinyl chloride shall be ultraviolet (UV) stabilized and mold-resistant. The coated parts shall be cured. The coating shall be a minimum 2 mm thick plus or minus 0.5 mm and shall have an 85 durometer hardness with a slip-resistant finish.

2.4.2 Wood Sealants

Exposed wood surfaces shall have, as a minimum, two shop coats of paint, varnish, sealer, or other approved preservative. Sealants shall seal all applied surfaces from air.

2.4.3 Paint

Paint shall be factory applied with a minimum of 2 coats. Paint shall be weather-resistant and resistant to cracking, peeling and fading.

2.4.4 Color

Color of site furnishing components shall be in accordance with Section 09915 COLOR SCHEDULE.

2.5 SITE FURNISHING STANDARDS

Site furnishings shall be furnished with the dimensions and requirements indicated.

2.5.1 Children's Outdoor Play Areas

2.5.1.1 Child Safety

Site furnishings placed in children's outdoor play areas shall meet the safety requirements of ASTM F 1487 for entrapment; sharp points, edges, and protrusions; entanglement; pinch, crush, and shear points. Refer to Section 02882 PLAYGROUND EQUIPMENT for Child Development Center (CDC) requirements for review and involvement.

2.5.1.2 Rounding Edges

Site furnishings to be included in children's outdoor play areas shall be

free from sharp vertical edges and any protruding elements and designed with a minimum radius of 13 mm on all vertical edges; this includes, but is not limited to, seat walls, containment curbs and planters. Where practical, horizontal edges exposed to children's activities shall be rounded.

2.5.2 Benches and Chairs

Benches and chairs shall be furnished with no sharp edges or protruding hardware.

2.5.2.1 Height of Benches and Chairs

The height above finished grade or specified surface shall be between 450-500 mm and level.

2.5.2.2 Benches

The seat surface shall be pitched or slotted to shed water; the seat depth shall be between 300-460 mm and pitched down at the back at a 0-5 degree angle. Seat shall have a minimum width of 610 mm per person, and shall overhang the support base by a minimum of 100 mm for heel space and to facilitate rising from a seating position. The seat rails shall be composed of a minimum 85 percent post-consumer recycled plastic.

Benches shall be classified as either 'Recreational' or 'Park' benches as follows:

The 'Recreational' bench shall be 1.8m in length, have powder-coat finished steel supports and legs, no back or armrest(s), and be direct-bury installed within the play lot rubber surface area. See Section 02791 PLAYGROUND PROTECTIVE SURFACING and Section 02882 PLAYGROUND EQUIPMENT.

The 'Park' bench shall be 1.8m in length, have powder-coat finished steel supports and legs, having a back and an armrest at each end, and be direct-bury installed along the perimeter walkway of the play lot or jogging path. See Section 02791 PLAYGROUND PROTECTIVE SURFACING and Section 02882 PLAYGROUND EQUIPMENT.

2.5.2.3 Back Rest

When back rests are required, the height shall be between 380-460 mm from the top of the seat and the connection shall be at a 90-110 degree angle to the seat. The seat back shall be composed of a minimum 85 percent post-consumer recycled plastic.

2.5.2.4 Arm Rest

When arm rests are required, a minimum of 150 mm height from the seat and a minimum arm rest width of 40 mm shall be provided. The arm rests shall be composed of a minimum 85 percent post-consumer recycled plastic.

2.5.2.5 Weight Limit

Seats shall support a minimum 136 kg for each person they are designed to accommodate.

2.5.3 Picnic Tables

Picnic tables shall be furnished with attached benches that have no backrests. Table's exposed edges and corners shall be rounded, eased or chamfered. Picnic table seat rails shall be composed of a minimum 85 percent post-consumer recycled plastic. Picnic table top shall be webbed steel with a powder-coat finish or natural wood. ADA accessible picnic tables shall have a table top extension specifically designed for wheelchair access at one end of the table.

2.5.3.1 Picnic Table Height

The table height shall be between 750-1200 mm from the finished grade to the lowest surface of the top, or as noted.

2.5.3.2 Picnic Table Clearance

A minimum vertical clearance of 230 mm between the seat top and the bottom edge of the table top shall be provided. A minimum of 460 mm of leg space under tables, measured from the inside edge of the seat top to the nearest table support, shall be provided. A minimum of 460 mm from the end of the table top to the nearest support leg shall be provided.

2.5.3.3 Picnic Table Top

Table top surfaces shall not contain recesses that might hold water or food particles. The table top width shall be a minimum of460 mm when utilized from one side only, and a minimum of 900 mm when utilized from two sides. The table top length shall be a minimum of 610 mm per person.

2.5.3.4 Wheelchair Accessibility

A minimum clear space of 740 mm from the finished grade to the underside of the table shall be provided for persons with disability to be able to pull a wheelchair beneath the table top at the end of the table; the minimum clear width shall be 860 mm .

2.5.4 Trash and Litter Receptacles

Trash and litter receptacles shall be furnished with weather protection, odor containment, and insect/animal-proofing. Container size shall be 113.5 Liter Gallon capacity, surface mounted to concrete, side opening, hinged access door and have a grid wire/metal powder-coat finish body or recycled plastic wood slat body.

2.5.4.1 Height

Trash and litter deposit openings shall be between 800-1000 mm above the ground.

2.5.4.2 Liners

Trash and litter receptacles shall be furnished with removable/reusable inner containers. Self-dumping type designs to include hinged bottom, top or sides will be rejected.

2.5.4.3 Anchors

Trash and litter receptacles that can be anchored to resist overturning by typical use, high winds, or animals shall be furnished and anchored in accordance with the manufacturer's recommendations.

2.5.4.4 Openings

Openings for trash and litter insertion shall be a minimum of 100 mm in diameter. Edges of the openings shall be crimped, rounded and smoothed.

2.5.5 Ash Urns/Receptacles

The Contractor shall provide ash receptacles with a fire-proof metal bowl or screen or sand-filled containers for ash containment. Ash urns/receptacles shall have a minimum diameter of 200 mm ; ash containers shall have a fire-proof metal bowl or screen and shall be easily removable for cleaning. Ash urns shall match the color, style and finish of litter receptacles and shall also be surface mounted.

2.5.6 Bicycle Racks or Stanchions

Bicycle ribbon-style racks or stanchions shall accommodate locking devices and secure, as a minimum, one wheel and part of the frame simultaneously. The spacing between racks or stanchions shall be a minimum of 610 mm .

2.5.7 Freestanding Planters

Freestanding planters shall support designated plant material to reduce wood deterioration from contact with soil and moisture; wood materials shall be provided only as a decorative exterior application to other types of planters. Insulate planters sufficiently to protect against frost damage to both the planter and plantings.

2.5.7.1 Size

The planter size shall be determined according to the spacial root requirements at 2/3 maturity size of the designated plant material, in conformance with Section 02930 EXTERIOR PLANTING.

2.5.7.2 Drainage

Drainage for the planter shall be as follows: a minimum of one drainage hole in the base of each planter and a minimum 3 mm space, in 2 locations, between the base of the planter and the supporting surface.

2.5.7.3 Base

The planter base shall be capable of supporting the weight of the planter filled with both the designated plant material and fully saturated soil. The planter shall not crack, overturn, or sink below the existing grade.

2.5.7.4 Relocation

Planters shall allow for relocation.

2.5.8 Tree Grates

Tree grates shall be supplied complete with matching frame. Tree grates and frames shall have factory applied finish. Install in conjunction with concrete pavement or brick/concrete paver applications.

2.5.9 Product Reference Table

The following table is a listing of products and their manufacturers. Alternates submitted for approval shall be compared to the following for technical equivalencies. Proponents are highly encouraged to utilize this table to obtain product quotes.

PRODUCT: MANUFACTURERS: WEB ADDRESS/PHONE: PRODUCT NAME:

Resilient Play Surface: (poured-in-place, recycled mat)
Vitricon, Inc. www.vitriturf.com 1-800-777-6596
No Fault Sport Group, LLC www.4nofault.com 1-866-NFSPORT
Guard Surfacing Corp. www.safeguardsurfacing.com 1-800-899-8703

Vinyl Coat Chainlink Fence:
Ameristar, Inc. www.ameristarfence.com 1-800-321-8724
Boundary Fence & Rail Sys. Inc. www.boundary-fences.com 1-800-628-8928
Master Halco www.mhfence.com 1-800-229-5619

White PVC Privacy Fence:
Boundary Fence & Rail Inc. www.boundary-fences.com 1-800-628-8928
Master Halco www.mhfence.com 1-800-229-5619
Digger Specialties www.diggerspecialties.com 1-800-446-7659

Basketball Goals and Poles, Gooseneck, direct burial):
Draper, Inc. www.draperinc.com 1-765-987-7999
AALCO Mfg. www.aalcomfg.com 1-800-537-1259
American Athletic Inc. www.americanathletic.com 1-800-247-3978

Soccer Goals: (direct burial)
Draper, Inc. www.draperinc.com 1-765-987-7999
AALCO Mfg. www.aalcomfg.com 1-800-537-1259
Jaypro Sports, Inc. www.jaypro.com 1-800-243-0533

Volleyball Poles/Nets: (direct burial)
Draper, Inc. www.draperinc.com 1-765-987-7999
AALCO Mfg. www.aalcomfg.com 1-800-537-1259
American Athletic Inc. www.americanathletic.com 1-800-247-3978

Recreational Benches:
Victor Stanley Co. www.victorstanley.com 1-800-368-2573
DuMor, Inc. www.dumor.com 1-800.598-4018
Landscape Forms, Inc. www.landscapeforms.com 1-800-430-6209

Park Benches:
Victor Stanley Co. www.victorstanley.com 1-800-368-2573
Landscape Forms, Inc. www.landscapeforms.com 1-800-430-6209
DuMor, Inc. www.dumor.com 1-800-598-4018

Litter Receptacles:
Victor Stanley Co.www.victorstanley.com 1-800-368-2573
Columbia Cascade www.timberform.com 1-800-547-1940
Dumor, Inc. www.dumor.com 1-800-598-4018

Picnic Shelters:
Litchfield Industries Co. www.landscapeelements.com 1-800-542-5282
Americana Building Products www.americana.com 1-800-851-0865
Poligon, Inc. www.poligon.com 1-800-354-7721

Outdoor BBQ Grills:
DuMor Co. www.dumor.com 1-800-598-4018
Litchfield Industries Co. www.landscapeelements.com 1-800-542-5282

Picnic Tables, Standard:
Webcoat Co. www.webcoat.com 1-800-505-5101
DuMor Co. www.dumor.com 1-800-598-4018
Victor Stanley Co. www.victorstanley.com 1-800-368-2573

Picnic Tables, Accessible:
Webcoat Co. www.webcoat.com 1-800-505-5101
DuMor Co. www.dumor.com 1-800-598-4018
Victor Stanley Co. www.victorstanley.com 1-800-368-2573

Steel Edger:
Border Concepts, Inc. www.borderconcepts.com 1-800-845-EDGE
Col-Met Mfg. www.colmet.com 1-800-829-8225
Sure-Loc Edging www.surelocedging.com 1-800-787-3562

Landscape Fabric:
Valleyview Industries www.valleyviewind.com 1-800-323-9369
Griffin Environmental Co. www.griffenenviro.com 1-315-451-5300
Colbond Geosynthetics www.colbond-usa.com 1-800-365-7391

Tot Lot Curb Containment:
Landscape Structures, Inc. www.playlsi.com 1-888-438-6574
Childspace Playground, Lts. www.playgroundequipment.com 1-800-661-1258
Goric Marketing Group www.goric.com 1-887-GORICUS

Pre-Teen & Tot Lot Play Equipment:
Landscape Structures, Inc. www.playsi.com 1-888-438-6574
Gametime www.gametime.com 1-800-235-2440
Kompan Industries www.kompan.com

Mailbox & Wood Post:
Salsbury Industries www.mailboxes.com 1-800-MAILBOX
Custom Home Accessories www.custom-mailboxes.com 1-800-265-0041
Seattleluxe Inc. www.seattleluxe.com 1-800-325-6262

PART 3 EXECUTION

3.1 INSTALLATION

The Contractor shall verify that finished grades and other operations affecting mounting surfaces have been completed prior to the installation of site furnishings. Site furnishings shall be installed plumb and true in accordance with the approved manufacturer's instructions.

3.1.1 Children's Outdoor Play Areas

The site furnishings shall be installed outside the play structure use zone in accordance with ASTM F 1487. The contractor shall verify and mark the locations of the use zone. These zones are to be free from obstacles and hard surfaces.

3.1.2 Child Accessibility

When child accessibility requirements are to be met, child anthropometric dimensions must be used and not adult anthropometric dimensions.

3.1.3 Application of Field Finishes

Where indicated, field finishes shall be applied only when noted as acceptable when a factory or shop finish is not possible.

3.1.4 Parts

New parts shall be acquired from the manufacturer. Substitute parts will not be accepted unless approved by the manufacturer.

3.1.5 Assembly

When the inspection of parts has been completed, the site furnishings shall be assembled and anchored according to manufacturer's instructions or as indicated. When site furnishings are assembled at the site, assembly shall not interfere with other operations or pedestrian and vehicular circulation.

3.1.6 Testing

Each site furnishing shall be tested to determine a secure and correct installation. A correct installation shall be according to the manufacturer's recommendations and by the following procedure: The Contractor shall measure the physical dimensions and clearance of each installed site furnishing for compliance with manufacturer's recommendations and as indicated. Site furnishings which do not comply shall be reinstalled. Fasteners and anchors determined to be non-compliant shall be replaced. A written report describing the results of the testing

shall be provided.

3.2 RESTORATION AND CLEAN UP

When the installation has been completed, the Contractor shall clean up and protect the site. Existing areas that have been damaged from the installation operation shall be restored to original condition at Contractor's expense.

3.2.1 Clean Up

The site shall be cleaned of all materials associated with the installation. Site furnishing surfaces shall be cleaned of dirt, stains, filings, and other blemishes occurring from shipment and installation. Cleaning methods and agents shall be according to manufacturer's instructions or as indicated.

3.2.2 Protection

The area shall be protected as required or directed by providing barricades and signage.

3.2.3 Disposal of Materials

Excess and waste material shall be removed and disposed off Government property.

3.3 RE-INSTALLATION

Where re-installation is required, the following shall be accomplished:

a. Re-install the product as specified. Material acquisition of replacement parts is the responsibility of the Contractor. Provide replacement materials that are new and supplied by the original manufacturer to match.

b. Damage caused by the failed installation shall be repaired.

-- End of Section --

SECTION 02882

PLAYGROUND EQUIPMENT
06/01

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 135	(1997c) Electric-Resistance-Welded Steel Pipe
ASTM A 153/A 153M	(2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 513	(2000) Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
ASTM B 26/B 26M	(1999) Aluminum Alloy Sand Castings
ASTM B 108	(1999) Aluminum-Alloy Permanent Mold Castings
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 179	(1996) Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes
ASTM B 221	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM D 648	(2000) Deflection Temperature of Plastics

	Under Flexural Load
ASTM D 822	(1996) Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus
ASTM D 1248	(2000) Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1735	(1999) Testing Water Resistance of Coatings Using Water Fog Apparatus
ASTM D 2454	(1995) Determining the Effect of Overbaking on Organic Coatings
ASTM D 2794	(1993; R 1999el) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 3363	(2000) Film Hardness by Pencil Test
ASTM D 6112	(1997) Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes
ASTM F 1487	(1998) Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
CONSUMER PRODUCT SAFETY COMMISSION (CPSC)	
CPSC Pub No 325	(1994) Handbook for Public Playground Safety

1.2 DEFINITIONS

Age-Appropriate: A term that describes equipment scale to include platform height, fall height and maximum equipment height, that allows safe and successful use by children of a specific chronological age; mental and physical ability; and anthropometric measurement. Maximum equipment height and complexity will not exceed a child's ability in that age group.

Composite Structure: Also "Composite Play Structure; Linked Structure". Two or more play events attached, directly adjacent or functionally linked, to create one integral unit that provides more than one play activity.

Designated Play Surface: Any elevated surface for standing, walking, sitting, or climbing; or a flat surface a minimum 50 mm wide having up to a maximum 30 degree angle from horizontal. In some play events the platform surface will be the same as the designated play surface. However, the terms should not be interchanged as they do not define the same point of measurement per ASTM F 1487.

Maximum Equipment Height: The highest point on the equipment (i.e., roof ridge, top of support pole).

Play Event: A piece of manufactured playground equipment that supports one or more play activities.

Protective Surfacing: Material to be used within the use zone that meets the fall attenuation requirements of Section 02791 PLAYGROUND PROTECTIVE SURFACING.

Suspended Hazard: Cable, wire, rope or similar devices suspended up to a maximum 2100 mm high between play events; or installed up to a maximum 45 degree angle from the ground to the play event.

Tot: A child under 4 years of age in the pre-toddler and toddler age group.

1.3 CHILD SAFETY AND ACCESSIBILITY STANDARDS

1.3.1 Child Safety

Play events shall meet the child safety performance requirements described in CPSC Pub No 325 and ASTM F 1487. The requirements include the following: Head and neck entrapment; sharp points, edges, and protrusions; entanglement; pinch, crush, and shear points; suspended hazards; play event access and egress points; play event use zone perimeter; and design criteria. Since ASTM F 1487 criteria is defined for the minimum user through the maximum user (2 through 12 years of age), the requirements for the infant or pre-toddler age group are not prescribed. This specification and Section 02791 PLAYGROUND PROTECTIVE SURFACING establish the requirements for the infant and pre-toddler age groups.

1.3.2 Child Accessibility

The accessibility requirement in accordance with ASTM F 1487 includes the following: When the play event use zone consists of a protective surfacing rated as unaccessible, at least one accessible route shall be provided from the use zone perimeter to the play event. When there is more than one of the same play activity provided, only one shall meet accessibility requirements (i.e., one swing seat or one spring rocking play event). When the access and egress points are not the same for a play event, an accessible route shall be provided to both. The accessible route shall access all accessible play events and elements. The protective surfacing performance requirements shall be in accordance with Section 02791 PLAYGROUND PROTECTIVE SURFACING.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Configuration;

Scale drawings defining the revised play event configuration.

Shop Drawings;

Scale drawings defining the revised use zone perimeters and play event layout.

Fall Height;

Scale drawings defining the revised depth or type of protective surfacing.

Finished Grade and Underground Utilities;

Finished grade, underground utilities, storm-drainage system and irrigation system status; and location of underground utilities and facilities.

SD-03 Product Data

Equipment;

Manufacturer's descriptive data; catalog cuts; references; and the latest edition of ASTM F 1487 and CPSC Pub No 325. Manufacturer's specifications, handling and storage requirements, installation procedures, and safety data sheets to include the following: bare or painted metal platform and slide bed orientation from the direct sun; warnings; and child safety performance standards.

Equipment Identification;

A list to include part numbers of furnished play event and equipment materials and components.

Delivery, Storage and Handling;

Delivery schedule and manufacturer's name.

Manufacturer Qualification;

Name of the owner or user; service or preventive maintenance provider; date of the installation; point of contact and telephone number; and address for 10 sites.

Wood;

Wood components obtained from managed forests.

Spare Parts;

Furnish manufacturer supplied spare parts.

Materials;

Assembled play event structural integrity tests; vertical load tests; and the maximum number of users that can be on the play event.

SD-04 Samples

Color;

Two (2) color charts displaying the colors and finishes.

SD-06 Test Reports

Recycled Plastic;

Individual component and assembled unit structural integrity test; creep tolerance; deflection tolerance; and vertical load test results. The estimated percentage of recovered material content in the material and components. Life-cycle durability.

Wood Finishes;

Wood finish chemical content and toxicity level.

SD-07 Certificates

Materials;

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include composition and tests to which the material has been subjected.

Manufacturer Qualification;

Certificate of Insurance AA rated for a minimum one million dollars.

Installer Qualification;

The installer's company name and address, and training and experience certification.

Manufacturer's Representative;

The individual's name, company name and address, and playground safety training certificate.

Wood Treatment;

Wood treatment chemical content, toxicity level, and life-cycle durability.

Substitution;

Technical representative's written approval.

Play Event Modification;

Manufacturer's written approval.

Child Safety and Accessibility Evaluation;

Record of measurements and findings by the certified playground safety inspector. Verification the installed play events and equipment meet manufacturer's recommendations and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

SD-10 Operation and Maintenance Data

Maintenance Instruction;

Two (2) bound copies of the manufacturer's operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery. Equipment shall be delivered, handled, and stored in accordance with the manufacturer's recommendations. The storage area shall be as designated. The materials shall be stored in a dry, covered area until installed.

1.6 EQUIPMENT IDENTIFICATION

Playground equipment shall be identified with attached and durable label stating the age-group that the equipment is designed to accommodate. There shall be permanent WARNING labels and manufacturer's identification labels, ASTM F 1487.

1.7 INSPECTION

Playground equipment shall be inspected upon arrival at the job site for meeting age-appropriate requirements for the age-group that the equipment is designated to accommodate and specified quality in accordance with paragraphs MATERIALS and CONFIGURATION. Prohibited or unacceptable equipment shall be removed from the job site.

1.8 PROHIBITED EQUIPMENT

Equipment that does not meet the Army's developmental play program requirements for children 9 years and under and are prohibited on outdoor play areas include the following: chain balance beams; rotating equipment, such as merry-go-rounds, log rolls, whirls and may poles; fulcrum seesaws

(teeter totters); spring rocking equipment intended for standing; animal figure swings; rope swings; multiple occupancy swings; swinging exercise and trapeze bars; swinging platforms; tire climbers; swinging dual exercise rings; roller slides; trampolines; swinging gates or doors; and new or used vehicle tires. Play houses or enclosures made of horizontal posts or bars with space between them. Prohibited in all play areas are wood components treated with creosote, pentachlorophenol, and tributyl tin oxide and wood components coated with a finish containing pesticide. Also, skate board park, events or equipment is prohibited. A play area composed of exercise stations for physical fitness is prohibited.

1.9 AGE GROUPS

Play areas are designed to provide challenging play activities by age group. Playground equipment shall be designed to be age appropriate for the age group designated to use it. There is no anthropometric or fall attenuation significance to the discrepancy for the school-age age group between paragraph PLAYGROUND AREAS OTHER THAN CHILD DEVELOPMENT CENTERS and paragraph CHILD DEVELOPMENT CENTERS as described below. The Army age groups are defined as follows:

1.9.1 Playground Areas Other Than Child Development Centers (CDC)

The age groups accommodated at these areas range from less than 12 months through 12 years of age defined as the following: infant age group (less than 12 months); pre-toddler age group (12 through 24 months); composite toddler/pre-school age group (2 through 5 years of age); school-age age group (5 through 9 years of age); and pre-teen age group (9 through 15 years of age). A multi-age playground consists of the following age groups: infant, pre-toddler, and composite toddler/pre-school age groups. Pre-teen play areas shall be located in proximity to younger age group tot lots, but not directly connected to or within those lots.

1.9.2 Child Development Centers (CDC)

The age groups accommodated by the CDC program range from 6 weeks through 8 years of age defined as the following: infant age group (6 weeks through 12 months); pre-toddler age group (12 through 24 months); toddler age group (2 through 3 years of age); pre-school age group (3 through 5 years of age); and school-age age group (5 through 8 years of age).

1.10 MANUFACTURER QUALIFICATION

Play events and equipment similar to those furnished shall have been installed in a minimum 10 sites and been in successful service for a minimum 5 year calendar period. The manufacturer shall provide a Certificate of Insurance AA rated for a minimum one million dollars covering both product and general liability.

1.11 INSTALLER QUALIFICATION

The installer shall be certified by the manufacturer for training and experience installing the play events and equipment.

1.12 WARRANTY

Furnished play events and equipment shall have a minimum 1 year calendar period warranty.

1.13 TECHNICAL REPRESENTATIVE

1.13.1 Playground Areas Other Than Child Development Centers (CDC)

The technical representative for outdoor play areas on sites other than CDCs shall be the Director of Public Works or designated representative. The design of these outdoor play areas shall be based on the play program and the age groups to be accommodated as determined by the play area committee.

1.13.2 Child Development Centers (CDC)

The technical representative for outdoor play areas at CDC is the installation Child Development Services (CDS) Coordinator. The design of the CDC outdoor play area shall be based on the developmental play program for the age groups accommodated at the CDC. The play area is designed to support the CDC program and to provide a stage set for creative play. Developmental activities are selected which promote the intellectual, social, emotional and physical growth of the children. The developmental play program is developed by the MACOM CDS Director, installation CDS Coordinator and CDC Director. They are responsible for the developmental play program and the selection of play events to meet that program.

1.14 MANUFACTURER'S REPRESENTATIVE

The manufacturer's certified playground safety inspector or the manufacturer's designated certified playground safety representative shall supervise the installation and adjustment of the play events and equipment to verify the installation meets the requirements of the manufacturer, this specification, and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be the standard products of a manufacturer regularly engaged in the manufacture of play event products.

2.1.1 Metal

Metal components shall have factory-drilled holes and be corrosion resistant. The components shall be free of excess weld and spatter. Metallic materials shall conform to Section 05500 MISCELLANEOUS METAL. Components with extra holes not filled by hardware or covered by components shall be rejected.

2.1.1.1 Steel

Steel components shall comply with ASTM A 135, ASTM A 500, or ASTM A 513.

Minimum tensile strength shall be 310 Mpa . Minimum yield point shall be 225 Mpa .

2.1.1.2 Aluminum

Extruded aluminum components shall be type 6061-T6, 6062-T6, or 6063-T6, and shall conform to ASTM B 221M . Minimum tensile strength of extruded aluminum components shall be 270 Mpa , and the minimum yield shall be 250 Mpa . Cast aluminum alloy shall conform to ASTM B 179, ASTM B 26/B 26M, and ASTM B 108.

2.1.1.3 Chain

Chain shall be a minimum size 4/0 and shall be corrosion resistant zinc plated. Polyvinyl chloride coating shall be as specified.

2.1.1.4 Rope Cable

Rope cable shall be composed of strands of steel cable with a polypropylene or Dacron synthetic covering that is UV stabilized. Cable ends shall be capped to prevent fraying.

2.1.1.5 Hardware

Hardware shall be corrosion resistant and consist of the following: aluminum, stainless steel, brass, zinc plated steel, zinc-chromate plated steel, or galvanized steel, ASTM A 153/A 153M. When secure the hardware shall require a tool to prevent unauthorized loosening and removal.

2.1.1.6 Rails, Loops, and Hand bars

Rails, loops, and hand bars shall consist of corrosion resistant aluminum, powder-coated steel or galvanized steel. Polyvinyl chloride coating, if provided, shall be as specified.

2.1.1.7 Anchors

Anchors shall be in accordance with manufacturer's recommendations.

2.1.2 Wood

Wood components shall be exterior premium grade and free of knots. Wood components obtained from managed forests shall be identified. Wood components shall have factory-drilled holes. Components with extra holes not filled by hardware or covered by other components will be rejected.

2.1.2.1 Wood Treatment

Wood components that are not naturally rot and insect resistant shall be treated to resist rot and insect attack by using standard treatment procedures. Any wood placed up to a maximum 150 mm above, or any portion below the top elevation of the protective surfacing, shall be treated after fabrication. Creosote, pentachlorophenol, and tributyl tin oxide are prohibited according to ASTM F 1487.

2.1.2.2 Plywood

Plywood shall be a minimum 19 mm thick exterior, marine grade premium and adhered with a waterproof glue that will not separate under conditions of prolonged freezing temperatures, extreme heat, or excessive moisture. Face layers shall be smooth, fine and tightly grained, free of knots, patches, or surface irregularities. Exposed surface shall consist of a material with high paint adhesion and retention characteristics. Edges shall be sanded smooth and eased to a minimum 3 mm radius. Voids at edges shall be filled with epoxy prior to sanding. Particle board and Orientated Strand Board (OSB) are prohibited.

2.1.3 Plastic Components

2.1.3.1 Panels

Plastic panels shall be molded of ultraviolet (UV) and color stabilized polyethylene or nylon with a minimum 5 mm thickness, ASTM F 1487. Edges shall be a minimum 5 mm radius.

2.1.3.2 Window

Plastic windows shall be flat or molded into a bubble shape, and consist of clear polycarbonate plastic a minimum 5 mm thick before forming in accordance with ASTM D 1248. Material shall be shatterproof and resistant to crazing, cracking, or fogging.

2.1.4 Recycled Plastic

Recycled plastic shall contain a minimum 85 percent of recycled post-consumer product and shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Recycled material shall be UV stable and constructed or manufactured with a maximum 6 mm deflection or creep in any member, ASTM D 648 and ASTM D 6112.

2.1.4.1 High Density Polyethylene

The components shall be molded of ultraviolet (UV) and color stabilized polyethylene. The material shall consist of a minimum 75% plastic profile of high-density polyethylene, low-density polyethylene, and polypropylene raw material. The material shall be non-toxic and have no discernible contaminates such as paper, foil, or wood. The material shall contain a maximum 3 percent air voids. The material shall be free of splinters, chips, peels, buckling, and cracks. Material shall be resistant to deformation from solar heat gain. Material shall have factory-drilled holes. Components with extra holes not filled by hardware or covered by other components shall be rejected. The material shall not be painted.

2.1.4.2 Panel

Panels shall be a minimum 6 mm thick; exposed edges shall be smoothed, rounded, and free of burrs and points; and the material shall be shatterproof and resistant to fading, cracking, or fogging.

2.1.4.3 Structural Component

Recycled plastic materials will not be used as load bearing structural members.

2.1.4.4 Recycled Plastic Molded As Lumber

For deck or platform construction, the span of the structural support members shall be a maximum 300 mm on center and recycled plastic decking shall connect to a minimum three joists. Material used for decking shall have a non-slip texture surface. The assembly shall deflect a maximum 1/360 of the span of the frame when exposed to a uniform live load of 585 N/m , ASTM D 648. The product shall meet the structural integrity test requirements, ASTM F 1487 and ASTM D 6112.

2.1.5 Coatings

2.1.5.1 Galvanized

Metal components shall be hot-dipped in zinc after fabrication according to ASTM A 123/A 123M. Tailings and sharp protrusions formed as a result of the hot-dip process shall be removed and edges shall be burnished.

2.1.5.2 Polyester Powder

Powder-coated surfaces shall receive electrostatic zinc coating prior to painting. Powder coating shall be electrostatically applied and shall be oven cured. Polyester powder shall be in accordance with the following: ASTM D 3359 for adhesion; ASTM D 1735 for flexibility; ASTM D 3363 for hardness; ASTM D 2794 for impact; ASTM D 2454 for overbake resistance; ASTM B 117 for salt spray resistance; and ASTM D 822 for weatherability.

2.1.5.3 Polyvinyl Chloride (PVC)

PVC coating shall be primed with a clear acrylic thermosetting solution. The primed parts shall be preheated prior to dipping. The liquid polyvinyl chloride shall be UV stabilized and mold-resistant. The coated parts shall be cured. The coating shall be a minimum 2 mm thick within a plus or minus 0.5 mm tolerance. The coating shall have an 85 durometer hardness, ASTM D 3363. The finish shall be slip-resistant.

2.1.5.4 Concrete

Concrete shall conform to Section 02754A CONCRETE PAVEMENTS FOR SMALL PROJECTS.

2.1.5.4 Cast-In Place Concrete

Cast-in-place concrete material shall conform to Section 02754A CONCRETE PAVEMENTS FOR SMALL PROJECTS.

2.1.6 Wood Sealants

Exposed wood surfaces shall have factory applied prime coat with a minimum 2 spray coats of two-component polyurethane or approved preservative that meets paragraph WOOD TREATMENT.

2.1.6.1 Paint

Paint shall be factory applied to a minimum 2 coats. Paint shall be weather resistant to cracking, peeling and fading. A baked powder-coat finish is preferred over a sprayed or brushed finish.

2.1.6.2 Sealants

Sealants shall seal all applied surfaces from air. Sealants containing pesticide are prohibited.

2.1.7 Color

Color shall be as selected by the Goverment from manufacturer standard samples. Custom colors or colors which require additional charge are to be omitted from the selection palette presented to the Goverment. Play equipment manufacturer shall guarantee their color palette from the date selected until fabrication.

2.2 EQUIPMENT

2.2.1 Configuration

Play event configuration, platform height, fall height, and maximum equipment height shall be as indicated in Section 02791 PLAYGROUND PROTECTIVE SURFACING. When the configuration varies from the play event shown, shop drawings defining the configuration shall be provided to include the following: equipment layout with the use zone perimeter; designated play surface spot elevations; maximum equipment height spot elevations; platform spot elevations; protective barriers; guardrails; bare or painted metal platform and slide bed orientation; and play events in relationship to the playground layout.

2.2.2 Substitution

Substitutions will not be allowed and play events will not be selected without written approval from the technical representative. Manufacturer substitutions which increase the play event platform height or maximum equipment height shall be evaluated. The increased height requires additional protective surfacing in accordance with paragraph FALL HEIGHT.

2.2.3 Platform Height

Platform height is used to define the age group for age appropriate play events and composite structures. To be age appropriate, the platform height shall meet the finished elevations of the age groups in the following paragraphs. For some play events platform height and paragraph FALL HEIGHT are the same.

2.2.3.1 Pre-Toddler Age Group

Platforms designed for children 12 through 24 months of age shall have a finished elevation a maximum 900 mm above the finished elevation of the protective surfacing.

2.2.3.2 Toddler Age Group

Platforms designed for children 2 through 3 years of age shall have a finished elevation a maximum 1200 mm above the finished elevation of the protective surfacing.

2.2.3.3 Pre-School Age Group

Platforms designed for children 3 through 5 years of age shall have a finished elevation a maximum 1200 mm above the finished elevation of the protective surfacing.

2.2.3.4 School-Age Age Group

Platforms designed for children 5 through 9 years of age shall have a finished elevation a maximum 1800 mm above the finished elevation of the protective surfacing.

2.2.3.5 Pre-Teen Age Group

Platforms designed for children 9 through 15 years of age shall have a finished elevation a maximum 1800 mm above the finished elevation of the protective surfacing.

2.2.4 Protective Barrier and Guardrail

Protective barriers and guardrails shall be provided in accordance with paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS. This specification establishes the protective barrier and guardrail requirements for the infant and pre-toddler age group.

2.2.4.1 Protective Barrier

A protective barrier is defined as an enclosing device around an elevated surface that prevents both inadvertent and deliberate attempts to pass through the device. The protective barrier for pre-toddler, toddler, and pre-school age groups shall be provided on elevated surfaces a minimum 760 mm above the protective surfacing. The protective barrier for school-age and pre-teen age groups shall be provided on elevated surfaces a minimum 1200 mm above the protective surfacing. The protective barrier shall completely surround the elevated surface except for the access or egress route. As infants are not to be placed on an elevated surface, the protective barrier for the infant age group shall be the same as the crawl wall defined in paragraph MEASURING FALL HEIGHT.

2.2.4.2 Guardrail

A guardrail is defined as a device around an elevated surface that prevents inadvertent falls from the elevated surface. The guardrail for

pre-toddler, toddler, and pre-school age groups shall be provided on elevated surfaces a minimum 510 mm above the protective surfacing. The guardrail for school-age and pre-teen age groups shall be provided on elevated surfaces a minimum 760 mm above the protective surfacing. The guardrail shall completely surround the elevated surface except for the access or egress route. As infants are not to be placed on an elevated surface, the guardrail for the infant age group shall be the same as the crawl wall defined in paragraph MEASURING FALL HEIGHT.

2.2.5 Sand Table

The sand table with a cover shall be as shown. The cover shall not be attached to the table. The sand sieve size shall be provided as defined in Section 02791 PLAYGROUND PROTECTIVE SURFACING.

2.2.6 Multiple-Axis (Rotating) Swing

The swivel mechanism shall contain a durable long life bearing to reduce friction and wear. A tire manufactured specifically for a multiple-axis swing shall be provided and shall weigh a maximum 15.8 kg . The tire shall be composed of rotationally molded, low density elastomer, and internally reinforced with a steel ring. The tire shall have no openings for insects or water. The multiple-axis swing shall not be confused with the multiple occupancy swing as they are not the same.

2.2.7 Single-Axis (To-Fro) Swing

2.2.7.1 General Requirements

The swing seat shall be molded of high quality rubber or polyurethane with an encapsulated steel reinforcement. The swing seat shall be designed to accommodate one user

2.2.7.2 Full Bucket Swing Seat

A full bucket swing seat is designed to accommodate children up to a maximum 4 years of age; the seat is used by a child with adult assistance. The swing seat shall be constructed of rubber with a tempered steel insert molded inside, shall be double-sided, shall be enclosed by rubber both front and back, and shall include a 360 degree waist enclosure and leg enclosures. Leg enclosures shall be sized to avoid head or neck entrapment. Finish shall be smooth and edges shall be rounded. These swing seats shall not be mixed with other swing seats within a bay.

2.2.8 Spring Rocking Equipment

Spring mechanisms shall conform to the requirements for pinch, crush, and shear points for a maximum 54 kg weight limit in accordance with ASTM F 1487. Seats shall be designed to accommodate only the intended number of users.

2.2.9 Roofs

Roofs shall contain no designated play surface.

2.2.10 Sliding Poles

Sliding poles shall be a maximum 48 mm diameter and a continuous surface with no protruding welds or joints along the sliding area.

2.2.11 Plastic Slide

The slide shall be molded of UV stabilized polyethylene or nylon with minimum of 5 mm wall thickness. The edge shall be a minimum 5 mm radius, ASTM D 1248, Type II, Class A, Grade G4.

2.2.12 Play House or Enclosures

The play house shall be provided with a shelf at the window. The play house and enclosures will be designed to provide other than direct outside visibility from a minimum 1.5 m to all inside corners.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Finished Grade and Underground Utilities

The Contractor shall verify that finished grades are as indicated; the smooth grading has been completed in accordance with Section 02300 EARTHWORK; installation of the underground utilities through the area has been completed in accordance with Section 02316 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS; installation of the storm-drainage system through the area has been completed in accordance with Section 02630 STORM-DRAINAGE SYSTEM. The location of underground utilities and facilities in the area of the operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.1.2 Layout

The layout of the entire outdoor play area shall be staked before excavation begins to include the following: all play event configuration access and egress points; use zone perimeters; hard surface areas and pathway widths; exterior plant material and planters; walls and fences; and structures. Sufficient space shall be provided between all adjacent play events and individual play events for play activities and circulation. Moving and rotating play events shall be located away from circulation to prevent collisions.

3.1.2.1 Use Zone

The use zone is defined as the area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around equipment; and on whose surface it is predicted that a user would land when falling from or exiting the equipment, (paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS). Also, the use zone is associated with the following terms; "Clear Area," and "Fall Zone". The use zone shall be free of hard surfaces, objects or obstacles that a child could run into or fall

on top of and be injured. The use zone shall consist of protective surfacing in accordance with the requirements of Section 02791 PLAYGROUND PROTECTIVE SURFACING. Use zone perimeters shall not overlap hard surfaces. The use zone perimeter shall meet or exceed the requirements of paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS. Use zone perimeters shall not overlap except for certain play events as defined in ASTM F 1487.

3.1.2.2 Shop Drawings

When the use zone perimeter and play event configuration conflict with the requirements and paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS, shop drawings defining corrective measures shall be submitted to include the following: Adjustment to the play event with the use zone perimeter; use zone perimeter overlaps; hard surface area and pathway widths; structures; exterior plant material and planters; walls and fences; and bare or painted metal platform and slide bed orientation to the direct sun.

3.1.3 Orientation

Bare or painted metal platforms and slide beds shall be oriented from the direct sun; or shaded to reduce contact burn risk. Play events that require orientation to adjacent play events or to meet visibility requirements shall be properly oriented.

3.1.4 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments shall be submitted for approval.

3.2 INSTALLATION

Play events shall be installed according to the manufacturer's recommendations and as shown to meet the requirements of paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS.

3.2.1 Play Event Modification

Site modifications of play events affect the coverage provided in paragraph WARRANTY; therefore, play events and equipment shall not be modified without the written approval of the manufacturer.

3.2.2 Wood Finishes

Field applied or touch up of wood finishes shall meet the same specifications as finishes applied at the factory.

3.2.3 Plastic Play Events

Plastic and recycled plastic components shall be connected by stainless steel hardware. The hardware shall be countersunk. Recycled plastic molded as lumber or wood-polymer lumber shall be installed in accordance with the manufacturer's recommendations.

3.2.4 Footings

The top elevation of play event footings will be installed at the subbase of the protective surfacing.

3.2.5 Multiple-Axis (Rotating) Swing

The multiple-axis (rotating) swing shall be located away from other play events and circulation. It shall not be attached to a composite structure.

3.2.6 Single-Axis (To-Fro) Swing

The single-axis (to-fro) swing shall be located on the perimeter of the outdoor play area. It shall not be attached to a composite structure.

3.2.7 Slide

The required exit region clear area shall be provided in accordance with ASTM F 1487.

3.2.8 Chain or Rope Ladder, Climber or Net Climber

A chain or rope ladder; climber; net climber; and similar components shall be installed in the vertical position. Angled or arch positions are not accepted.

3.2.9 Composite Structure

The composite structure use zone perimeter shall be composed of the use zone perimeters of the play events that, when joined together, comprise the composite structure.

3.2.10 Fall Height

3.2.10.1 General

The fall height is defined as the vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it. For some play events the fall height and paragraph PLATFORM HEIGHT are the same. For some play events the fall height and maximum equipment height are the same. When the furnished play event fall height varies from the play event shown, shop drawings defining the revised depth or type of protective surfacing to meet or exceed the requirements of Section 02791 PLAYGROUND PROTECTIVE SURFACING shall be provided.

3.2.10.2 Measuring Fall Height

EQUIPMENT	MEASURING FALL HEIGHT
Composite Structure:	For a platform surrounded by protective barriers, measure from the platform finished elevation.

EQUIPMENT	MEASURING FALL HEIGHT For a platform surrounded by guardrails, measure from the guardrail top elevation.
Infant Crawl Area:	A maximum 600 mm height, measured from the crawl wall or barrier finished elevation.
Playhouse, Nonclimbable:	Measure from the designated play surface finished elevation.
Spring Rocking Equipment:	Measure from the seat top elevation.
Stationary Equipment, Climbable:	Measure from the maximum equipment height finished elevation.
Stationary Equipment, Nonclimbable:	Measure from the designated play surface finished elevation.
Swing:	Measure from the bottom of the pivot point.

3.2.11 SIGNAGE

For playground areas other than CDC, durable permanent signage shall be provided to identify the age group the equipment is designed to accommodate, as typical 'rules' of the play area as defined in ANSI 1487 and CPSC Pub. 325, and the play equipment manufacturer.

3.3 RESTORATION AND CLEAN UP

When the operation has been completed, the Contractor shall clean up and protect the site. Existing areas that have been damaged from the operation shall be restored to original condition at the Contractor's expense.

3.3.1 Clean Up

The site and play events shall be cleaned of all materials associated with the operation. Play events and surfaces shall be cleaned of dirt, stains, filings, and other blemishes occurring from shipment and installation. Cleaning methods and agents shall be as recommended by the manufacturer. Required labeling shall be undamaged and visible in accordance with paragraph EQUIPMENT IDENTIFICATION.

3.3.2 Protection

The area shall be protected as required or directed by providing barricades and signage.

3.3.3 Disposal of Materials

Excess and waste material shall be removed and disposed off Government property.

3.4 PLAYGROUND ACCEPTANCE

3.4.1 Child Safety and Accessibility Evaluation

When the protective surfacing is installed the play events and protective surfacing shall be thoroughly inspected and measured to verify the playground meets manufacturer's recommendations, paragraph CHILD SAFETY AND ACCESSIBILITY STANDARDS, and paragraph FALL HEIGHT. The play events shall be age appropriate for the age group using them in accordance with paragraph PLATFORM HEIGHT. Determine 1) secure anchoring; 2) all hardware and connectors are tight; 3) all hardware and connectors require tools to loosen; 4) all hooks are closed; 5) head and neck entrapment; 6) sharp points, edges, and protrusions; 7) entanglement; 8) pinch, crush, and shear points; 9) suspended hazards; 10) all component holes are filled; and 11) recycled plastic components used as load bearing structural members. Use zone distances shall be measured to determine the area is free of hard surfaces, objects or obstacles. Determine exceptions to use zone overlaps occur in accordance with paragraph USE ZONE. Play event fall height shall be measured and compared to critical height value for thickness of installed protective surfacing. The slide exit region shall have the required clear zone. Play events and surfaces shall be properly oriented. Chain, rope, net climbers or similar components shall be installed in a vertical position. Swing seat clearances shall be measured while occupied by a maximum user for the age group using the equipment. Warning labels and manufacturer identification labels shall be visible in accordance with paragraph EQUIPMENT IDENTIFICATION. Play events that do not comply shall be reinstalled. Fasteners, anchors, hardware and labels that do not comply shall be replaced. Ensure positive drainage for the area and the lowest elevation of protective surfacing subgrade has been provided. A written report describing the results of the evaluation shall be provided.

3.4.2 Spare Parts

Play event and equipment spare parts provided by the manufacturer shall be furnished.

3.4.3 Maintenance Instruction

The manufacturer's operation and maintenance manual describing the recommended preventive maintenance, inspection frequency and techniques, periodic adjustments, lubricants, and cleaning requirements shall be furnished.

3.5 RE-INSTALLATION

When re-installation is required, accomplish the following: Re-install the product as specified. Provide new replacement materials supplied by the manufacturer. Material acquisition of replacement parts is the responsibility of the Contractor. Damage caused by the failed installation shall be repaired at the Contractor's expense.

-- End of Section --

SECTION 02921A

SEEDING
11/02

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a) Agricultural Liming Materials
ASTM D 2028	(1976; R 1997) Cutback Asphalt (Rapid-Curing Type)
ASTM D 4972	(1995a) pH of Soils
ASTM D 5268	(1992; R 1996) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996el) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes
ASTM D 977	(1998) Emulsified Asphalt

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1995) Federal Seed Act Regulations Part 201

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment;
Surface Erosion Control Material;
Chemical Treatment Material;

Manufacturer's literature including physical characteristics,

application and installation instructions for equipment, surface erosion control material and chemical treatment material.

A listing of equipment to be used for the seeding operation.

Delivery;

Delivery schedule.

Finished Grade and Topsoil;

Finished grade status.

Topsoil;

Availability of topsoil from the stripping and stock piling operation.

Quantity Check;

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period;

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

Maintenance Record;

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide;

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil;

Samples taken from several locations at the source.

Soil Amendments;

A 4.5 kg sample.

Mulch;

A 4.5 kg sample.

SD-06 Test Reports

Equipment Calibration;

Certification of calibration tests conducted on the equipment used in the seeding operation.

Soil Test;

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Seed;
Topsoil;
pH Adjuster;
Fertilizer;
Organic Material;
Soil Conditioner;
Mulch;
Asphalt Adhesive;
Pesticide;

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.

b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

d. Fertilizer. Chemical analysis and composition percent.

e. Organic Material: Composition and source.

f. Soil Conditioner: Composition and source.

g. Mulch: Composition and source.

h. Asphalt Adhesive: Composition.

i. Pesticide. EPA registration number and registered uses.

1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.3 Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

1.4.3 Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.5 Time Limitation

Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Seed Classification

[State-certified] [State-approved] seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS Seed Act and applicable state seed laws.

2.1.2 Permanent Seed Species and Mixtures

Permanent seed species and mixtures shall be proportioned by weight as regulated by the Kentucky Department of Transportation Standard Specifications for Construction. Use seed mixture No. 1, per section 212. All seed and mulch shall be certified weed-free. Rate of application shall be a minium of 6.8 kilograms per acre .

Seed mixtures shall not contain millet or any other large-seed producing grass.

2.1.3 Temporary Seed Species

Temporary seed species for surface erosion control or overseeding shall be an agricultural grade cover crop of annual oats applied at the producers recommend rate. Cover crop seeds shall contain no less than 95% pure live seed.

Seed mixtures shall not contain millet or any other large-seed producing grass as defined by KdOT.

2.1.4 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture.

2.1.5 Seed Mixing

The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.

2.1.6 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300A EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the seed specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite shall not be used.

2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 55 percent shall pass through a 0.250 mm sieve. To raise soil pH, ground limestone shall be used.

2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm sieve and a minimum 97 percent shall pass through a 0.250 mm sieve.

2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 35 percent shall pass through a 0.250 mm sieve.

2.3.2 Fertilizer

It's content shall be as recommended by the soil test and the fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.3.3 Nitrogen Carrier Fertilizer

Nitrogen carrier fertilizer shall be commercial grade, free flowing, and uniform in composition. The fertilizer may be a liquid nitrogen solution.

2.3.4 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.3.4.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.4.2 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

2.3.4.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

2.3.4.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm in length. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.3.4.5 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

2.3.5 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination to meet the requirements of the soil test.

2.3.5.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm sieve and a minimum 10 percent by weight shall pass a 1.18 mm sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

2.3.5.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized and applied according to the manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide, with an absorption capacity of 250-400 times its weight. Polymers shall also be added to the seed and be a starch grafted polyacrylonitrite, with graphite added as a tacky sticker. It shall have an absorption capacity of 100 plus times its weight.

2.3.5.3 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 650 degrees C. Gradation: A minimum 90 percent shall pass a 2.36 mm sieve; a minimum 99 percent shall be retained on a 0.250 mm sieve; and a maximum 2 percent shall pass a 0.150 mm sieve. Bulk density: A maximum 640 kilogram per cubic meter .

2.3.5.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.3.5.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

2.4.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice, furnished in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment. Straw shall not be used under woody plants as mulch.

2.4.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other herbaceous mowings, furnished in an air-dry condition suitable for placing

with commercial mulch-blowing equipment. Hay shall not be used under woody plants as mulch.

2.4.3 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

2.4.4 Paper Fiber

Paper fiber mulch shall be recycled news print that is shredded for the purpose of mulching seed.

2.5 ASPHALT ADHESIVE

Asphalt adhesive shall conform to the following: Emulsified asphalt, conforming to ASTM D 977, Grade SS-1; and cutback asphalt, conforming to ASTM D 2028, Designation RC-70.

2.6 WATER

Water shall be the responsibility of the Contractor, unless otherwise noted. Water shall not contain elements toxic to plant life. All water used shall be potable and imported from off-site. Contractor shall not use house unit exterior sillcock or internal hose-bib for turf/seed/plant watering.

2.7 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

2.8 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

2.8.1 Surface Erosion Control Blanket

Blanket shall be machine produced mat of wood excelsior formed from a web of interlocking wood fibers; covered on one side with either knitted straw blanket-like mat construction; covered with biodegradable plastic mesh; or interwoven biodegradable thread, plastic netting, or twisted kraft paper cord netting.

2.8.2 Surface Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 19 to 25 mm square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

2.8.3 Surface Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 605 grams per meter and 1200 mm wide with mesh openings of approximately 25 mm square.

2.8.3 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLING SEED TIME AND CONDITIONS

3.1.1 Seeding Time

Seed shall be installed from April 25 to June 25 for Spring establishment and from Septemeber 15 to October 15 for fall establishment. Summer seeding between the last Spring date and first Fall date is not recommended dut to heat stress, moisture deprevation and high rate of mortality.

3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval.

3.1.3 Equipment Calibration

Immediately prior to the commencement of seeding operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. The calibration test results shall be provided within 1 week of testing.

3.1.4 Soil Test

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection on site shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified.

3.2 SITE PREPARATION

3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 02300A EARTHWORK, prior to the commencement of the seeding operation.

3.2.2 Application of Soil Amendments

3.2.2.1 Applying pH Adjuster

[The pH adjuster shall be applied as recommended by the soil test] The pH adjuster shall be incorporated into the soil to a maximum 100 mm depth or may be incorporated as part of the tillage operation.

3.2.2.2 Applying Fertilizer

[The fertilizer shall be applied as recommended by the soil test] Fertilizer shall be incorporated into the soil to a maximum 100 mm depth or may be incorporated as part of the tillage or hydroseeding operation.

3.2.2.3 Applying Soil Conditioner

[The soil conditioner shall be as recommended by the soil test] The soil conditioner shall be spread uniformly over the soil a minimum 25 mm depth and thoroughly incorporated by tillage into the soil to a maximum 100 mm depth.

3.2.2.4 Applying Super Absorbent Polymers

Polymers shall be spread uniformly over the soil as recommended by the manufacturer and thoroughly incorporated by tillage into the soil to a maximum 100 mm depth.

3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 100 mm depth. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum 50 mm depth by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner may be applied during this procedure.

3.2.4 Prepared Surface

3.2.4.1 Preparation

The prepared surface shall be a maximum 25 mm 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 debris.

3.2.4.2 Lawn Area Debris

Debris and stones over a minimum 16 mm in any dimension shall be removed from the surface.

3.2.4.3 Field Area Debris

Debris and stones over a minimum 75 mm in any dimension shall be removed from the surface.

3.2.4.4 Protection

Areas with the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

3.3 INSTALLATION

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.3.1 Installing Seed

Seeding method shall be Drill Seeding. Seeding procedure shall ensure even coverage. Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used because of the difficulty in achieving even coverage, unless otherwise approved. Absorbent polymer powder shall be mixed with the dry seed at the rate recommended by the manufacturer.

3.3.1 Drill Seeding

Seed shall be uniformly drilled to a maximum 13 mm depth and at the rate of 2.7 kilograms per square yards , using equipment having drills a maximum 175 mm distance apart. Row markers shall be used with the drill seeder. Half the total rate of seed application shall be drilled in 1 direction, with the remainder of the seed rate drilled at 90 degrees from the first direction. The drilling equipment shall be maintained with half full seed boxes during the seeding operations.

3.3.1.3 Rolling

The entire area shall be firmed with a roller not exceeding 130 kilograms per meter roller width. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled. Areas seeded with seed drills equipped with rollers shall not be rolled.

3.3.2 Mulching

3.3.2.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 0.75 metric tons per hectare . 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 disk-anchored immediately following spreading.

3.3.2.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.3.2.3 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier shall be sprayed at a rate between 666 to 866 liters per hectare . Sunlight shall not be completely excluded from penetrating to the ground surface.

3.3.2.4 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.

3.3.2.5 Asphalt Adhesive Coated Mulch

Hay or straw mulch may be spread simultaneously with asphalt adhesive applied at a rate between 666 to 866 liters per hectare , 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.

3.3.2.6 Wood Cellulose Fiber, Paper Fiber, and Recycled Paper

Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. The mulch shall be mixed and applied in accordance with the manufacturer's recommendations.

3.3.3 Watering Seed

Watering shall be started immediately after completing the seeding of an area. Water shall be applied to supplement rainfall at a rate sufficient to ensure moist soil conditions to a minimum 25 mm depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.4 SURFACE EROSION CONTROL

3.4.1 Surface Erosion Control Material

Where indicated or as directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.

3.4.2 Temporary Seeding

[The application rate shall be 2.7 kilograms per square yard .] When directed during contract delays affecting the seeding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded in accordance with temporary seed species listed under Paragraph SEED. Temporary seed cover crop shall be an annual agricultural crop of wheat or oats.

3.4.2.1 Soil Amendments

When soil amendments have not been applied to the area, the quantity of 1/2 of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. The area shall be watered in accordance with paragraph Watering Seed.

3.4.2.2 Remaining Soil Amendments

The remaining soil amendments shall be applied in accordance with the paragraph Tillage when the surface is prepared for installing seed.

3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of material used shall be compared with the total area covered to determine the rate of application used. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into

contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

3.7 RESTORATION AND CLEAN UP

3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding operation shall be restored to original condition at Contractor's expense.

3.7.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.9 SEED ESTABLISHMENT PERIOD

3.9.1 Commencement

The seed establishment period to obtain a healthy stand of grass plants shall begin on the first day of seeding work under this contract and shall continue through the remaining life of the contract and end one calendar yar after the last day of the seeding operation required by this contract. Written calendar time period shall be furnished for the seed establishment period. When there is more than 1 seed establishment period, the boundaries of the seeded area covered for each period shall be described. The seed establishment period shall be coordinated with Sections 02922A SODDING and 02930A EXTERIOR PLANTING. The seed establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health when the grass plants are a minimum 25 mm high. If turf is not established at the time of turn-over to the Government, the contractor shall be required to return until acceptable turf establishment has been met.

3.9.2.1 Lawn Area

A satisfactory stand of grass plants from the seeding operation for a lawn area shall be a minimum 1000 grass plants per square meter . Bare spots

shall be a maximum 150mm square. The total bare spots shall be a maximum 2 percent of the total seeded area.

3.9.2.2 Field Area

A satisfactory stand of grass plants from the seeding operation for a field area shall be a minimum 1000 grass plants per square meter . The total bare spots shall not exceed 2 percent of the total seeded area.

3.9.3 Maintenance During Establishment Period

Maintenance of the seeded areas shall include eradicating weeds, insects and diseases; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting installed areas from traffic; mowing; watering; and post-fertilization.

3.9.3.1 Mowing

a. Lawn Areas: Lawn areas shall be mowed to a minimum 75 mm height when the turf is a maximum 100 mm high. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

b. Field Areas: Field areas shall be mowed once during the season to a minimum 75 mm height. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

3.9.3.2 Post-Fertilization

[The fertilizer shall be applied as recommended by the soil test] A maximum 4 kilograms per hectare of actual available nitrogen shall be provided to the grass plants. The application shall be timed prior to the advent of winter dormancy and shall be made without burning the installed grass plants.

3.9.3.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.9.3.4 Repair or Reinstall

Unsatisfactory stand of grass plants and mulch shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

3.9.3.5 Maintenance Record

A record of each site visit shall be furnished, describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

-- End of Section --

SECTION 02922A

SODDING
07/02

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a; R 2001) Agricultural Liming Materials
ASTM D 4972	(2001) pH of Soils
ASTM D 5268	(1992; R 1997) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996el) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment;
Chemical Treatment Material;

A listing of equipment to be used for the sodding operation. Manufacturer's literature including physical characteristics, application and installation instructions for equipment and chemical treatment material.

Delivery;

Delivery schedule.

Finished Grade and Topsoil;

Finished grade status.

Topsoil;

Availability of topsoil from the stripping and stock piling operation.

Quantity Check;

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed. The quantity of sod used shall be compared against the total area installed.

Sod Establishment Period;

Calendar time period for the sod establishment period. When there is more than one sod establishment period, the boundaries of the sodded area covered for each period shall be described.

Maintenance Record;

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide;

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil;

Samples taken from several locations at the source.

Soil Amendments;

A 4.5 kg sample.

Temporary Seeding;

Sample of annual seed species and application rate.

SD-06 Test Reports

Equipment Calibration;

Certification of calibration tests conducted on the equipment used in the sodding operation.

Soil Test;

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Sod Grower;
Topsoil;
pH Adjuster;
Fertilizer;
Organic Material;
Soil Conditioner;
Pesticide;

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Sod. Classification, botanical name, common name, mixture percentage of species, percent purity, quality grade, field location, grower's name, address and state certification.

b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

d. Fertilizer. Chemical analysis and composition percent.

e. Organic Material: Composition and source.

f. Soil Conditioner: Composition and source.

g. Pesticide. EPA registration number and registered uses.

1.3 SOURCE INSPECTION

The sources of sod material and delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Sod

Sod shall be protected during delivery to prevent desiccation, internal

heat buildup, or contamination.

1.4.1.2 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

1.4.1.3 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.4 Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.4.2 Inspection

Sod shall be inspected upon arrival at the job site for conformity to species. Sod shall be checked for visible broadleaf weeds, and a visible consistency with no obvious patches of foreign grasses that exceed 2 percent of the canopy. Sod that is heating up, dry, moldy, yellow, irregularly shaped, torn, or of uneven thickness shall be rejected. Other materials shall be inspected for compliance with specified requirements. Open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm diameter; and topsoil that contains viable plants and plant parts, shall be rejected. Unacceptable materials shall be removed from the job site.

1.4.3 Storage

1.4.3.1 Sod

Sod shall be stored in designated areas and kept in a moist condition by watering with a fine mist, and covered with moist burlap, straw, or other covering. Covering shall allow air to circulate, preventing internal heat from building up. Sod shall be protected from exposure to wind and direct sunlight until installed. Sod shall be laid down within 36 hours of stripping. Any dried, browned or dead sod shall be rejected.

1.4.3.2 Other Material Storage

Materials shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations, away from contaminants. Chemical treatment materials shall be stored according to manufacturer's instructions and not with sod operation materials.

1.4.4 Handling

Sod shall not be damaged during handling. Except for bulk deliveries, materials shall not be dropped or dumped from vehicles. Any damaged material shall be replaced immediately at the contractors expense.

1.4.5 Time Limitation

Time limitation between harvesting and installing sod shall be a maximum 36 hours.

PART 2 PRODUCTS

2.1 SOD

2.1.1 Sod Classification

Nursery-grown sod shall be provided as classified by applicable state laws. Sod section shall be sized to permit rolling and lifting without breaking.

2.1.2 Grass Species

Grass species shall be proportioned as 90% Kentucky Bluegrass, 5% Perennial Rye-grass, 5% Creeping Red Fescue or mixture approved by the Govermment prior to installation. All grass installed shall be weed-free.

2.1.3 Quality

Sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 25 mm in diameter, woody plant roots, and other materials detrimental to a healthy stand of grass plants. Broadleaf weeds and patches of foreign grasses shall be a maximum 2 percent of the sod section.

2.1.4 Thickness

Sod shall be machine cut to a minimum 35 mm thickness. Measurement for thickness shall exclude top growth and thatch.

2.1.5 Anchors

Sod anchors shall be as recommended by the sod supplier.

2.1.6 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300A EARTHWORK. When additional topsoil is required beyond the available topsoil from stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the sod

species specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash, or other material over a maximum 40 mm diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material, and soil conditioners meeting the following requirements. Vermiculite shall not be used.

2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 55 percent shall pass through a 0.250 mm sieve. To raise soil pH, ground limestone shall be used.

2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm sieve and a minimum 97 percent shall pass through a 0.250 mm sieve.

2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 35 percent shall pass through a 0.250 mm sieve.

2.3.2 Fertilizer

It shall be as recommended by the soil test or if no test results exist, the nutrients ratio shall be 70 percent nitrogen, 05 percent phosphorus, and 20 percent potassium. Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients. See Section 3.1.4 beiow for testing requirements. Fertilizer shall be applied after sodding operations have completed.

2.3.3 Nitrogen Carrier Fertilizer

Nitrogen carrier fertilizer shall be commercial grade, free flowing, and uniform in composition. The fertilizer may be a liquid nitrogen solution.

2.3.4 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.3.4.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.4.2 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

2.3.4.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material free of stones, sticks, soil, and toxic substances harmful to plants, fully composted or stabilized with nitrogen.

2.3.4.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent or less by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm in length. The Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

2.3.4.5 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

2.3.5 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination to meet the requirements for topsoil.

2.3.5.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95

percent by weight shall pass a 2 mm sieve and a minimum 10 percent by weight shall pass a 1.18 mm sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

2.3.5.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized and applied according to the manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide with an absorption capacity of 250-400 times its weight.

2.3.5.3 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to minimum temperature of 650 degrees C. Gradation: A minimum 90 percent passing 2.36 mm sieve; a minimum 99 percent shall be retained on a 0.250 mm sieve; and a maximum 2 percent shall pass a 0.150 mm sieve. Bulk density: A maximum 640 kilogram per cubic meter .

2.3.5.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.3.5.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

2.4 WATER

Water shall be the responsibility of the Contractor unless otherwise noted. Water shall not contain elements toxic to plant life. All water used shall be potable and imported from off-site. Contractor shall not use house unit exterior sillcock or internal hose-bib for turf/seed/plant watering.

2.5 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

PART 3 EXECUTION

3.1 INSTALLING SOD TIME AND CONDITIONS

3.1.1 Sodding Time

Sod shall be installed from April 25 to June 25 for Spring establishment and from September 15 to October 31 for fall establishment. Sodding in the summer months between the last Spring date and first Fall date is highly discouraged due to heat stress and a high mortality probability.

3.1.2 Sodding Conditions

Sodding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the sodding operations, proposed alternate times shall be submitted for approval.

3.1.3 Equipment Calibration

Immediately prior to the commencement of sodding operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. Provide calibration test results within one week of testing.

3.1.4 Soil Test

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection on site shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the sod species specified.

3.2 SITE PREPARATION

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 02300A EARTHWORK.

3.2.1.1 Finished Grade for Airfields

Finished grades in sodded areas shall be undercut sufficiently so the top of newly laid sod will be 37.5 mm below adjacent paved areas and flush with any adjacent seeded or turfed areas except when directed otherwise by the Contracting Officer.

3.2.2 Application of Soil Amendments

3.2.2.1 Applying pH Adjuster

[The pH adjuster shall be applied at the rate recommended by the soil test] The pH adjuster shall be incorporated into the soil to a maximum 100 mm depth or may be incorporated as part of the tillage operation.

3.2.2.2 Applying Fertilizer

[The fertilizer shall be applied at the rate recommended by the soil test] Fertilizer shall be incorporated into the soil to a maximum 100 mm depth or may be incorporated as part of the tillage or hydroseeding operation.

3.2.2.3 Applying Soil Conditioner

[The soil conditioner shall be as recommended by the soil test] The soil conditioner shall be spread uniformly over the soil a minimum 25 mm depth and thoroughly incorporated by tillage into the soil to a maximum 100 mm depth.

3.2.2.4 Applying Super Absorbent Polymers

Polymers shall be spread uniformly over the soil as recommended by the manufacturer and thoroughly incorporated by tillage into the soil to a maximum 50 mm deep prior to placement of sod.

3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 100 mm deep. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum 50 mm deep by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner may be applied during this procedure.

3.2.4 Prepared Surface

3.2.4.1 Preparation

The prepared surface shall be a maximum 25 mm below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be rolled and completed with a light raking to remove from the surface debris and stones over a minimum 16 mm in any dimension.

3.2.4.2 Protection

Areas within the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

3.3 INSTALLATION

Prior to installing sod, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Areas shall be sodded as indicated. Adequate soil moisture shall be ensured prior to sodding by spraying water on the area to be

sodded and wetting the soil to a maximum 25 mm depth.

3.3.1 Installing Sod

Rows of sod sections shall be placed parallel to and tightly against each other. Joints shall be staggered laterally. The sod sections shall not be stretched or overlapped. All joints shall be butted tight. Voids and air drying of roots shall be prevented. Sod sections shall be laid across the slope on long slopes. Sod sections shall be laid at right angles to the flow of water in ditches. Sod sections shall be anchored on slopes steeper than 3-horizontal-to-1-vertical. Anchoring may be required when surface weight or pressure upon placed sod sections is anticipated to cause lateral movement. Sod anchors shall be placed a minimum 600 mm on center with a minimum 4 anchors per sod section. Use metal sod staples engineered for this purpose for sod on slopes of 3:1 or greater. Metal sod staples shall be installed such that the top loop of the metal sod staple is flush with the sod thatch layer. Wood lathe or stakes are not allowed. Syhthetic anchors are not allowed.

3.3.2 Finishing

Displacement of the sod shall be prevented by tamping or rolling the sod in place and knitting the sod to the soil. Air pockets shall be eliminated and a true and even surface shall be provided. Frayed edges shall be trimmed, and holes or missing corners shall be patched with sod.

3.3.3 Rolling

The entire area shall be firmed with a roller not exceeding 130 kilograms per meter roller width. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled.

3.3.4 Watering Sod

Watering shall be started immediately after completing each day of installing sod. Water shall be applied at least 3 times per week to supplement rainfall, at a rate sufficient to ensure moist soil conditions to a minimum depth of 25 mm . 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.

3.4 TEMPORARY SEEDING

[The application rate shall be 2.7 kilograms per square meter .] When directed during contract delays affecting the sodding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded with annual seed in accordance with Section 02921A SEEDING.

3.4.1 Soil Amendments, Tillage and Watering

When soil amendments have not been applied to the area, the quantity of 1/2 of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. The area shall be watered in

accordance with paragraph Watering Sod as required.

3.4.2 Remaining Soil Amendments

The remaining soil amendments shall be applied in accordance with the paragraph Tillage when the surface is prepared for installing sod.

3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of the material used shall be compared with the total area covered to determine the rate of application. The quantity of sod used shall be compared against the total area established with sod. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.7 RESTORATION AND CLEAN UP

3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the sodding operation shall be restored to original condition at Contractor's expense.

3.7.2 Clean Up

Excess and waste material shall be removed from the sodded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the sodding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

3.9 SOD ESTABLISHMENT PERIOD

3.9.1 Commencement

The sod establishment period to obtain a healthy stand of grass plants shall commence on the first day of sodding work under this contract and shall continue through the remaining life of the contract and one calendar year after the last day of sodding operation required by this contract. Written calendar time period shall be furnished for the sod establishment period. When there is more than 1 sod establishment period, the boundaries of the sodded area covered for each period shall be described. The sod establishment period should be coordinated with Sections 02921A SEEDING, and 02930A EXTERIOR PLANTING. The sod establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas. If turf is not established at the time of turn-over to the Government, the contractor is required to return until an acceptable stand of turf is established, as defined herein.

3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health. A satisfactory stand of grass plants from the sodding operation shall be living sod uniform in color and leaf texture. Bare spots shall be a maximum 50 mm square. Joints between sod pieces shall be tight and free from weeds and other undesirable growth.

3.9.3 Maintenance During Establishment Period

Maintenance of the sodded areas shall include eradicating weeds, insects and diseases; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting installed areas from traffic; mowing; watering; and post-fertilization.

3.9.3.1 Mowing

Sodded areas shall be mowed to a minimum 75 mm height when the turf is a maximum 100 mm height. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

3.9.3.2 Post-Fertilization

[The fertilizer shall be applied as recommended by the soil test] A maximum 4 kilograms per hectare of actual available nitrogen shall be provided to the grass plants. The application shall be timed prior to the advent of winter dormancy and shall be made without burning the installed grass

plants.

3.9.3.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.9.3.4 Repair

Unsatisfactory stand of grass plants shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

3.9.3.5 Maintenance Record

A record of each site visit shall be furnished which describes the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

-- End of Section --

SECTION 02930A

EXTERIOR PLANTING
01/02

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 basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance

AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA Z60.1	(1996) Nursery Stock

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a) Agricultural Liming Materials
ASTM D 4972	(1995a) pH of Soils
ASTM D 5034	(1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM D 5035	(1995) Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D 5268	(1992; R 1996) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996el) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings;

Scale drawings defining areas to receive plant materials.

Finished Grade, Topsoil and Underground Utilities;

Finished grade status; location of underground utilities and facilities; and availability of topsoil from the stripping and stock piling operation.

SD-03 Product Data

Geotextile;
Chemical Treatment Material;

Manufacturer's literature including physical characteristics, application and installation instructions for geotextile and chemical treatment material.

Equipment;

A listing of equipment to be used for the planting operation.

Delivery;

Delivery schedule.

Plant Establishment Period; G,

Calendar time period for the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

Maintenance Record;

Maintenance work performed, quantity of plant losses, and replacements; and diagnosis of unhealthy plant material.

Application of Pesticide;

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil;

Samples taken from several locations at the source.

Soil Amendments;

A 4.5 kg sample.

Mulch;

A 4.5 kg sample.

Geotextile;

A 150 mm square sample.

SD-06 Test Reports

Soil Test;
Percolation Test;

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Plant Material;
Topsoil;
pH Adjuster;
Fertilizer;
Organic Material;
Soil Conditioner;
Organic Mulch;
Mycorrhizal Fungi Inoculum;
Pesticide;

Prior to delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following.

a. Plant Material: Classification, botanical name, common name, size, quantity by species, and location where grown.

b. Topsoil: Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.

c. pH Adjuster: Sieve analysis and calcium carbonate equivalent.

d. Fertilizer: Chemical analysis and composition percent.

e. Organic Material: Composition and source.

f. Soil Conditioner: Composition and source.

g. Organic Mulch: Composition, source, and treatment against fungi growth.

h. Mycorrhizal Fungi Inoculum: Plant material treated.

i. Pesticide. EPA registration number and registered uses.

SD-10 Operation and Maintenance Data

Maintenance Instructions;

Instruction for year-round care of installed plant material.

1.3 SOURCE INSPECTIONS

The nursery or source of plant material and the source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

1.4.1.3 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL. A soil test shall be provided for delivered topsoil.

1.4.1.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.1.5 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

1.4.2 Inspection

Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion. Plant material shall be checked for unauthorized substitution and to establish nursery grown status. Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution shall be rejected. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container. Plant material with broken or cracked balls; or broken containers shall be rejected. Bare-root plant material that is not dormant or is showing roots were pulled from the ground shall be rejected. Other materials shall be inspected for compliance with paragraph PRODUCTS. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 40 mm diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected. Unacceptable material shall be removed from the job site.

1.4.3 Storage

1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall not be stored longer than 30 days. Plant material shall be protected from direct exposure to wind and sun. Bare-root plant material shall be heeled-in. All plant material shall be kept in a moist condition by watering with a fine mist spray until installed.

1.4.3.2 Other Material Storage

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment materials shall be stored according to manufacturer's instructions and not with planting operation material.

1.4.4 Handling

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped, containerized or boxed plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

1.4.5 Time Limitation

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum 24 hours. Healing-in plants on the site is not acceptable for any period of time.

1.5 WARRANTY

Furnished plant material shall have a warranty for plant growth to be in a vigorous growing condition for a once complete growing season. A minimum one calendar year time period for the warranty of plant growth shall be provided regardless of the contract time period. Warranty period for newly installed plant materials shall begin when the site is turned over to the Government, not when the plant is installed. When plant material is determined to be unhealthy in accordance with paragraph PLANT ESTABLISHMENT PERIOD, it shall be replaced within 60 days of notification. Failure to replace plant material as requested within the 60 day grace period will result in the financial penalty of the cost of the plant plus labor. Replace plants as often as necessary until turn-over, then plants to be replaced once under this warranty. Replace all plants with same species and size as those which have died. Plant substitutions for dead material allowd only if directed by the Government.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

2.1.1 Plant Material Classification

The plant material shall be nursery grown stock conforming to ANLA Z60.1 and shall be the species specified.

2.1.2 Plant Schedule

The plant schedule shall provide botanical names as included in one or more of the publications listed under "Nomenclature" in ANLA Z60.1.

2.1.3 Substitutions

Substitutions will not be permitted without written request and approval from the Government.

2.1.4 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Plant quality is determined by the growing conditions; method of shipment to maintain health of the root system; and growth of the trunk and crown as follows.

2.1.5 Growing Conditions

Plant material shall be native to or well-suited to the growing conditions of the project site. Plant material shall be grown under climatic conditions similar to those at the project site.

2.1.6 Method of Shipment to Maintain Health of Root System

2.1.6.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine.

2.1.6.2 Balled and Potted (Pot) Plant Material

Ball size and ratio shall be in accordance with ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be done by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. Container shall be used to retain the ball unbroken. Container shall be rigid to hold ball shape and protect root mass during shipping.

2.1.6.3 Balled and Platform (BP) Plant Material

Ball size and ratio shall be in accordance with ANLA Z60.1. Plants shall be prepared as balled and burlapped plant material and securely fastened to wood platform for shipping.

2.1.6.4 Bare-Root (BR) Plant Material

Bare-root or lining-out stock is not acceptable.

2.1.6.5 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

2.1.7 Growth of Trunk and Crown

2.1.7.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed. All trees shall be native to the Fort Knox, Kentucky region.

a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 150 mm from ground level.

c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.7.2 Palms

Palms are not to be planted unless indigenous to the development area.

2.1.7.3 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project. All shrubs shall be native to the Fort Knox, Kentucky region.

2.1.7.4 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA Z60.1. The coniferous evergreen trees shall not be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated. All evergreens shall be native to the Fort Knox, Kentucky region.

2.1.7.5 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANLA Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project.

2.1.7.6 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of runners and length of runner recommended by ANLA Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well

developed root system and shall be furnished in containers. All ground covers shall be native to the Fort Knox, Kentucky region.

2.1.8 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be provided at no additional cost to the Government.

2.1.9 Plant Material Measurement

Plant material measurements shall be in accordance with ANLA Z60.1.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300A EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the plant material specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite is not recommended.

2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 55 percent shall pass through a 0.25 mm sieve. To raise soil pH, ground limestone shall be used.

2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm sieve and a minimum 97 percent shall pass through a 0.25 mm sieve.

2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140

percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 35 percent shall pass through a 0.25 mm sieve.

2.3.2 Fertilizer

[It shall be as recommended by the soil test] Fertilizer shall be controlled release commercial grade; free flowing, pellet or tablet form; uniform in composition; and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.3.3 Organic Material

Organic material shall consist of either bonemeal, peat, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.3.3.1 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.3.2 Rotted Manure

Rotted manure shall be unleached horse, chicken, or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and shall be free of stones, sticks, and soil.

2.3.3.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants, and stabilized with nitrogen.

2.3.3.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. It shall be derived from food, agricultural, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent or less by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm in length.

2.3.3.5 Worm Castings

Worm castings shall be screened from worms and food source and shall be

commercially packaged.

2.3.4 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for single use or in combination to meet topsoil requirements for the plant material specified.

2.3.4.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm sieve and a minimum 10 percent by weight shall pass a 1.18 mm sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

2.3.4.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized according to manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide with an absorption capacity of 250-400 times its weight.

2.3.4.3 Calcined Clay

Granular particles shall be produced from montmorillonite clay calcined to minimum temperature of 650 degrees C. Gradation: A minimum 90 percent passing 2.36 mm sieve; a minimum 99 percent shall be retained on 0.25 mm sieve; and a maximum 2 percent shall pass a 0.15 mm sieve. Bulk density: A maximum 640 kilogram per cubic meter .

2.3.4.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.3.4.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as a mulch because it would encourage surface rooting of the plant material and weeds.

2.4.1 Inorganic Mulch

When inorganic mulch is required for decorative purposes, it shall be provided in areas designated, and consist of:

a. Recycled rubber, [shredded,][chips,][colored][black] ranging in size from 6 to 19mm .

b. Riverbank stone ranging in size from 76 to 127mm .

c. Crusher run rock ranging in size from 6 to 19mm .

d. Granite chips ranging in size from 3 to 12mm .

2.4.2 Organic Mulch

Organic mulch materials shall be native to the project site and consist of recycled mulch, shredded bark, wood chips, or ground bark.

2.4.2.1 Recycled Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 65 x 65 mm screen. It shall be cleaned of all sticks a minimum 25 mm in diameter and plastic materials a minimum 75 mm length. The material shall be treated to retard the growth of mold and fungi. Other recycled mulch may include peanut shells, pecan shells or coco bean shells.

2.4.2.2 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

2.4.2.3 Wood Chips and Ground Bark

Locally chipped or ground material shall be treated to retard the growth of mold and fungi. Gradation: A maximum 50 mm wide by 100 mm long.

2.5 GEOTEXTILE

Geotextile shall be woven or nonwoven; polypropylene, polyester, or fiberglass, mat in accordance with ASTM D 5034 or ASTM D 5035. It shall be made specifically for use as a fabric around plant material. Nominal weight shall be a minimum 120 grams per square meter . Permeability rate shall be a minimum 1 mm per second.

2.6 WOOD STAKING MATERIAL

Wood stakes shall be hardwood or fir; rough sawn; free from knots, rot, cross grain, or other defects that would impair their strength.

2.6.1 Bracing Stake

Wood bracing stakes shall be a minimum 50 x 50 mm square and a minimum 2400 mm long with a point at one end. Stake shall be set without damaging rootball.

2.6.2 Wood Ground Stakes

Wood ground stakes shall be a minimum of 50 x 50 mm square and a minimum 900 mm long with a point at one end.

2.6.3 Deadmen

Wood deadmen shall be a minimum 100 x 100 x 900 mm long.

2.7 METAL STAKING AND GUYING MATERIAL

Metal shall be aluminum or steel consisting of recycled content made for holding plant material in place.

2.7.1 Bracing Stakes

Metal bracing stakes shall be a minimum 25 mm diameter and a minimum 2400 mm long. Stake shall be set without damaging rootball.

2.7.2 Metal Ground Stakes

Metal ground stakes shall be a minimum 13 mm diameter and a minimum 900 mm long.

2.7.3 Earth Anchor

Metal earth anchors shall be a minimum 13 mm diameter and a minimum 600 mm long.

2.7.4 Guying Material

Metal guying material shall be a minimum 12 gauge wire. Multi-strand cable shall be woven wire. Guying material tensile strength shall conform to the size of tree to be held firmly in place.

2.7.5 Turnbuckle

Metal turnbuckles shall be galvanized or cadmium-plated steel, and shall be a minimum 75 mm long with closed screw eyes on each end. Screw thread tensile strength shall conform to the size of tree to be held firmly in place.

2.8 PLASTIC STAKING AND GUYING MATERIAL

Plastic shall consist of recycled plastic product made for holding plant material firmly in place. Plastic shall not be used for deadmen.

2.8.1 Plastic Bracing Stake

Plastic bracing stakes shall be a minimum 50 mm diameter and a minimum 2400 mm long. Stake shall be set without damaging rootball.

2.8.2 Plastic Ground Stakes

Plastic ground stakes shall be a minimum 50 mm diameter and a minimum 900 mm long.

2.8.3 Plastic Guying Material

Plastic guying material shall be designed specifically for the purpose of firmly holding plant material in high wind velocities.

2.8.3.1 Edger Material

A .95mm thick commercial grade black steel edger strip shall be installed to contain all foundation planting beds and plant beds at entrance signs, picnic shelters, etc.

2.8.4 Chafing Guard

Plastic chafing guards shall be used to protect tree trunks and branches when metal is used as guying material. The material shall be the same color throughout the project site. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

2.9 RUBBER GUYING MATERIAL

Rubber chafing guards, consisting of recycled material, shall be used to protect tree trunks and branches when metal guying material is applied. The material shall be the same color throughout the project. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

2.10 FLAG

Plastic flag material shall be used on guying material. It shall be a minimum 150 mm long. Tape color shall be consistent and visually complimentary to the entire project area. The tape color shall meet pedestrian visual safety requirements for day and night.

2.11 TREE ROOT BARRIERS

Tree root barriers shall be metal or plastic consisting of recycled content. Barriers shall utilize vertical stabilizing members to encourage downward tree root growth. Barriers shall limit, by a minimum 90 percent, the occurrence of surface roots. Tree root barriers which are designed to be used as plant pit liners will be rejected.

2.11.1 Weed Barrier Filter Fabric

Under all woody shrubs and non-spreading perennials contained within edger material, install a commercial grade weed barrier under the mulch layer.

2.12 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

2.13 WATER

Unless otherwise directed, water shall be the responsibility of the

Contractor. Water shall not contain elements toxic to plant life. All water shall be potable and imported from off-site. No watering of plant material from house unit sillcock or internal hose-bib will be allowed.

2.14 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

PART 3 EXECUTION

3.1 INSTALLING PLANT MATERIAL TIME AND CONDITIONS

3.1.1 Deciduous Plant Material Time

Deciduous plant material shall be installed from April to October.

3.1.2 Evergreen Plant Material Time

Evergreen plant material shall be installed from April to June and from September to November.

3.1.3 Plant Material Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval.

3.1.4 Tests

3.1.4.1 Percolation Test

Test for percolation shall be done to determine positive drainage of plant pits and beds. A positive percolation shall consist of a minimum 25 mm per 3 hours; when a negative percolation test occurs, a shop drawing shall be submitted indicating the corrective measures intended to be taken.

3.1.4.2 Soil Test

Delivered topsoil, excavated plant pit soil, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection onsite shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the plant material specified.

3.2 SITE PREPARATION

3.2.1 Finished Grade, Topsoil and Underground Utilities

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300A EARTHWORK, prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.2.2 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

3.2.3 Protecting Existing Vegetation

When there are established lawns in the planting area, the turf shall be covered and/or protected during planting operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline to protect them during planting operations.

3.3 EXCAVATION

3.3.1 Obstructions Below Ground
3.3.4 Approved Treess

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, type of plant and planting method shall be submitted for approval.

3.3.2 Turf Removal

Where the planting operation occurs in an existing lawn area, the turf shall be removed from the excavation area to a depth that will ensure the removal of the entire root system.

3.3.3 Plant Pits

Plant pits for ball and burlapped or container plant material shall be dug to a depth equal to the height of the root ball as measured from the base of the ball to the base of the plant trunk. Plant pits for bare-root plant material shall be dug to a depth equal to the height of the root system. Plant pits shall be dug a minimum 50 percent wider than the ball or root system to allow for root expansion. The pit shall be constructed with sides sloping towards the base as a cone, to encourage well aerated soil to be available to the root system for favorable root growth. Cylindrical pits with vertical sides shall not be used.

3.3.4 Approved Trees & Shrubs for Planting

The following is a sample list of trees recommended for planting. Small flowering trees are not desirable. All vegetation proposed for this project must be indigenous to the region. Exotics are not allowed.

Large Trees:

Autumn Blaze Maple (Acer x freemanii)
Recommended Cultivars: Celebration, Autumn Blaze
(allowable hybrid maple)

Whitespire Birch (Betula platphylla 'Whitesprire')
Recommended Cultivars: Whitespire

Winter King Hawthorn (Crataegus viridis)

European Beech (Fagus sylvatica)
Recommended Cultivars: Asplenifolia, Atropunucea, Tricolor

American Ash (Fraxinus americana)
Recommended Cultivars: Rosehill, Autumn Applause, Autumn Purple

Maidenhair Tree (Ginkgo biloba), no female plants allowed.
Recommended Cultivars: Princeton Sentry, Autumn Gold, Magyar
(non-native, but already planted at Fort Knox)

Golden Raintree (Koelreuteria paniculata)
Recommended Cultivars: September

Sweetgum (Liquidambar styraciflua)

Galaxy Magnolia (Magnolia x 'galaxy')

Dawn Redwood (Metasequoia glyptostroboides)

Sawtooth Oak (Quercus acutissima)

Scarlet Oak (Quercus coccinea)

Willow Oak (Quercus phellos)

Common Bald Cypress (Taxodium distichum)
Recommended Cultivars: Shawnee Brave

American Elm (Ulmus americana)
Recommended Cultivars: Valley Forge, New Harmony, Princeton

Japanese Zelkova (Zelkova serrata)
Recommended Cultivars: Green Vase, Village Green

Sugar Maple (Acer Saccharum)
Recommended Cultivars: Green Mountain, Commemoration

Sweet Birch (Betula lenta)

River Birch (Betula nigra)
Recommended Cultivars: Heritage

European Hornbeam (Carpinus betulas)
Recommended Cultivars: Fastigiata

American Yellowood (Cladrastis kentukea)

American Beech (Fagus grandifolia)

Weeping European Beech (Fagus sylvatica 'pendula')
Recommended Cultivars: Purpurea, Purple Fountain

Green Ash (Fraxinus pennsylvatica)
Recommended Cultivars: Patmore, Urbanite, Cimmaron

Shademaster Locust (Gleditsia triacanthos inermis)
Recommended Cultivars: Shademaster, True Shade, Skyline

Kentucky Coffee Tree (Gymnocladus dioicus)

Japanese Larch (Larix kaempferi)

Tulip Poplar (Liriodendron tulipifera)

Loebner Magnolia (Magnolia x loebneri)
Recommended Cultivars: Merrill

Black Gum (Nyssa sylvatica)

Swamp White Oak (Quercus bicolor)

Shingle Oak (Quercus imbricaria)

English Oak (Quercus robur)
Recommended Cultivars: Rosehill

Littleleaf Linden (Tilia Cordata)
Recommended Cultivars: Glenleven, Greensprire

Lacebark Elm (Ulmus parvifolia)

Large Deciduous Shrubs:

Bottlebrush Buckeye (Aesculus parviflora)

White Fringetree (Chionanthus virginicus)

Border Forsythia (Forsythia x intermedia)
Recommended Cultivars: Spring Glory, Karl Sax

Rose of Sharon (Hibiscus syriacus)
Recommended Cultivars: Diana, Aphrodite, Minerva

Panicle Hydrangea (Hydrangea paniculata)
Recommended Cultivars: Unique, Tardiva

Possumhaw Holly (Ilex dicidua)
Recommended Cultivars: Warren Red,
Council Fire

Doublefile Viburnum (Virburnum plicatum var. tomemtosum)
Recommended Cultivars: Mariesii, Shasta, Newport

Lantanaphyllum Viburnum (Virburnum x rhytidophylloides)
Recommended Cultivars: Alleghany, Willowwood

Fringetree (Chionanthus retusus)

Redosier Dogwood (Cornus sericea)
Recommended Cultivars: Bailey, Flaviramea (yellow stems), Elegantissima

Witch Hazel (Hamamelis x intermedia)
Recommended Cultivars: Jelena, Diane, Arnold Promise

Bigleaf Hydrangea (Hydrangea macrophylla)
Recommended Cultivars: Domotoi, Nikko Blue, Pink Beauty, Variegata,
'Merritt Supreme'

Oakleaf Hydrangea (Hydrangea quercifolia)
Recommended Cultivars: Snow Queen, Sikes Dwarf

Winterberry Holly (Ilex verticillata)
Recommended Cultivars: Winter Red, Red Sprite

Arrowwood Viburnum (Viburnum dentatum)
Recommended Cultivars: Chicago Luster

Blackhaw Virburnum (Viburnum prunifolium)

Burkwood Viburnum (Viburnum x burkwoodii)
Recommended Cultivars: Mohawk

Judd Viburnum (Viburnum x juddii)

Medium / Small Deciduous Shrubs:

Glossy Abelia (Abelia x grandiflora)
Recommended Cultivars: Francis Mason, Sherwood

Japanese Barberry (Berberis thunbergii)
Recommended Cultivars: Kolbold, Rose Glow,
Crimson Pygmy, Golden Nuggett

Purple Beautyberry (Callicarpa dichotoma)

Bluebeard (Caryopteris x clandonensis)
Recommended Cultivars: Dark Knight, Longwood Blue,

'Blue Mist'

Summersweet (Clethera alnifolia)
Recommended Cultivars: Ruby Spice, Hummingbird

Rock Cotoneaster (Cotoneaster horizontalis)
Recommended Cultivars: Apiculatus, Scarlet Leader, Dammeri

Dwarf Forsythia (Forsythia viridissima)
Recommended Cultivars: Bronxensis, Gold Tide

Dwarf Fothergilla (Fothergilla gardenii)
Recommended Cultivars: Mt. Airy, Blue Mist

Smooth Hydrangea (Hydrangea arborescens)
Recommended Cultivars: Annabelle

Virginia Sweetspire (Itea virginica)
Recommended Cultivars: Henry's Garnet, Little Henry

Northern Bayberry (Myrica pensylvanica)

Exbury Azalea (Rhododendron 'Exbury Azalea'
Recommended Cultivars: Gibraltar, Chetco, Northern Lights

Red Chokeberry (Aronia arbutifolia)
Recommended Cultivars: Brilliantissima, Melanocarpa

Butterfly Bush (Buddleia x davidii)
Recommended Cultivars: Black Knight, Nanho Blue, Pink Charming, White Profusion

Sweetshrub (Calycanthus floridus)

Common Flowering Quince (Chaenomeles speciosa)
Recommended Cultivars: Texas Scarlet, Cameo, Jet Trail

Harry Lauder's Walking Stick (Corylus avellana)
Recommended Cultivars: Contorta

Compact Burning Bush (Euonymus alatus 'Compactus'
Recommended Cultivars: Rudy Haag

Golden St. Johnswort (Hypericum frondosum)
Recommended Cultivars: Sunburst, Hidcote

Japanese Kerria (Kerria japonica)
Recommended Cultivars: Pleniflora, Golden Guinea

Mockorange (Philadelphus x virginalis)
Recommended Cultivars: Minnesota Snowflake, Natchez

Fragrant Sumac (Rhus aromatica)
Recommended Cultivars: Grow-Low

Smooth Witherod Viburnum (Viburnum nudum)
Recommended Cultivars: Winterthur

Japanese Spirea (Spiraea japonica)
Recommended Cultivars: Anthony Waterer, Little Princess, Gold Mound, Alpine

Service Viburnum (Viburnum utile)
Recommended Cultivars: Eskimo, Cheasapeake

Other native plants will be considered upon written request to the Fort Knox Post Forestry Department. Total plantings shall contain no more than 20% of any one single species.

3.4 INSTALLATION

3.4.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown.

3.4.1.1 Bare-Root Plant Material

Bare-root plant material shall be placed in water a minimum 30 minutes prior to setting.

3.4.2 Tree Root Barrier

Tree root barriers shall be installed as recommended by the manufacturer. Tree root barriers shall be used for trees located up to a maximum 1800 mm from paved surfaces or structures.

3.4.3 Backfill Soil Mixture

The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used.

3.4.4 Adding Mycorrhizal Fungi Inoculum

Mycorrhizal fungi inoculum shall be added as recommended by the manufacturer for the plant material specified.

3.4.5 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Additional requirements are as follows.

3.4.5.1 Balled and Burlapped, and Balled and Platformed Plant Material

Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/3 depth from the top of the root ball. Backfill mixture shall be added to the plant pit in 150 mm layers with each layer tamped.

3.4.5.2 Bare-Root Plant Material

The root system shall be spread out and arranged in its natural position. Damaged roots shall be removed with a clean cut. The backfill soil mixture shall be carefully worked in amongst the roots and watered to form a soupy mixture. Air pockets shall be removed from around the root system, and root to soil contact shall be provided.

3.4.5.3 Container-Grown and Balled and Potted Plant Material

The plant material shall be carefully removed from containers that are not biodegradeable. Prior to setting the plant in the pit, a maximum 1/4 depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. Backfill mixture shall be added to the plant pit in 150 mm layers with each layer tamped.

3.4.5.4 Earth Berm

An earth berm, consisting of backfill soil mixture, shall be formed with a minimum 100 mm height around the edge of the plant pit to aid in water retention and to provide soil for settling adjustments.

3.4.6 Plant Bed

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas. Earth berms shall be provided. Polymers shall be spread uniformly over the plant bed and in the planting pit as recommended by the manufacturer and thoroughly incorporated into the soil to a maximum 100 mm depth.

3.4.7 Watering

Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated with potable, imported water only.

3.4.8 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity.

3.4.8.1 One Bracing Stake

Trees 1200 to 1800 mm high shall be firmly anchored in place with one

bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly to the stake with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. A chafing guard shall be used when metal is the guying material.

3.4.8.2 Two Bracing Stakes

Trees from 1800 to 2400 m height shall be firmly anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly between the stakes with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Chafing guards shall be used when metal is the guying material.

3.4.8.3 Three Ground Stakes

Trees over a minimum 2400 mm height and less than a maximum 150 mm caliper shall be held firmly in place with 3 bracing or ground stakes spaced equidistantly around the tree. Ground stakes shall be avoided in areas to be mowed. Stakes shall be driven into firm ground outside the earth berm. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. For trees over maximum 75 mm diameter at breast height, turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used when metal is the guying material.

3.4.9 Deadmen or Earth Anchors

Trees over a minimum 150 mm caliper shall be held firmly in place with wood deadmen buried a minimum 900 mm in the ground or metal earth anchors. Multi-strand cable guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used.

3.4.10 Flags

A flag shall be securely fastened to each guy line equidistant between the tree and the stake, deadmen, or earth anchor. The flag shall be visible to pedestrians.

3.5 FINISHING

3.5.1 Plant Material

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent turf area, shaped as indicated. The installed area shall be raked and smoothed while maintaining the earth berms.

3.5.2 Placing Geotextile

Prior to placing mulch, geotextile shall be placed as indicated in accordance with the manufacturer's recommendations.

3.5.3 Placing Mulch

The placement of mulch shall occur a maximum 48 hours after planting. Mulch, used to reduce soil water loss, regulate soil temperature and prevent weed growth, shall be spread to cover the installed area with a minimum 100 mm uniform thickness. Mulch shall be kept out of the crowns of shrubs, ground cover, and vines and shall be kept off buildings, sidewalks and other facilities.

3.5.4 Pruning

Pruning shall be accomplished by trained and experienced personnel. The pruning of trees and palms shall be in accordance with ANSI A300. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3.6 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, and adjusting settling.

3.7 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.7.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

3.7.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall

only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

3.8 RESTORATION AND CLEAN UP

3.8.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.8.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

3.9 PLANT ESTABLISHMENT PERIOD

3.9.1 Commencement

The plant establishment period for maintaining exterior plantings in a healthy growing condition shall commence on the first day of exterior planting work under this contract and shall continue through the remaining life of the contract. Plants which die while the site is under contractor control shall be replaced immediately and as often as necessary. Single plant replacement for one calendar year shall occur upon development turn-over to the Government. If plant establishment has not been met at time of building turn-over, the contractor shall return to the site as often as necessary to achieve acceptable establishment, prior to full site acceptance and warranty period commencement. See the paragraph WARRANTY in this specification section. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described. The plant establishment period shall be coordinated with Sections 02921A SEEDING & 02922A SODDING. The plant establishment period shall be modified for inclement weather shut down periods, or for separate completion dates for areas.

3.9.2 Maintenance During Establishment Period

Maintenance of plant material shall include straightening plant material, straightening stakes; tightening guying material; correcting girdling; supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants.

3.9.2.1 Watering Plant Material

The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of 25 mm absorbed water per week, delivered in the form of rain or augmented by

watering. 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 existing plant material shall be prevented.

3.9.2.2 Weeding

Grass and weeds in the installed areas shall not be allowed to reach a maximum 75 mm height before being completely removed, including the root system.

3.9.2.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.9.2.4 Post-Fertilization

The plant material shall be topdressed at least once during the period of establishment with controlled release fertilizer, reference paragraph SOIL AMENDMENTS. Apply at the rate of 1 kilogram per 10 square meters of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

3.9.2.5 Plant Pit Settling

When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit or plant bed until the backfill level is equal to the surrounding grade. Serious settling that affects the setting of the plant in relation to the maximum depth at which it was grown requires replanting in accordance with paragraph INSTALLATION. The earth berm shall be maintained.

3.9.2.6 Maintenance Record

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, and the quantity of replacements made on each site visit.

3.9.3 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 2 mm square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement. Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

3.9.4 Replacement Plant Material

Unless otherwise directed, plant material shall be provided for replacement

in accordance with paragraph PLANT MATERIAL. Replacement plant material shall be installed in accordance with paragraph INSTALLATION, and recommendations in paragraph PLANT ESTABLISHMENT PERIOD. Plant material shall be replaced in accordance with paragraph WARRANTY. An extended plant establishment period shall not be required for replacement plant material.

3.9.5 Maintenance Instructions

Written instructions shall be furnished containing drawings and other necessary information for year-round care of the installed plant material; including, when and where maintenance should occur, and the procedures for plant material replacement,.

-- End of Section --

SECTION 02935A

EXTERIOR PLANT MATERIAL MAINTENANCE
01/02

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 basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300	(1995) Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a) Agricultural Liming Materials
ASTM D 4972	(1995a) pH of Soils
ASTM D 5883	(1996el) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL PROCEDURES:

SD-03 Product Data

Chemical Treatment Material;

Manufacturer's literature including physical characteristics, application and installation instructions for chemical treatment material.

Work Plan and Schedule;
Delivery Schedule;

Contractor's work plan and schedules.

Maintenance Record;

Contractor's record of each site visit.

Application of Pesticide;

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-06 Test Reports

Soil Tests;
Percolation Test;

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

pH Adjuster;
Fertilizer;
Mulch;
Pesticide;

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. pH Adjuster. Calcium carbonate equivalent and sieve analysis.

b. Fertilizer. Chemical analysis and composition percent.

c. Mulch: Composition and source.

d. Pesticide. EPA registration number and registered uses.

1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.3.1 Delivery Schedule

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.3.2 Delivery of Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

1.3.3 Storage

Materials shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.3.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

PART 2 PRODUCTS

2.1 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite shall not be used.

2.1.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified or in place.

2.1.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 55 percent shall pass through a 0.250 mm sieve. To raise soil pH, ground limestone shall be used.

2.1.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm sieve and a minimum 97 percent shall pass through a 0.250 mm sieve.

2.1.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 35 percent shall pass through a 0.250 mm sieve.

2.1.2 Fertilizer

Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The nutrients ratio shall be percent nitrogen, percent phosphorus, and percent potassium. The fertilizer shall be derived from sulfur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

2.1.3 Nitrogen Carrier Fertilizer

Nitrogen carrier fertilizer shall be commercial grade, free flowing, and uniform in composition. The nutrients ratio shall be percent nitrogen, percent phosphorus, and percent potassium. The fertilizer may be a liquid nitrogen solution.

2.1.4 Organic Material

Organic material shall consist of bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

2.1.4.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.1.4.2 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds.

2.1.4.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall consist of ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

2.1.4.4 Recycled Compost

Recycled compost shall be well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter.

2.1.4.5 Worm Castings

Worm castings shall be screened from worms and food source, commercially packaged.

2.1.5 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination.

2.1.5.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm sieve and a minimum 10 percent by weight shall pass a 1.18 mm sieve. Green sand shall be balanced with the inclusion of trace minerals and nutrients.

2.1.5.2 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 650 degrees C. Gradation: A minimum 90 percent shall pass a 2.36 mm sieve; a minimum 99 percent shall be retained on a 0.250 mm sieve; and a maximum 2 percent shall pass a 0.150 mm sieve. Bulk density: A maximum 640 kilogram per cubic meter .

2.1.5.3 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

2.1.5.4 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall conform to ASTM D 5883.

2.2 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure shall not be used. Use Single Shread Hardwood mulch.

2.2.1 Inorganic Mulch

Where inorganic mulch is used for decorative purposes, it shall be replaced or augmented in areas designated. Match existing mulch in size, color, and texture.

a. Recycled rubber pellets & Smooth-Tumbled Recycled Glass ranging in size from 6 to 19mm .

b. Riverbank stone ranging in size from 76 to 127mm .

c. Crusher run rock ranging in size from 6 to 19mm .

d. Granite chips ranging in size from 3 to 12mm .

2.2.2 Organic Mulch

Organic mulch materials shall be native to the project site and consist of recycled mulch, shredded bark, wood chips, or ground bark for use when remulching trees, shrubs, and ground covers.

2.2.2.1 Recycled Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 65 x 65 mm screen. It shall be cleaned of all sticks a minimum 25 mm in diameter and plastic materials a minimum 75 mm length. The material shall be treated to retard the growth of mold and fungi. Other recycled mulch may include walnut hulls, pecan hulls or coco bean shells.

2.2.2.2 Shredded Bark

Locally single-shredded hardwood material shall be treated to retard the growth of mold and fungi.

2.2.2.3 Wood Chips and Ground Bark

Locally chipped or ground material shall be treated to retard the growth of mold and fungi. Gradation: A maximum 50 mm wide by 100 mm long.

2.3 WATER

Water shall be the responsibility of the Contractor. Water shall not contain elements toxic to plant life. Water shall be potable and imported from off-site. Water may not be obtained from house sillcocks or from interior hose bibs.

2.4 PESTICIDE

Pesticide shall be an insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

2.5 HERBICIDE

Herbicide shall be EPA registered and approved; furnished for [preemergence] [and] [postemergence] application for [crabgrass control] [and] [broad leaf weed control] and complying with Federal Insecticide, Fungicide, and Rodenticide Act (Title 7 U.S.C. Section 136) for requirements on Contractor's licensing, certification, and record keeping. Contractor shall keep records of all pesticide applications and forward data monthly to Contracting Officer. Record keeping format shall be submitted to Contracting Officer for approval.

PART 3 EXECUTION

3.1 SOIL TESTS

Contractor shall perform soil tests in accordance with [ASTM D 4972].

3.2 SITE PREPARATION

3.2.1 Applying pH Adjuster

pH adjuster shall be applied at a rate of 1.5 kilograms per square meter . Soil conditioner shall be applied at a rate of .25 kilograms per square meter .]

3.2.2 Applying Fertilizer

Apply fertilizer at rate of .68 kilograms per square meter .

3.3 MULCHING

Mulch shall be mixed and applied in accordance with the manufacturer's recommendations. Mulch shall be placed a minimum of 10cm deep.

3.4 WATERING

Water to supplement rainfall shall be applied at a rate sufficient to ensure plant growth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

3.5 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

3.5.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control.

3.5.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended to prevent the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

3.6 GENERAL MAINTENANCE REQUIREMENTS

3.6.1 Fertilization

Fertilizer shall be applied at rate of .68 kilograms per square meter . Application shall be timed prior to the advent of winter dormancy and performed without burning plants.

3.6.2 Pesticide Treatment

Pesticide treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.6.3 Irrigation

Irrigation systems are prohibited for this project at Fort Knox.

3.6.4 Maintenance Record

A record of each site visit shall be furnished, describing:

a. Maintenance work performed.

b. Areas repaired or reinstalled.

c. Diagnosis for unsatisfactory stand of grass.

d. Diagnosis for unsatisfactory stand of plant material in planting bed.

e. Condition of trees.

f. Condition of shrubs.

g. Quantity and diagnosis of plant loss.

3.7 GRASS PLANT QUALITY

Grass plants shall be evaluated for species and health when the grass plants are a minimum 25 mm high. The living grass area shall be maintained to be uniform in color and leaf texture; and free from weeds and other undesirable growth. The living grass area shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 25 mm in diameter, woody plant roots, and other materials detrimental to a healthy stand of grass plants. Broadleaf weeds and patches of foreign grasses shall be a maximum 2 percent of the total area.

3.7.1 Lawn Area

A satisfactory stand of grass plants for a lawn area shall be a minimum 200 grass plants per square meter . Bare spots shall be a maximum 150mm square. The total bare spots shall be a maximum 2 percent of the total area.

3.7.2 Field Area

A satisfactory stand of grass plants for a field area shall be a minimum 100 grass plants per square meter . The total bare spots shall not exceed 2 percent of the total seeded area.

3.8 LAWN AND FIELD AREAS MAINTENANCE

3.8.1 Mowing

Lawn and field areas shall be mowed throughout the growing season to meet the requirements of paragraph GRASS PLANT QUALITY. Cutting height shall be adjusted according to type of grass. Frequency of mowing shall be adjusted so that no more than 1/4 of leaf length is removed during a cutting.

3.8.1.1 Lawn Areas

Lawn areas shall be mowed to a minimum 50mm height when the turf is a maximum 76mm high. Remove clippings when the amount cut prevents sunlight from reaching the ground surface.

3.8.1.2 Field Areas

Field areas shall be mowed [once] during the season to a minimum 152mm height. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

3.8.2 Turf Trimming

Turf adjoining paved areas, planting beds and trees shall be kept neatly trimmed at all times, essentially after each mowing. String trimmers at trees and shrubs will be [allowed][prohibited].

3.8.3 Aeration

Turf areas shall be aerated [once] per year using approved devices. Coring shall be performed by pulling soil plugs to minimum of 100mm . Soil plugs produced in turf areas shall be left in place. Debris generated during aeration operations shall be removed. Aeration shall be performed only on turf areas which receive concentrated foot or vehicle traffic sufficient to warrant aeration, or when water ponds on the surface after a 5 mm, watering.

3.8.4 Lime

Lime for pH modification shall be applied as required to meet the requirements of paragraph GRASS PLANT QUALITY.

3.8.5 Herbicide Weed Control

Two or more applications of a pre-emergent herbicide and of a post-emergent herbicide shall be performed to meet the requirements of paragraph GRASS PLANT QUALITY.

3.8.6 Turf Fertilization Program

A regular program of fertilization shall be established to include a spring feeding and early summer feeding to meet the requirements of paragraph GRASS PLANT QUALITY. A total of four pounds of Nitrogen per 92 square meters shall be applied annually. Additional one pound Nitrogen applications shall be provided as grass color warrants.

3.9 PLANTING BEDS MAINTENANCE

3.9.1 Trimming

Spent flower heads shall be removed. Seasonal succession of bloom requires removal for new plant or trimming back bulb foliage.

3.9.1 Weed Control

Grass and weeds in planting beds shall be completely removed before reaching 75 mm in height. Do not spray herbicide in plant beds, pull weeds by hand or by digging with a small hand tool.

3.10 PLANT MATERIAL QUALITY

3.10.1 General Requirements

Plant material shall be identified as native to the region of the site or as a specimen. Plant material shall be maintained as well shaped, well grown, vigorous plant material having healthy root systems. The plant material shall be maintained as free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems. Plant quality is determined by the growing conditions; climate and microclimate of the site for maintaining a healthy root system; and growth of the trunk and crown as follows.

3.10.2 Growth of Trunk and Crown

3.10.2.1 Deciduous Trees

Deciduous tree height to caliper relationship shall be maintained. Height of branching shall bear a relationship to the size and species of the tree and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader. Do not pole tree leaders.

b. Multi-stem: To be considered a stem, there shall be no division of the trunk which branches more than 150 mm from ground level.

c. Specimen: The tree shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be indicated.

3.10.2.2 Palms

Palms shall be maintained to have healthy fronds or foliage as typical for the variety grown in the region of the site.

3.10.2.3 Deciduous Shrubs

Deciduous shrub height to number of primary stems shall be maintained. Shrubs shall be maintained as well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the site.

3.10.2.4 Coniferous Evergreen Plant Material

Coniferous evergreen plant material height-to-spread ratio shall be maintained. The coniferous evergreen trees shall not be "poled" or the leader removed. The plant material shall be maintained to be well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be indicated.

3.10.2.5 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material height-to-spread ratio shall be maintained. The plant material shall be shaped to be recognized by the trade as typical for the variety grown in the region of the site.

3.10.2.6 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall be maintained to have a heavy, well developed, and balanced crown with vigorous, well developed root system.

3.11 SHRUB AND HEDGE MAINTENANCE

3.11.1 Trimming and Pruning

Trimming shall be performed to ensure the following:

a. Safety.

b. Quality (size, height, and shape).

c. Health (removing broken, diseased branches).

d. Rejuvenation (removing one third to one half of the older stems or branches).

e. Visibility (signs, building entrances, motorist line of sight).

Shrubs shall be pruned to the requirements of paragraph PLANT MATERIAL QUALITY. Pruning shall be accomplished by trained and experienced personnel in accordance with ANSI A300. The typical growth habit of individual plant material or the theme shape of the hedge shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed.

3.11.1 Shrub Fertilization Program

A regular program of fertilization shall be established to include a fall feeding to meet the requirements of paragraph PLANT MATERIAL QUALITY. Use industry standards for foliage and root fertilizing the plant material inventoried.

3.12 TREE MAINTENANCE

3.12.1 Trimming and Pruning of Trees

Trimming shall be performed to ensure the following:

a. Safety.

b. Quality (size, height).

c. Health (removing broken, diseased wood branches).

d. Rejuvenation (removing one third to one half of the older stems or branches).

e. Visibility (signs, building entrances, motorist line of sight).

Trees shall be pruned to meet the requirements of paragraph PLANT MATERIAL QUALITY. Pruning shall be accomplished by trained and experienced personnel in accordance with ANSI A300. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3.12.1 Tree Fertilization Program

A regular program of fertilization shall be established to include a fall feeding to meet the requirements of paragraph PLANT MATERIAL QUALITY. Use industry standards for foliage and root fertilizing the plant material inventoried.

3.12.2 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 2 mm square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement. Unhealthy or dead plant material shall be removed immediately.

3.13 RESTORATION AND CLEAN UP

3.13.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the maintenance operations shall be restored to original condition at Contractor's expense.

3.13.2 Clean Up

Excess and waste material shall be removed from the maintenance areas and dispose off site. Adjacent paved areas shall be cleaned as determined by the Contracting Officer.

3.14 CLEANING OF PAVED AREAS

Grass, weeds, leaves, and debris from mowing, clipping, and pruning shall be removed immediately. Excess and waste material shall be removed from paved areas and disposed off site. Debris, leaves shall be removed [weekly.][monthly.]

-- End of Section --

SECTION 03101A

FORMWORK FOR CONCRETE
09/01

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1.5 SAMPLE PANELS

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3.2.2 Formwork Supporting Weight of Concrete

3.3 INSPECTION

-- End of Section --

SECTION 03150A

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS
05/98

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-- End of Section --

SECTION 03200A

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09/97

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-- End of Section --

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE
11/01

PART 1 GENERAL

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1.6.2.1 Strength Requirements

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1.6.3 Air Entrainment

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1.8 STORAGE OF MATERIALS

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2.11 FLOOR HARDENER

2.12 PERIMETER INSULATION

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2.14 JOINT MATERIALS

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3.1.1.2 Preparation of Rock

3.1.1.3 Excavated Surfaces in Lieu of Forms

3.1.2 Previously Placed Concrete

3.1.2.1 Air-Water Cutting

3.1.2.2 High-Pressure Water Jet

3.1.2.3 Wet Sandblasting

3.1.2.4 Waste Disposal

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SECTION 06200A

FINISH CARPENTRY
11/01

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SECTION 06650

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10/00

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-- End of Section --

SECTION 07311

ASPHALT SHINGLES
02/03

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 41	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 224	(1989; R 1996) Smooth-Surfaced Asphalt Roll Roofing (Organic Felt)
ASTM D 226	(1997; Rev. A) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 249	(1989; R 1996) Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules
ASTM D 1970	(2001) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D 3018	(2000) Class A Asphalt Shingles Surfaced with Mineral Granules
ASTM D 3462	(2001) Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules
ASTM D 4586	(2000) Asphalt Roof Cement, Asbestos Free
ASTM D 4869	(1988; R 1993) Asphalt-Saturated Organic Felt Shingle Underlayment Used in Roofing

UNDERWRITERS LABORATORIES (UL)

UL 790	(1997) Fire Resistance of Roof Covering Materials
UL 997	(1995) Wind Resistance of Prepared Roof Covering Materials

1.2 DEFINITIONS

1.2.1 Top Lap

That portion of shingle overlapping shingle in course below.

1.2.2 Head Lap

The triple coverage portion of top lap which is the shortest distance from the butt edge of an overlapping shingle to the upper edge of a shingle in the second course below.

1.2.3 Exposure

That portion of a shingle exposed to the weather after installation.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL REQUIREMENTS FOR DESIGN/BUILD:

SD-03 Product Data

Shingles

Submit data including type, weight, class, UL labels, and special types of underlayment and eave flashing.

SD-04 Samples

Shingles; G

Full shingle sample and manufacturer's standard size samples of materials and products requiring color or finish selection.

Color charts; G

SD-08 Manufacturer's Instructions

Application

1.4 DELIVERY AND STORAGE

Deliver materials in the manufacturer's unopened bundles and containers bearing the manufacturer's brand name. Keep materials dry, completely covered, and protected from the weather. Store according to manufacturer's written instructions. Roll goods shall be stored on end in an upright position or in accordance with manufacturer's recommendations. Immediately before laying, roofing felt shall be stored for 24 hours in an area maintained at a temperature not lower than 10 degrees C. (50 degrees F).

1.5 WARRANTIES

Warranties shall begin on the date of Government acceptance of the work.

1.5.1 Manufacturer's Warranty

Furnish the asphalt shingle manufacturer's standard 30 year warranty for the asphalt shingles. The warranty shall run directly to the Government.

1.5.2 Contractor's Warranty

The Contractor shall warrant for 5 years that the asphalt shingle roofing system, as installed, is free from defects in workmanship. When repairs due to defective workmanship are required during the Contractor's warranty period, the Contractor shall make such repairs within 72 hours of notification. When repairs are not performed within the specified time, emergency repairs performed by others will not void the warranty.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Shingles

Mineral granule-surfaced asphalt shingles, self-sealing, square tab, strip, fungus-resistant. ASTM D 3018, Type I, and ASTM D 3462, architectural shingles weighing not less than 14.2 kilograms per square meter 113 kg (250 pounds per 100 square feet). Shingles shall meet the fire resistance requirements of UL 790 for Class A and the wind resistance requirements of UL 997. Color shall be as selected from the manufacturer's standard color charts. All shingles shall be from one color lot.

2.1.2 Mineral-Surfaced Asphalt Roll Roofing

ASTM D 249.

2.1.3 Smooth-Surfaced Asphalt Roll Roofing

ASTM D 224, Type II.

2.1.4 Underlayment

Asphalt-saturated felt conforming to ASTM D 4869 or ASTM D 226, Type I, number 15, without perforations or other material specified by the shingle manufacturer for use as underlayment.

2.1.4.1 Leak Barrier Underlayment

Self-adhering leak barrier or ice dam underlayment shall comply with ASTM D 1970 for sealability around nails.

2.1.5 Self-Adhering Membrane

Self-adhering rubberized asphaltic membrane, a minimum of one mm (40 mils) thick, and recommended by the shingle manufacturer for use as eaves

flashing.

2.1.6 Nails for Applying Shingles and Asphalt-Saturated Felt

Aluminum or hot-dipped galvanized steel or equivalent corrosion resistant with sharp points and flat heads 10 to 11 mm (3/8 to 7/16) inch in diameter. Shank diameter of nails shall be a minimum of 2.67 mm (0.105 inch) and a maximum of 3.43 mm (0.135 inch) with garb or otherwise deformed for added pull-out resistance. Nails shall be long enough to penetrate completely through or extend a minimum of 20 mm (3/4 inch) into roof deck, whichever is less, when driven through materials to be fastened.

2.1.7 Asphalt Roof Cement

ASTM D 4586, Type II.

2.1.8 Asphalt Primer

ASTM D 41.

2.1.9 Ventilators

2.1.9.1 Nailable Plastic Shingle Over Type Ridge Vents

Ridge vents shall be constructed of UV stabilized nailable rigid polypropylene material, approximately 0.30 m (1 foot) wide and 25 mm (1 inch) thick, and shall be in 1.2 m (4 foot) long interlocking sections with self-aligning ends or corrugated polyethylene rigid roll or rigid strip ridge vent with aluminum wind deflectors on each side. Vents shall be designed to prevent infiltration of insects, rain, and snow.

2.1.9.2 Nailable Mesh Shingle Over Type Ridge Vents

Ridge vents shall be constructed of UV stabilized nailable polyester mesh material, approximately 0.30 m (one foot) wide. Vents shall be designed to prevent infiltration of insects, rain, and snow.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

Ensure that roof deck is smooth, clean, dry, and without loose knots. Roof surfaces shall be firm and free from loose boards, large cracks,and projecting ends that might damage the roofing. Vents and other projections through roofs shall be properly flashed and secured in position, and projecting nails shall be driven flush with the deck.

3.2 SURFACE PREPARATION

Cover knotholes and cracks with sheet metal nailed securely to sheathing. Flash and secure vents and other roof projections, and drive projecting nails firmly home.

3.3 APPLICATION

Apply roofing materials as specified herein unless specified or recommended otherwise by shingle manufacturer's written instructions.

3.3.1 Underlayment

Provide for roof slopes one in three (4 inches per foot) and greater. Apply one layer of shingle underlayment to roof deck. Lay underlayment parallel to roof eaves, starting at eaves. Provide minimum 50 mm (2 inch) head laps, 100 mm (4 inch) end laps, and 150 mm (6 inch) laps from both sides over hips and ridges. Nail sufficiently to hold until shingles are applied. Turn up vertical surfaces a minimum of 100 mm (4 inches)When a self-adhering membrane is used for eave flashing, start underlayment from upper edge of eave flashing..

3.3.2 Drip Edges

Provide metal drip edges as specified in Section 07600N, "Flashing and Sheet Metal," applied directly on the wood deck at eaves and over the underlayment at rakes. Extend back from edge of deck a minimum of 75 mm (3 inches), and secure with nails spaced a maximum of 100 millimeters (4 inches) o.c. along inner edge.

3.3.3 Starter Strip

Apply starter strip at eaves, using 225 mm (9 inch) wide strip of mineral-surfaced roll roofing of a color to match shingles. Optionally, use a row of shingles with tabs removed and trimmed to ensure that joints are not exposed at shingle cutouts. Apply starter strip along eaves, overhanging the metal drip edge at eaves and rake edges 6 to 10 mm (1/4 inch to 3/8 inch); fasten in a line parallel to and 75 to 100 mm (3 to 4 inches) above eave edge. Place nails so top of nail is not exposed in cutouts of first course of shingles. Fasten with 6 nails per strip of shingles or space nails at 150 mm (6 inches) o.c. for roll roofing. Seal tabs of first course of shingles with asphalt roof cement as specified below.

3.3.4 Shingle Courses

Start first course with full shingle, and apply succeeding courses with joints staggered at thirds or halves. Butt-end joints of shingles shall not align vertically more often than every fourth course. Apply shingle courses as follows:

a. Fastening: Do not drive fasteners into or above the factory-applied adhesive unless adhesive is located 16 mm (5/8 inch) or closer to top of cutouts. Place fasteners so they are concealed by shingle top lap and penetrate the head lap.

b. Nailing: Apply shingles with nominal 125 mm (5 inch) exposure. Apply each shingle with minimum of six nails. Place one nail 25 mm (one inch) from each end and one nail on each side of each cutout, on a horizontal line 16 mm (5/8 inch) above cutouts.

c. Sealing: Seal each tab with continuous, 225 mm (9 inch) long, 6 mm (1/4 inch) diameter bead of asphalt roof cement, applied to the surface of course below. Place bead on horizontal line 16 mm (5/8 inch) above cutouts so bead will be 25 mm (one inch) from bottom edge of tab to be sealed and so bead will not show through cutouts. After nailing each shingle, press tabs down to ensure spreading and bonding of asphalt roof cement.

3.3.5 Hips and Ridges

Form with 225 by 300 mm (9 by 12 inch) individual shingles or with 300 by 300 mm (12 by 12 inch) shingles cut from 300 by 900 mm (12 by 36 inch) strip shingles. Bend shingles lengthwise down center with equal exposure on each side of hip or ridge. Lap shingles to provide a maximum 125 mm (5 inch) exposure, and nail each side in unexposed area 140 mm (5 1/2 inches) from butt and 25 mm (one inch) in from edge.

3.3.6 Valleys

Provide either closed cut, woven, open roll roofing, or open sheet metal valleys.

3.3.6.1 Closed Cut Valleys

Provide 900 mm (36 inch) wide valley lining of single layer of smooth-surfaced or mineral-surfaced roll roofing, with mineral-surface facing down, for full length of valley as follows:

a. Center lining in valley over underlayment. Provide minimum 300 mm (12 inch) end laps in the lining and seal laps with asphalt roof cement. Fasten lining to hold it in place until shingles are applied.

b. Apply first regular course of shingles along eaves of one of the intersecting roof planes and across valley. Extend course at least 300 mm (12 inches) onto adjoining roof.

c. Apply succeeding courses in same manner as first course, extending across valley and onto adjoining roof.

d. Press shingles tightly into valley and nail in normal manner, except apply nails not closer than 150 mm (6 inches) to valley centerline, and apply additional nail in top corner of each shingle crossing valley.

e. Apply shingles on the adjoining roof plane, starting along eaves and across valley onto previously applied shingles. Trim overlapping courses back to a line parallel to and a minimum of 50 mm (2 inches) back from valley centerline.

f. Trim 25 mm (one inch) on a 45 degree angle from upper corner of each end shingle. Embed end shingles in a 75 mm (3 inch) wide band of asphalt roof cement.

3.3.7 Flashing

3.3.7.1 Eave Flashing

Provide for roof slopes one in 3 (4 inches per foot) and greater. Provide eave flashing strips consisting of smooth-surfaced roll roofing. Flashing strips shall overhang metal drip edge 6 to 10 mm (1/4 inch to 3/8 inch) and extend up the slope far enough to cover a point 300 mm (12 inches) inside interior face of exterior wall. Where overhangs require flashings wider than 900 mm (36 inches), locate laps outside exterior wall face. Laps shall be at least 50 mm (2 inches) wide and cemented with asphalt roof cement over entire length of lap. Lap end 300 mm (12 inches) and cement.

For self-adhering membrane installation, apply one layer of self-adhering membrance from the eaves to a point 600 mm inside interior wall line, Follow membrane manufacturer's printed installation instructions.

3.3.7.2 Stepped Flashing

For sloping roofs which abut vertical surfaces, provide stepped metal flashing as specified in Section 07600, "Flashing and Sheet Metal."

3.3.7.3 Vent and Stack Flashing

Apply shingles up to point where vent or stack pipe projects through roof, and cut nearest shingle to fit around pipe. Before applying shingles beyond pipe, prepare flange of metal pipe vent flashing as specified in Section 07600, "Flashing and Sheet Metal," by applying a 3 mm (1/8 inch) thick coating of asphalt roof cement on bottom side of flashing flange. Slip flashing collar and flange over pipe, and set coated flange in 2 mm (1/16 inch) coating of asphalt roof cement. After applying flashing flange, continue shingling up roof. Lap lower part of flange over shingles. Overlap flange with side and upper shingles. Fit shingles around pipe, and embed in 2 mm (1/16 inch) thick coating of asphalt roof cement where shingles overlay flange.

3.3.7.4 Self-Adhering Membrane

Text

-- End of Section --

SECTION 07600

FLASHING AND SHEET METAL
02/03

PART 1 GENERAL

1.1 REFERENCES

1.2 General Requirements

1.3 SUBMITTALS

1.4 DELIVERY, HANDLING, AND STORAGE

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Exposed Sheet Metal Items

2.1.2 Drainage

2.1.3 Copper, Sheet and Strip

2.1.4 Lead-Coated Copper Sheet

2.1.5 Lead Sheet

2.1.6 Steel Sheet, Zinc-Coated (Galvanized)

2.1.6.1 Finish

2.1.7 Zinc Sheet and Strip

2.1.8 Stainless Steel

2.1.9 Terne-Coated Steel

2.1.10 Aluminum Alloy Sheet and Plate

2.1.10.1 Alclad

2.1.10.2 Finish

2.1.11 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

2.1.12 Solder

2.1.13 Polyvinyl Chloride Reglet

2.1.14 Bituminous Plastic Cement

2.1.15 Building Paper

2.1.16 Asphalt Primer

2.1.17 Through-Wall Flashing

2.1.18 Fasteners

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Workmanship

3.1.2 Nailing

3.1.3 Cleats

3.1.4 Soldering

3.1.4.1 Edges

3.1.5 Welding and Mechanical Fastening

3.1.5.1 Welding of Aluminum

3.1.5.2 Mechanical Fastening of Aluminum

3.1.6 Protection from Contact with Dissimilar Materials

3.1.6.1 Copper or Copper-bearing Alloys

3.1.6.2 Aluminum

3.1.6.3 Metal Surfaces

3.1.6.4 Wood or Other Absorptive Materials

3.1.7 Expansion and Contraction

3.1.8 Base Flashing

3.1.9 Counterflashing

3.1.10 Metal Reglets

3.1.10.1 Caulked Reglets

3.1.10.2 Friction Reglets

3.1.11 Polyvinyl Chloride Reglets (Temporary Construction Installation)

3.1.12 Metal Drip Edge

3.1.13 Gutters

3.1.14 Downspouts

3.1.14.1 Terminations

3.1.15 Flashing for Roof Drains

3.1.16 Splash Pans

3.1.17 Open Valley Flashing

3.1.18 Eave Flashing

3.1.19 Sheet Metal Covering on Flat, Sloped, or Curved Surfaces

3.1.20 Expansion Joints

3.1.20.1 Roof Expansion Joints

3.1.20.2 Floor and Wall Expansion Joints

3.1.21 Flashing at Roof Penetrations and Equipment Supports

3.1.22 Single Pipe Vents

3.1.23 Stepped Flashing

3.2 PAINTING

3.2.1 Aluminum Surfaces

3.3 CLEANING

3.4 REPAIRS TO FINISH

3.5 FIELD QUALITY CONTROL

3.5.1 Procedure

-- End of Section --

SECTION 07620A

MESH TERMITE BARRIER
08/99

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 SYSTEM INSTALLERS

1.4 DELIVERY, STORAGE, AND HANDLING

1.5 SYSTEM DESCRIPTION

1.6 WARRANTY

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Asbestos Prohibition

2.1.2 Barrier Mesh

2.1.3 Accessories

PART 3 EXECUTION

3.1 SITE CONDITIONS

3.1.1 Site Preparation

3.1.2 Ground Preparation

3.1.3 Verification

3.2 INSTALLATION

3.3 PROTECTION

3.4 VISUAL INSPECTION GUIDE

3.5 REPAIRS

-- End of Section --

SECTION 07840

FIRESTOPPING
04/03

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 GENERAL REQUIREMENTS

1.4 DELIVERY AND STORAGE

1.5 INSTALLER QUALIFICATIONS

1.6 COORDINATION

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

2.1.1 Fire Hazard Classification

2.1.2 Toxicity

2.1.3 Fire Resistance Rating

2.1.3.1 Through-Penetrations

2.1.3.2 Construction Joints and Gaps

PART 3 EXECUTION

3.1 PREPARATION

3.2 INSTALLATION

3.2.1 Insulated Pipes and Ducts

3.2.2 Data and Communication Cabling

3.3 INSPECTION

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SECTION 07900A

JOINT SEALING
06/97

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 ENVIRONMENTAL REQUIREMENTS

1.4 DELIVERY AND STORAGE

PART 2 PRODUCTS

2.1 BACKING

2.1.1 Rubber

2.1.2 PVC

2.1.3 Synthetic Rubber

2.1.4 Neoprene

2.2 BOND-BREAKER

2.3 PRIMER

2.4 CAULKING

2.5 SEALANT

2.5.1 LATEX

2.5.2 ELASTOMERIC

2.5.3 ACOUSTICAL

2.5.4 BUTYL

2.5.5 PREFORMED

2.5.5.1 Tape

2.5.5.2 Bead

2.5.5.3 Foam Strip

2.6 SOLVENTS AND CLEANING AGENTS

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Surface Preparation

3.1.2 Concrete and Masonry Surfaces

3.1.3 Steel Surfaces

3.1.4 Aluminum Surfaces

3.1.5 Wood Surfaces

3.2 APPLICATION

3.2.1 Masking Tape

3.2.2 Backing

3.2.3 Bond-Breaker

3.2.4 Primer

3.2.5 Sealant

3.3 CLEANING

-- End of Section --

SECTION 08110

STEEL DOORS AND FRAMES

05/01

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.1 STANDARD STEEL AND VINYL CLAD DOORS

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Standard Duty Doors

2.2 INSULATED STEEL DOOR SYSTEMS

2.3 VINYL CLAD DOOR SYSTEMS

2.3.1 French Patio Door

Text

2.4 ACCESSORIES

2.4.1 Louvers

2.4.1.1 Interior Louvers

2.4.1.2 Exterior Louvers

2.5 INSULATION CORES

2.6 FIRE DOORS AND FRAMES

2.6.1 Labels

2.7 WEATHERSTRIPPING

2.7.1 Integral Gasket

2.8 HARDWARE PREPARATION

2.9 FINISHES

2.9.1 Factory-Primed Finish

2.9.2 Factory-Applied Enamel Finish

2.10 FABRICATION AND WORKMANSHIP

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Doors

3.1.2 Fire Doors and Frames

3.2 PROTECTION

3.3 CLEANING

3.4 SCHEDULE

-- End of Section --

SECTION 08210

WOOD DOORS
09/99

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY, STORAGE, AND HANDLING

1.4 WARRANTY

PART 2 PRODUCTS

2.1 DOORS

2.1.1 Stile and Rail Doors

2.1.2 Flush Doors

2.1.2.1 Interior Flush Doors

2.1.3 Prehung Doors

2.2 ACCESSORIES

2.3 FABRICATION

2.3.1 Quality and Construction

2.3.2 Preservative Treatment

2.3.3 Adhesives and Bonds

2.3.4 Prefitting

2.3.5 Finishes

2.3.5.1 Field Painting

2.3.5.2 Factory Finish

2.3.5.3 Plastic Laminate Finish

2.3.5.4 Color

2.3.6 Water-Resistant Sealer

2.4 SOURCE QUALITY CONTROL

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Prehung Doors

3.2 SCHEDULE

-- End of Section --

SECTION 08361

SECTIONAL OVERHEAD DOORS
08/01

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Hard-Drawn Springwire

2.1.2 Oil-Tempered Springwire

2.1.3 Steel Sheet

2.1.4 Steel Shapes

2.1.5 Glass

2.2 DOORS

2.3 DESIGN REQUIREMENTS

2.4 FABRICATION

2.4.1 Steel Overhead Doors

2.4.1.1 Insulated Sections

2.4.2 Tracks

2.4.3 Hardware

2.4.4 Counterbalancing

2.5 MANUAL OPERATORS

2.5.1 Pushup Operators

2.6 WEATHER SEALS AND SAFETY DEVICE

2.7 FINISHES

2.7.1 Galvanized and Shop Primed

PART 3 EXECUTION

3.1 INSTALLATION

3.2 TESTING

-- End of Section --

SECTION 08560

PLASTIC WINDOWS
08/01

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 QUALITY ASSURANCE

1.3.1 Labels

1.3.2 Certification

1.4 DELIVERY, STORAGE, AND HANDLING

1.5 PROTECTION

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR WINDOWS

2.2 MATERIALS

2.2.1 Windows

2.2.2 Glass and Glazing

2.2.3 Calking and Sealing

2.2.4 Insect Screening

2.2.5 Accessories

2.3 WINDOW TYPES

2.3.1 Casement Windows

2.3.2 Double Hung Windows

2.3.3 Dual Action (Tilt/Turn) Windows

2.3.3.1 Construction

2.3.3.2 Hardware

2.3.3.3 Performance Requirements

2.4 FABRICATION

2.4.1 Subframes, Mullions and Transom Bars

2.4.2 Combination Windows

2.4.3 Frames and Sash

2.4.3.1 Corners and Reinforcement

2.4.3.2 Adjustability

2.4.3.3 Drips and Weep Holes

2.4.3.4 Provisions for Glazing

2.4.4 Hardware

2.4.5 Weatherstripping

2.4.6 Screens

2.4.7 Color

2.4.8 Fasteners

2.4.9 Accessories

2.4.9.1 Anchors

2.4.9.2 Window-Cleaner Anchors

2.4.9.3 Grills

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Anchors and Fastenings

3.2 ADJUSTING

3.3 CLEANING

3.4 PROTECTION

-- End of Section --

SECTION 08710

DOOR HARDWARE
02/02

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 HARDWARE SCHEDULE

1.4 KEY BITTING CHART REQUIREMENTS

1.5 QUALITY ASSURANCE

1.5.1 Hardware Manufacturers and Modifications

1.6 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

2.2 HARDWARE FOR FIRE DOORS

2.3 HARDWARE ITEMS

2.3.1 Hinges

2.3.2 Spring Hinges

2.3.3 Locks and Latches

2.3.3.1 Residential Bored Locks and Latches

2.3.4 Cylinders and Cores

2.3.5 Keying System

2.3.6 Lock Trim

2.3.6.1 Knobs and Roses

2.3.6.2 Lever Handles

2.3.6.3 Texture

2.3.7 Keys

2.3.8 Door Stops and Viewers

2.3.9 Thresholds

2.3.10 Weather Stripping Gasketing

2.3.10.1 Interlocking Type

2.3.11 Lightproofing and Soundproofing Gasketing

2.4 FASTENERS

2.5 FINISHES

2.6 KEY CABINET AND CONTROL SYSTEM

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Weather Stripping Installation

3.1.2 Threshold Installation

3.2 FIRE DOORS

3.3 HARDWARE LOCATIONS

3.4 KEY CABINET AND CONTROL SYSTEM

3.5 FIELD QUALITY CONTROL

3.6 HARDWARE SETS

-- End of Section --

SECTION 08810A

GLASS AND GLAZING
05/97

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 SYSTEM DESCRIPTION

1.4 DELIVERY, STORAGE AND HANDLING

1.5 PROJECT/SITE CONDITIONS

1.6 WARRANTY

1.6.1 Insulating Glass

PART 2 PRODUCTS

2.1 INSULATING GLASS

2.1.1 Low-E Insulating Glass

2.2 REFLECTIVE GLASS

2.2.1 Low-Emissivity (Low-E) Glass

2.3 HEAT-TREATED GLASS

2.3.1 Tempered Glass

2.4 GLAZING ACCESSORIES

2.4.1 Preformed Tape

2.4.2 Sealant

2.4.3 Glazing Gaskets

2.4.3.1 Fixed Glazing Gaskets

2.4.3.2 Wedge Glazing Gaskets

2.4.3.3 Aluminum Framing Glazing Gaskets

2.4.4 Putty and Glazing Compound

2.4.5 Setting and Edge Blocking

PART 3 EXECUTION

3.1 PREPARATION

3.2 INSTALLATION

3.3 CLEANING

3.4 PROTECTION

-- End of Section --

SECTION 09250

GYPSUM BOARD
11/01

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

1.3.2 Storage

1.3.3 Handling

1.4 ENVIRONMENTAL CONDITIONS

1.4.1 Temperature

1.4.2 Exposure to Weather

1.5 QUALIFICATIONS

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Gypsum Board

2.1.1.1 Regular

2.1.1.2 Type X (Special Fire-Resistant)

2.1.2 Gypsum Backing Board

2.1.2.1 Regular

2.1.2.2 Type X (Special Fire-Resistant)

2.1.3 Regular Water-Resistant Gypsum Backing Board

2.1.3.1 Regular

2.1.3.2 Type X (Special Fire-Resistant)

2.1.4 Cementitious Backer Units

2.1.5 Joint Treatment Materials

2.1.5.1 Embedding Compound

2.1.5.2 Finishing or Topping Compound

2.1.5.3 All-Purpose Compound

2.1.5.4 Setting or Hardening Type Compound

2.1.5.5 Joint Tape

2.1.6 Fasteners

2.1.6.1 Screws

2.1.7 Adhesives

2.1.7.1 Adhesive for Fastening Gypsum Board to Wood Framing

2.1.8 Gypsum Studs

2.1.9 Accessories

2.1.10 Asphalt Impregnated Building Felt

2.1.11 Water

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

3.1.2 Gypsum Board and Framing

3.2 APPLICATION OF GYPSUM BOARD

3.2.1 Application of Single-Ply Gypsum Board to Wood Framing

3.2.2 Application of Two-Ply Gypsum Board to Wood Framing

3.2.3 Adhesive Nail-On Application to Wood Framing

3.2.4 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

3.3.2 Joint Treatment

3.4 FINISHING OF GYPSUM BOARD

3.4.1 Uniform Surface

3.5 SEALING

3.6 FIRE-RESISTANT ASSEMBLIES

3.7 PATCHING

-- End of Section --

SECTION 09310

CERAMIC TILE, QUARRY TILE, AND PAVER TILE
8/02

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY AND STORAGE

1.4 ENVIRONMENTAL REQUIREMENTS

1.5 WARRANTY

1.6 EXTRA STOCK

PART 2 PRODUCTS

2.1 TILE

2.1.1 PAVER TILE

2.1.2 Glazed Wall Tile

2.1.3 Accessories

2.2 SETTING-BED

2.2.1 Aggregate for Concrete Fill

2.2.2 Portland Cement

2.2.3 Sand

2.2.4 Hydrated Lime

2.2.5 Metal Lath

2.2.6 Reinforcing Wire Fabric

2.3 WATER

2.4 MORTAR, GROUT, AND ADHESIVE

2.4.1 Dry-Set Portland Cement Mortar

2.4.2 Conductive Dry-Set Mortar

2.4.3 Latex-Portland Cement Mortar

2.4.4 Ceramic Tile Grout

2.4.5 Organic Adhesive

2.4.6 Epoxy Resin Grout

2.4.7 Furan Resin Grout

2.4.8 Cementitious Backer Board

2.4.9 Glass Mat Gypsum Backer Panel

2.5 MARBLE THRESHOLDS

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

3.2 GENERAL INSTALLATION REQUIREMENTS

3.3 INSTALLATION OF WALL TILE

3.3.1 Workable or Cured Mortar Bed

3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

3.3.3 Organic Adhesive

3.3.4 Furan Mortar and Grout

3.4 INSTALLATION OF FLOOR TILE

3.4.1 Workable or Cured Mortar Bed

3.4.2 Dry-Set and Latex-Portland Cement

3.4.3 Ceramic Tile Grout

3.4.4 Waterproofing

3.4.5 Concrete Fill

3.5 INSTALLATION OF MARBLE THRESHOLDS

3.6 EXPANSION JOINTS

3.6.1 Walls

3.6.2 Floors

3.7 CLEANING AND PROTECTING

-- End of Section --

SECTION 09645

WOOD FLOORING
07/02

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY AND STORAGE

1.4 ENVIRONMENTAL CONDITIONS

1.5 SCHEDULING

1.6 WARRANTY

PART 2 PRODUCTS

2.1 FLOORING MATERIALS

2.1.1 Solid Flooring

2.1.1.1 Grading

2.1.1.2 Construction

2.1.1.3 Dimensions

2.1.1.4 Moisture Content

2.1.1.5 Finish

2.1.2 Accessories and Supporting Materials

2.1.2.1 Adhesive

2.1.2.2 PRIMER

2.1.2.3 Shoe Molds

2.2 FLOORING SYSTEMS

2.2.1 Flooring on Concrete Slabs

2.2.2 Flooring on Subflooring and Underlayment

PART 3 EXECUTION

3.1 PREPARATION OF SURFACES

3.1.1 Concrete Slabs

3.1.2 Underlayment and Subflooring

3.1.3 Adhesive-Applied Wood Flooring on Concrete Slab

3.1.4 Nailed Wood Flooring on Subflooring and Underlayment

3.2 INSTALLATION

3.2.1 Flooring on Concrete Slabs

3.2.2 Flooring on Subflooring and Underlayment

3.2.3 Expansion Spaces

3.2.4 Shoe Molds

3.3 SANDING AND FINISHING SOLID FLOORING

3.3.1 Sanding

3.3.2 Finishing

3.4 PROTECTION

-- End of Section --

SECTION 09650

RESILIENT FLOORING
08/02

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY AND STORAGE

1.4 ENVIRONMENTAL REQUIREMENTS

1.5 SCHEDULING

1.6 WARRANTY

1.7 EXTRA MATERIALS

PART 2 PRODUCTS

2.1 UNDERLAYMENT

2.2 TILE FLOORING

2.2.1 Vinyl-Composition Style

2.2.2 Lining Felt

2.2.3 Adhesive for Vinyl Composition Tile

2.3 STRIPS

2.3.1 Edge

2.3.2 Feature

2.3.3 Transition

2.4 POLISH/FINISH

2.5 CAULKING AND SEALANTS

2.6 MANUFACTURER'S COLOR AND TEXTURE

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

3.1.1 Subfloor Requirements

3.1.2 Surface Examination

3.2 SURFACE PREPARATION

3.2.1 Concrete Floor

3.2.2 Plywood Underlayment

3.2.3 Final Cleaning of Substrate

3.3 MOISTURE TEST

3.4 GENERAL APPLICATION REQUIREMENTS

3.5 INSTALLATION OF VINYL-COMPOSITION TILE

3.6 INSTALLATION OF FEATURE STRIPS

3.7 CLEANING

3.8 PROTECTION

-- End of Section --

SECTION 09900

PAINTS AND COATINGS
02/02

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 Contractor Qualification

1.4 QUALITY ASSURANCE

1.4.1 Field Samples and Tests

1.4.1.1 Sampling Procedure

1.4.1.2 Testing Procedure

1.4.2 Textured Wall Coating System

1.4.3 Sample Textured Wall Coating System Mock-Up

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

1.5.2 Lead Content

1.5.3 Chromate Content

1.5.4 Asbestos Content

1.5.5 Mercury Content

1.5.6 Silica

1.5.7 Human Carcinogens

1.6 PACKAGING, LABELING, AND STORAGE

1.7 SAFETY AND HEALTH

1.7.1 Safety Methods Used During Coating Application

1.7.2 Toxic Materials

1.8 ENVIRONMENTAL CONDITIONS

1.8.1 Coatings

1.9 COLOR SELECTION

1.10 LOCATION AND SURFACE TYPE TO BE PAINTED

1.10.1 Painting Included

1.10.1.1 Exterior Painting

1.10.1.2 Interior Painting

1.10.2 Painting Excluded

1.10.3 Mechanical and Electrical Painting

1.10.4 Exterior Painting of Site Work Items

1.10.5 MISCELLANEOUS PAINTING

1.10.6 Definitions and Abbreviations

1.10.6.1 Qualification Testing

1.10.6.2 Batch Quality Conformance Testing

1.10.6.3 Coating

1.10.6.4 DFT or dft

1.10.6.5 DSD

1.10.6.6 EPP

1.10.6.7 EXT

1.10.6.8 INT

1.10.6.9 micron / microns

1.10.6.10 mil / mils

1.10.6.11 mm

1.10.6.12 MPI Gloss Levels

1.10.6.13 MPI System Number

1.10.6.14 Paint

1.10.6.15 REX

1.10.6.16 RIN

PART 2 PRODUCTS

2.1 MATERIALS

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

3.2 SURFACE PREPARATION

3.3 PREPARATION OF METAL SURFACES

3.3.1 New Ferrous Surfaces

3.3.2 Final Ferrous Surface Condition:

3.3.3 Galvanized Surfaces

3.3.4 Non-Ferrous Metallic Surfaces

3.3.5 Terne-Coated Metal Surfaces

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Gypsum Board

3.5 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.5.1 New Plywood and Wood Surfaces, Except Floors:

3.5.2 Wood Floor Surfaces, Natural Finish

3.5.3 Interior Wood Surfaces, Stain Finish

3.6 APPLICATION

3.6.1 Coating Application

3.6.2 Mixing and Thinning of Paints

3.6.3 Two-Component Systems

3.6.4 Coating Systems

3.7 COATING SYSTEMS FOR METAL

3.8 COATING SYSTEMS FOR WOOD AND PLYWOOD

3.9 PIPING IDENTIFICATION

3.10 INSPECTION AND ACCEPTANCE

3.11 PAINT TABLES

3.11.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

EXTERIOR GALVANIZED SURFACES

EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

DIVISION 6: EXTERIOR WOOD; DRESSED LUMBER, PANELING, DECKING, SHINGLES PAINT TABLE

3.11.2 INTERIOR PAINT TABLES

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

DIVISION 9: GYPSUM BOARD PAINT TABLE

-- End of Section --

SECTION 09915

COLOR SCHEDULE
08/02

PART 1 GENERAL

1.1 GENERAL

1.2 SUBMITTALS

PART 2 PRODUCTS

2.1 REFERENCE TO MANUFACTURER'S COLOR

2.2 COLOR SCHEDULE

2.2.1 Exterior Walls

2.2.1.1 Brick

2.2.1.2 Mortar

2.2.1.3 Paint

2.2.1.4 Glass and Glazing

2.2.1.5 Cultured Stone

2.2.2 Exterior Trim

2.2.2.1 Steel Doors and Door Frames

2.2.2.2 Fascia

2.2.2.3 Soffits and Ceilings

2.2.2.4 Overhangs

2.2.2.5 Downspouts, Gutters, Louvers, and Flashings

2.2.2.6 Caulking and Sealants

2.2.2.7 Stringers and Stair Framing

2.2.2.8 Control Joints

2.2.2.9 Expansion Joint and/or Covers

2.2.2.10 Signage

2.2.3 Exterior Roof

2.2.3.1 Shingles

2.2.3.2 Penetrations:

2.2.4 Interior Floor Finishes

2.2.4.1 Vinyl Composition Tile

2.2.4.2 Ceramic Tile

2.2.4.3 Porcelain Tile

2.2.4.4 Grout

2.2.4.5 Wood

2.2.5 Interior Base Finishes

2.2.5.1 Ceramic Tile

2.2.5.2 Porcelain Tile

2.2.5.3 Grout

2.2.5.4 Paint

2.2.5.5 Wood

2.2.6 Interior Wall Finishes

2.2.6.1 Paint

2.2.6.2 Ceramic Tile

2.2.6.3 Ceramic Tile Grout

2.2.7 Interior Ceiling Finishes

2.2.7.1 Paint

2.2.8 Interior Trim

2.2.8.1 Wood Doors

2.2.8.2 Wood Stain

2.2.8.3 Window Sills

2.2.8.4 Handrails

2.2.9 Interior Window Treatment

2.2.9.1 Horizontal Blinds

2.2.10 Interior Miscellaneous

2.2.10.1 Solid Surfacing Material

2.2.10.2 Casework

2.2.10.3 Wall Switch Handles and Standard Receptacle Bodies

2.2.10.4 Electrical Device Cover Plates

2.2.10.5 Electrical Panels

2.2.10.6 Shower Curtain

2.3 PLACEMENT SCHEDULE

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 10800

TOILET ACCESSORIES
07/02

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 DELIVERY, STORAGE, AND HANDLING

1.4 WARRANTY

PART 2 PRODUCTS

2.1 ACCESSORY ITEMS

2.1.1 Grab Bar (GB)

2.1.2 Medicine Cabinet (MC)

2.1.2.1 Swinging Door Cabinet, Class 2

2.1.3 Mirrors, Glass (MG)

2.1.4 Mirror, Tilt (MT)

2.1.5 Shower Curtain Rods (SCR)

2.1.6 Soap Holder (SH)

2.1.7 Towel Bar (TB)

2.1.8 Toilet Paper Holder

2.1.9 Toothbrush and Tumbler Holder (TTH)

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Recessed Accessories

3.1.2 Surface Mounted Accessories

3.2 CLEANING

3.3 SCHEDULE

-- End of Section --

SECTION 12320A

CABINETS AND COUNTERTOPS
05/98

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 570	(1995) Water Absorption of Plastics
ASTM D 638	(1997) Tensile Properties of Plastics
ASTM D 2583	(1995) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM E 84	(1997a) Surface Burning Characteristics of Building Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9	(1994) Cabinet Hardware

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1	(1995) Performance & Construction Standards for Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	(1995) High-Pressure Decorative Laminates

1.2 DESIGN

Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes. Cabinets shall be constructed as specified and shall meet the requirements of KCMA A161.1. Wall and base cabinet assemblies shall consist of individual units joined into continuous sections. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Counters shall be provided with watertight sink rim when indicated. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals. Shelves shall be fixed or adjustable.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL REQUIREMENTS FOR DESIGN/BUILD:

SD-02 Shop Drawings

Installation; G

Drawings showing each type of cabinet and related item, and clearly indicating the complete plan, location, and elevations of the cabinets and accessories and pertinent details of construction, fabrication, and attachments.

SD-03 Product Data

Cabinets; G
Countertops and Backsplash; G

Manufacturer's printed data, catalog cuts, installation and cleaning instructions.

SD-04 Samples

Cabinets; G
Countertops and Backsplash; G

In lieu of individual samples, complete minimum size cabinets may be furnished as samples. Mock-up units are not acceptable. Samples shall be of sufficient size to show color, pattern, and method of assembly.

a. Countertop and backsplash - One section, containing both.

b. Door and drawer front - One of each, with hardware mounted.

c. Countertop color samples approximately 50 x 75 mm (2 x 3 inches) size.

d. Stain/color samples approximately 50 x 75 mm (2 x 3 inches) size.

SD-06 Test Reports

Cabinets and Countertops; G

Test reports certifying that all cabinets comply with the requirements of KCMA A161.1. Tests shall be conducted by independent laboratories approved by KCMA. KCMA certification seals affixed to the cabinets will be accepted in lieu of certified test reports.

1.4 DELIVERY AND STORAGE

Cabinets shall be delivered to the jobsite wrapped in a protective covering. Cabinets shall be stored in accordance with manufacturer's recommendations in an adequately ventilated, dry location that is free of dust, water, or other contaminants and in a manner to permit access for inspection and handling. Cabinets shall be handled carefully to prevent damage to the surfaces. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 CABINETS

Wall and base cabinets shall be of the same construction and same outside appearance. Door design shall be 16 mm (5/8 inch) solid oak raised panel face from vendors standard styles. Corner cabinets shall be equipped with full circle shelves as indicated. Shelves shall be fixed or fully adjustable as indicated. Shelves shall be supported by self-locking clips or wood dowels. Dowels shall be approximately 8 mm (5/16) inch in diameter by 40 mm (1-9/16 inches) long. Shelves shall be minimum 12 mm (1/2 inch) thick plywood Grade A-B veneer. Drawer fronts shall be16 mm (5/8 inch) thick solid hardwood frame with hardwood plywood panel.

2.1.1 Frame Type Cabinets

The cabinets shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 19 mm thick by 38 mm wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Top and bottom corners shall be braced with either hardwood blocks that are glued together with water resistant glue and nailed in place, or metal or plastic corner braces. Backs of wall cabinets shall be 5 mm (3/16) inch thick plywood. Backs of base and tall cabinets shall be 5 mm (3/16 inch) thick hardwood. Bottoms of cabinets shall be minimum 9 mm (3/8 inch) thick good grade plywood and shall be braced with wood members glued in place. Base cabinet ends shall be 13 mm (1/2 inch) hardwood plywood; wall cabinet ends shall be 10 mm (3/8 inch) hardwood plywood.

2.2 COUNTERTOPS AND BACKSPLASH

2.2.1 Solid Polymer Countertops

Only bathroom countertop and backsplash shall be constructed with integral sink and lavatory. Kitchen shall have commercial grade stainless steel sink and solid polymer countertop with integral backsplash. Material shall be12.7 mm (1/2 inch) thickness, cast, and filled nonporous solid surfacing composed of acrylic polymer, mineral fillers, and pigments. Superficial damage to a depth of 0.25 mm (0.010 inch) shall be repairable by sanding or polishing. Material shall comply with the following performance requirements.

a. Tensile Strength; 18.3 N/mm^2 (4100 psi), when tested in accordance

with ASTM D 638.

b. Hardness; Barcol Impressor 50 when tested in accordance with ASTM D 2583.

c. Flammability; rated Class I with a flame spread of 25 maximum and a smoke developed of 100 maximum when tested in accordance with ASTM E 84.

d. Boiling water resistance; no effect when tested in accordance with NEMA LD 3.

e. High temperature; no effect when tested in accordance with NEMA LD 3.

f. Liquid absorption; 0.06% maximum (24 hours) when tested in accordance with ASTM D 570.

g. Sanitation; National Sanitation Foundation approval for food contact in accordance with Standard 51 and approval for food area applications.

h. Impact resistance; no failure for ball drop when tested in accordance with NEMA LD 3.

2.3 FINISH

2.3.1 Cabinet Finish

Cabinets shall be provided with a factory-applied durable finish in accordance with KCMA A161.1 requirements and of a type standard with the manufacturer. Natural finish solid oak doors, solid oak drawer fronts, cabinet fronts, and exposed cabinet sides shall be fabricated of wood which will be free of extreme color variations within each panel or between adjacent panels. Exposed exterior surfaces shall be hardwood or grade A-A hardwood veneer with natural stain and sprayed on factory applied finish.

2.3.2 Backer Sheets

Backer Sheets of high pressure plastic laminate, shall conform to NEMA LD 3, Grade BK20 and shall be applied to the underside of all core material.

2.4 HARDWARE

Hardware shall conform to BHMA A156.9, shall be suitable for kitchen cabinet use, and shall include all miscellaneous hardware for a complete installation. Door hinges shall be self-closing type. Drawer runners shall be 20 gauge slides/glides. Hardware and fastenings for doors and drawers with particle board cores shall be of the through-bolt type.

2.5 COLOR, TEXTURE, AND PATTERN

Design, color, and finish shall be as selected by the Contracting Officer.

PART 3 EXECUTION

3.1 INSTALLATION

Cabinets shall be installed level, plumb, and true to line, and shall be attached to the walls or floors with suitable devices to securely anchor each unit. Countertops, accessories, and hardware shall be installed as indicated on the drawings. Installation shall be in accordance with the manufacturer's approved printed instructions. Closer and filler strips and finish moldings shall be provided as required. Prior to final acceptance, doors shall be aligned, and hardware shall be adjusted.

3.2 CLEANING

Cabinet and countertop surfaces shall be cleaned in accordance with manufacturer's instructions.

-- End of Section --

SECTION 12490A

WINDOW TREATMENT
01/98

PART 1 WORK DESCRIPTION

1.1 REFERENCES

1.2 SUBMITTALS

1.3 GENERAL

1.4 DELIVERY, STORAGE, AND HANDLING

1.5 FIELD MEASUREMENTS

1.6 WARRANTY

PART 2 PRODUCTS

2.1 WINDOW BLINDS

2.1.1 Horizontal Blinds

2.1.1.1 Head Channel and Slats

2.1.1.2 Controls

2.1.1.3 Intermediate Brackets

2.1.1.4 Hold-Down Brackets

2.1.2 Vertical Blinds

2.1.2.1 Louvers

2.1.2.2 Carriers

2.1.2.3 Headrail System

2.1.2.4 Cornice, Fascia, or Valance

2.1.2.5 Controls

2.1.2.6 Connectors and Spacers

2.1.2.7 Intermediate Brackets

2.2 COLOR

PART 3 EXECUTION

3.1 INSTALLATION

-- End of Section --

SECTION 15050N

BASIC MECHANICAL MATERIALS AND METHODS
09/01

PART 1 GENERAL

1.1 REFERENCES

1.2 RELATED REQUIREMENTS

1.3 QUALITY ASSURANCE

1.3.1 Material and Equipment Qualifications

1.3.2 Alternative Qualifications

1.3.3 Service Support

1.3.4 Manufacturer's Nameplate

1.3.5 Modification of References

1.3.5.1 Definitions

1.3.5.2 Administrative Interpretations

1.4 DELIVERY, STORAGE, AND HANDLING

1.5 ELECTRICAL REQUIREMENTS

1.6 ELECTRICAL INSTALLATION REQUIREMENTS

1.6.1 New Work

1.6.2 Modifications to Existing Systems

1.6.3 High Efficiency Motors

1.6.3.1 High Efficiency Single-Phase Motors

1.6.3.2 High Efficiency Polyphase Motors

1.6.4 Three-Phase Motor Protection

1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

1.8 ACCESSIBILITY

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

3.1.1 Factory Painting Systems

3.1.2 Shop Painting Systems for Metal Surfaces

-- End of Section --

SECTION 15080A

THERMAL INSULATION FOR MECHANICAL SYSTEMS
07/02

PART 1 GENERAL

1.1 REFERENCES

1.2 SYSTEM DESCRIPTION

1.3 GENERAL QUALITY CONTROL

1.3.1 Standard Products

1.3.2 Installer's Qualifications

1.3.3 Surface Burning Characteristics

1.3.4 Identification of Materials

1.4 SUBMITTALS

1.5 STORAGE

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

2.1.1 Adhesives

2.1.1.1 Acoustical Lining Insulation Adhesive

2.1.1.2 Mineral Fiber Insulation Cement

2.1.1.3 Lagging Adhesive

2.1.2 Contact Adhesive

2.1.3 Caulking

2.1.4 Corner Angles

2.1.5 Finishing Cement

2.1.6 Fibrous Glass Cloth and Glass Tape

2.1.7 Staples

2.1.8 Jackets

2.1.8.1 White Vapor Retarder All Service Jacket (ASJ)

2.1.8.2 Aluminum Jackets

2.1.8.3 Polyvinyl Chloride (PVC) Jackets

2.1.9 Vapor Retarder Required

2.1.9.1 Vapor Retarder Mastic Coatings

2.1.9.2 Laminated Film Vapor Retarder

2.1.10 Vapor Retarder Not Required

2.1.11 Wire

2.1.12 Sealants

2.2 PIPE INSULATION MATERIALS

2.2.1 Aboveground Cold Pipeline

2.2.1.2 Mineral Fiber Insulation

Mineral fiber insulation is prohibited for aboveground cold pipeline.

2.2.2 Aboveground Hot Pipeline

2.2.3 Above Ground Dual Temperature Pipeline - Outdoors, Indoor - Exposed or Concealed

2.2.4 Below-ground Pipeline Insulation

2.2.4.1 Cellular Glass

2.3 DUCT INSULATION MATERIALS

2.3.1 Rigid Mineral Fiber

2.3.2 Flexible Mineral Fiber

2.3.3 Cellular Glass

2.3.4 Phenolic Foam

2.3.5 Flexible Elastomeric Cellular

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

3.1.1 Installation

3.1.2 Fire-stopping

3.1.3 Painting and Finishing

3.1.4 Installation of Flexible Elastomeric Cellular Insulation

3.1.5 Pipes/Ducts which Require Insulation

3.2 PIPE INSULATION INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

3.2.1.2 Pipes Passing Through Walls, and Floors

3.2.1.3 Pipes Passing Through Hangers

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

3.2.2 Aboveground Cold Pipelines

3.2.2.1 Insulation Thickness

3.2.2.2 Jacket for Mineral Fiber, Cellular Glass, and Phenolic Foam Insulated Pipe

3.2.2.3 Insulation for Straight Runs (Mineral Fiber, Cellular Glass, and Phenolic Foam)

3.2.2.4 Insulation for Fittings and Accessories

3.2.2.5 Optional PVC Fitting Covers

3.2.3 Aboveground Hot Pipelines

3.2.3.1 Insulation Thickness

3.2.3.2 Jacket for Insulated Hot Pipe, Except Pipe Insulated with Flexible Elastomeric Cellular

3.2.3.3 Insulation for Straight Runs

3.2.3.4 Insulation for Fittings and Accessories

3.2.4 Below ground Pipe Insulation

3.2.4.1 Type of Insulation

3.2.4.2 Installation of Below ground Pipe Insulation

3.3 DUCT INSULATION INSTALLATION

3.3.1 Duct Insulation Thickness

3.3.2 Insulation and Vapor Retarder for Cold Air Duct

3.3.2.1 Installation on Exposed Duct Work

3.3.3 Ducts Handling Air for Dual Purpose

3.3.4 Insulation for Evaporative Cooling Duct

3.3.5 Duct Test Holes

-- End of Section --

SECTION 15182A

REFRIGERANT PIPING
02/03

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 QUALIFICATIONS

1.4 SAFETY REQUIREMENTS

1.5 DELIVERY, STORAGE, AND HANDLING

1.6 PROJECT/SITE CONDITIONS

1.6.1 Verification of Dimensions

1.6.2 Drawings

1.6.3 Spare Parts

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

2.2 ELECTRICAL WORK

2.3 REFRIGERANT PIPING SYSTEM

2.4 PIPE, FITTINGS AND END CONNECTIONS (JOINTS)

2.4.1 Copper Tubing

2.4.2 Solder

2.4.3 Brazing Filler Metal

2.5 VALVES

2.5.1 Refrigerant Stop Valves

2.5.2 Check Valves

2.5.3 Liquid Solenoid Valves

2.5.4 Expansion Valves

2.5.5 Safety Relief Valves

2.5.6 Evaporator Pressure Regulators, Direct-Acting

2.5.7 Refrigerant Access Valves

2.6 PIPING ACCESSORIES

2.6.1 Filter Driers

2.6.2 Sight Glass and Liquid Level Indicator

2.6.2.1 Assembly and Components

2.6.2.2 Gauge Glass

2.6.2.3 Bull's-Eye and Inline Sight Glass Reflex Lens

2.6.2.4 Moisture Indicator

2.6.3 Vibration Dampeners

2.6.4 Flexible Pipe Connectors

2.6.5 Strainers

2.6.6 Pressure and Vacuum Gauges

2.6.7 Temperature Gauges

2.6.7.1 Stem Cased-Glass

2.6.7.2 Bimetallic Dial

2.6.7.3 Liquid-, Solid-, and Vapor-Filled Dial

2.6.7.4 Thermal Well

2.7 FABRICATION

2.7.1 Factory Coating

2.7.2 Factory Applied Insulation

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Directional Changes

3.1.2 Functional Requirements

3.1.3 Fittings and End Connections

3.1.3.1 Threaded Connections

3.1.3.2 Brazed Connections

3.1.3.3 Flared Connections

3.1.3.4 Flanged Connections

3.1.4 Valves

3.1.4.1 General

3.1.4.2 Expansion Valves

3.1.4.3 Valve Identification

3.1.5 Vibration Dampers

3.1.6 Strainers

3.1.7 Filter Dryer

3.1.8 Sight Glass

3.1.9 Discharge Line Oil Separator

3.1.10 Accumulator

3.1.11 Flexible Pipe Connectors

3.1.12 Temperature Gauges

3.1.13 Pipe Hangers, Inserts, and Supports

3.1.13.1 Hangers

3.1.13.2 Inserts

3.1.13.3 C-Clamps

3.1.13.4 Angle Attachments

3.1.13.5 Multiple Pipe Runs

3.1.13.6 Seismic Requirements

3.1.14 Access Panels

3.1.15 Field Applied Insulation

3.1.16 Field Painting

3.1.16.1 Color Coding

3.1.16.2 Color Coding Scheme

3.2 CLEANING AND ADJUSTING

3.3 REFRIGERANT PIPING TESTS

3.3.1 Preliminary Procedures

3.3.2 Pneumatic Test

3.3.3 Evacuation Test

3.3.4 System Charging and Startup Test

3.3.5 Refrigerant Leakage

3.3.6 Contractor's Responsibility

3.4 DEMONSTRATIONS

-- End of Section --

SECTION 15400A

PLUMBING, GENERAL PURPOSE
04/03

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 STANDARD PRODUCTS

1.4 ELECTRICAL WORK

1.5 PERFORMANCE REQUIREMENTS

1.6 REGULATORY REQUIREMENTS

1.7 PROJECT/SITE CONDITIONS

PART 2 PRODUCTS

2.1 MATERIALS

2.2 VALVES

2.2.1 Wall Hydrants

2.2.2 Relief Valves

2.3 FIXTURES

2.3.1 Upgraded Plumbing Fixtures

All plumbing fixtures shall be manufacturer's designer line and be approved by Contracting Officer.

2.3.1.1 Water Closets

Water closets shall be low flow type.
0.211 liter (0.8 gallon) per flush water closets shall be prohibited.

2.3.1.2 Lavatories

Lavatories shall be one piece polymer solid surface with integral bowl and counter.

2.3.1.3 Bathtub

Bathtubs shall be porcelain enamel formed steel.
Tub surrounds shall be polymer solid surface and full height.

2.3.1.4 Faucets and Drains

1. Shower Heads

Shower heads shall be low flow type.

2.3.2 Handicap Fixtures

2.4 DRAINS

2.4.1 Bathtub Drains

2.5 TRAPS

2.6 WATER HEATERS

2.6.1 Automatic Storage Type

2.6.1.1 Electric Type

2.7 PUMPS

2.7.1 Circulating Pumps

2.7.2 Flexible Connectors

2.8 DOMESTIC WATER SERVICE METER

2.9 RANGE HOODS

Range hoods shall be stainless steel with length equal to range. The hood shall be equipped with NFPA approved wet chemical fire suppression system. The hood shall have separately switched light and exhaust fan and washable filter. Sound level shall not exceed 6 sones. Duct exhaust to outside and provide backdraft protection

2.10 APPLIANCES

2.10.1 Range and Refrigerator Shall be Government Furnished

2.10.2 Dishwasher

2.10.3 Garbage Disposal

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

3.1.1.2 Cutting and Repairing

3.1.1.3 Protection of Fixtures, Materials, and Equipment

3.1.1.4 Mains, Branches, and Runouts

3.1.1.5 Pipe Drains

3.1.1.6 Expansion and Contraction of Piping

3.1.1.7 Water Hammer Arresters

3.1.2 Joints

3.1.2.1 Threaded

3.1.2.2 Mechanical Couplings

3.1.2.3 Unions and Flanges

3.1.2.4 Copper Tube and Pipe

3.1.2.5 Plastic Pipe

3.1.3 Pipe Sleeves and Flashing

3.1.3.1 Flashing Requirements

3.1.3.2 Waterproofing

3.1.3.3 Optional Counterflashing

3.1.4 Fire Seal

3.1.5 Supports

3.1.5.1 General

3.1.6 Pipe Cleanouts

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

3.2.2 Heat Traps

3.2.3 Connections to Water Heaters

3.3 FIXTURES AND FIXTURE TRIMMINGS

3.3.1 Fixture Connections

3.3.2 Height of Fixture Rims Above Floor

3.3.3 Shower Bath Outfits

3.3.4 Access Panels

3.3.5 Traps

3.4 WATER METER REMOTE READOUT REGISTER

3.5 ESCUTCHEONS

3.6 TESTS, FLUSHING AND DISINFECTION

3.6.1 Plumbing System

3.6.2 Defective Work

3.6.3 System Flushing

3.6.3.1 During Flushing

3.6.3.2 After Flushing

3.6.4 Operational Test

3.6.5 Disinfection

3.7 PLUMBING FIXTURE SCHEDULE

3.8 POSTED INSTRUCTIONS

3.9 PERFORMANCE OF WATER HEATING EQUIPMENT

3.9.1 Storage Water Heaters

3.9.1.1 Electric

3.10 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

TABLE III
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

-- End of Section --

SECTION 15741A

VERTICAL GROUND-COUPLED HEAT EXCHANGE SYSTEMS (VGCHES)
11/99

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 basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1693	(1998) Environmental Stress-Cracking of Ethylene Plastics
ASTM D 2447	(1995) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2513	(1998) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 3035	(1995) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D 3261	(1997) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350	(1998a) Polyethylene Plastic Pipe and Fittings Materials
ASTM F 1055	(1998) Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1993) Rev 1; Rev 2; Rev 3; Rev 4) Motors and Generators

1.2 COORDINATION OF TRADES

Pump supports, piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

All equipment shall be delivered and placed in storage with protection from the weather, humidity and temperature variations, dirt, dust, and other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

1.4 FIELD MEASUREMENTS

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL REQUIREMENTS FOR DESIGN/BUILD:

SD-02 Shop Drawings

VGCHES Installation Drawings; G

Drawings consisting of VGCHES layout including assembly and installation details and electrical connection diagrams; layout and installation details of circulation pumps, distribution manifolds and all piping, including points of connection to piping specified in other Sections, or heat pumps and other equipment shown on the drawings and to piping specified in related sections. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function within the HVAC system and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance and the test point locations where the VGCHES will be monitored during testing.

SD-03 Product Data

VGCHES Piping Components; G
General Equipment Requirements; G

Manufacturer's catalog data included with the VGCHES Installation Drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

a. VGCHES piping components, including recommendations for preparing joints using an electrofusion process.

b. VGCHES circulating pump(s)

VGCHES Calculations; G

Calculations, submitted concurrently with the VGCHES Installation Drawings, demonstrating that the VGCHE will perform as specified.

VGCHES Tests; G

Proposed test procedures, at least 2 weeks prior to the start of related testing.

System Diagrams; G

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and circulation pumps, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

VGCHES Designer

A letter no later than 14 days after the Notice to Proceed providing the name and Statement of Qualifications of the individual who will prepare the VGCHES Design and Calculations.

VGCHES Specialist

A letter not later than 14 days after the Notice to Proceed, providing the name and Statement of Qualifications of the individual who will serve as the VGHES Specialist.

On-Site Training; G

Proposed On-site Training schedule, at least 14 days prior to the start of related training.

Hydrostatic Test; G

Proposed test schedule, at least 14 days prior to the start of related testing.

Performance Test; G

Proposed test schedule, at least 14 days prior to the start of related testing.

SD-06 Test Reports

VGCHES Tests; G

Test reports, signed by both the VGCHES Designer and the VGCHES Specialist, for the hydrostatic and performance tests in booklet form, no later than 14 days after completion of testing. Reports shall document all phases of tests performed including initial test summary, all corrections and adjustments made, and final test results.

SD-07 Certificates

VGCHES Installation Drawings
VGCHES Calculations
VGCHES Piping Installation

Concurrent with the submittal of VGCHES Installation Drawings and the VGCHES Calculations, submit certification by both the VGCHES Designer and the VGCHES Specialist that the VGCHES drawings and calculations have been coordinated with related work and will perform as specified.

Concurrent with submittal of the VGCHES Test Reports, submit certification by the VGCHES Specialist that the VGCHES is installed in accordance with the contract requirements, including signed approval of the VGCHES Test Reports.

VGCHES Designer; G

Concurrent with submittal of the VGCHES Installation Drawings, submit certification by the VGCHES Designer that the VGCHES design and calculations conform to all contract requirements, including signed approval of the VGCHES Test Reports.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to on-site training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour on-site response to

a service call on an emergency basis.

1.6 VGCHES DESIGNER

The VGCHES shall be designed by an individual who is a registered professional engineer and is regularly engaged in the design of the type and capacity of system(s) specified in this project for the immediate three years prior to the submittal of the VGCHES Designer's Statement of Qualifications. The VGCHES Designer's Statement of Qualifications shall include data identifying the location, VGCHES type, and capacity of at least three systems designed by the proposed VGCHES Designer during that period. The Contractor shall furnish documentation from the owner of each of these three VGCHES verifying that each system has performed in the manner intended for the 6 months prior to submission of the Statement of Qualifications.

1.7 VGCHES SPECIALIST

Work specified in this section shall be performed under the supervision of and certified by the VGCHES Specialist. The VGCHES Specialist shall be a Certified as an "Installer" by the International Ground Source Heat Pump Association (IGSHPA) and shall be engaged in the installation of the type and capacity of the system(s) specified in this project for the immediate three years prior to the submittal of the VGCHES Specialist's Statement of Qualifications. The VGCHES Specialist's Statement of Qualifications shall include a copy of IGSHPA Installer Certification and data identifying the location, VGCHES type, and capacity of at least three systems installed under the guidance of the proposed VGHES Specialist during that period. The Contractor shall furnish documentation from the owner of these three VGCHES verifying that each system has performed in the manner intended for the 6 months prior to submission of the Statement of Qualifications.

1.8 VGCHES CALCULATIONS

Heat transfer calculations shall be prepared by the VGCHES Designer using computer software specifically intended for VGCHES's. The design shall be based on calculations that will provide the most life cycle cost effective VGCHES using an expected life of 25 years and shall be sized based upon the loads shown on the drawings. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss, and the maximum expected expansion and contraction of the pipe shall be indicated in the program output. An accompanying schematic drawing showing reference points used in the calculations shall be included with the calculations. The maximum entering water temperature to the heat pumps under the peak air conditioning load design condition should not exceed 32 degrees C (90 degrees F). The minimum entering water temperature to the heat pumps under the peak heating load design condition should be no lower than -1 degrees C (40 degrees F). Lower temperatures may be allowed if proper freeze protection is provided. Adjacent VGCHE will not be spaced closer than 4 m (15 feet).

1.9 DELIVERY AND STORAGE

Equipment placed in storage shall be protected from the weather, humidity and temperature variations, dirt and dust or other contaminants.

1.10 DRILLING LOGISTICS PLAN

Designer/Contractor shall provide a logistics plan for drilling of geothermal wells prior to any construction. The drilling plan shall include quantity, location, and construction schedule for all geothermal wells.

PART 2 PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.1.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

2.2 VGCHES PIPING COMPONENTS

VGCHES piping terminates at the point shown on the drawings. The connecting piping shall be as specified in Section 15741N, WATER SOURCE HEAT PUMP SYSTEMS.

2.2.1 Pipe

Piping and heat-fused materials shall be manufactured from virgin polyethylene and an extrusion compound material conforming to ASTM D 2513 with PE345434C or PE355434 cell classification with an ASTM D 3350 Class C, D, or E UV stabilizer, with the exception that the material shall exhibit zero failures (FO) when tested for 192 hours or more in accordance with ASTM D 1693, condition C as required in ASTM D 3350. Pipe shall be manufactured as specified in ASTM D 2447 Schedule 40 or ASTM D 3035 with a standard dimension ratio (SDR) of 13.5 for pipe diameters ranging from 32 mm (1.25 inches) and less to 75 mm (3 inches), and a minimum SDR of 17.0 for pipe diameters 75 mm (3 inches) and greater.

2.2.2 Fittings

Butt and sidewall fittings shall be polyethylene and conform to ASTM D 3261 Socket fittings shall conform to ASTM D 2513; electrofusion fittings shall conform to ASTM F 1055. Barbed fittings and hose clamps shall not be used.

2.3 ELECTRICAL WORK

Electrical motor-driven equipment shall be provided complete with motor, motor starter, disconntect switch, and controls. Electrical service shall be provided for all items recommended by the VGCHES manufacturer to meet

the requirements specified herein. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall conform to Section 16415 ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 745 W (1 Hp) and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall conform to NEMA MG 1 and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Any manual or automatic controls, protective or signal devices, and corresponding wiring required for VGCHES operation shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for 0.745 kW through 7.45 kW (fractional hp through
10 hp) ratings. Adjustable frequency drives shall be used for larger motors.

2.4 CONTROLS

Controls for the VGCHES shall be integrated with the HVAC system controls package specified in Section 15950A HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS. VGCHES controls shall be designed in accordance with the manufacturer's recommendations and to comply with the sequence of controls shown on the drawings.

PART 3 EXECUTION

3.1 VGCHES PIPING INSTALLATION

Piping components shall be joined by a heat fusion method that conforms the piping manufacturer's recommendation for this application.

3.2 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section 02315A EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.3 FIELD PAINTING AND FINISHING

Field painting and finishing are specified in Section 09900 PAINTING, GENERAL.

3.4 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990A TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the entire HVAC system, including controls, has been completed with the exception of performance tests. The VGCHES shall be charged with chemically treated water (type and concentration as specified by the VGCHES Designer) prior to testing, adjusting, and balancing.

3.5 VGCHES TESTS

3.5.1 Hydrostatic Test

Prior to any cover or backfill of bore holes or trenches, the VGCHES piping shall be isolated from all connections to piping specified in Section 15741N WATER SOURCE HEAT PUMP SYSTEMS and shall be flushed of all dirt and debris using potable water flowing at twice the normal operating VGCHES flow rate for a minimum of four hours or until no dirt of debris is visible, whichever is greater. The VGCHES piping shall then be plugged or capped as necessary in preparation for the hydrostatic test(s). The piping shall be pressurized to 1000 kPa (150 psi) and monitored for a period of 8 hours. If there is any pressure loss or visible leakage during this period, the leak shall be identified and repaired in accordance with the piping components manufacturer's recommendations. Test shall be repeated until there is no loss in pressure during the test period.

3.5.2 Performance Test

Test(s) shall be repeated in entirety until results are considered satisfactory by the VGCHES Designer. Test shall be conducted by the VGCHES Specialist. All items required to perform the tests, including the heating and cooling source(s) necessary to maintain constant water temperature to the ground and interface to the HVAC systems and all instruments required for tests shall be furnished by the Contractor. The accuracy of test instruments shall be as specified in Section 15990A TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS. Test shall demonstrate that the entire system is functioning according to the Sequence of Operation on the drawings. The operational test shall cover a period of not less than 72 continuous hours of operation using only system controls in normal mode. Supply and return VGCHES flow and temperatures shall be recorded at the locations shown on the VGCHES Installation Drawings for each VGCHES piping system at hourly intervals for the duration of the test period. In addition, weather conditions, including the ambient temperature and humidity in a shaded and weather protected area shall be recorded at hourly intervals along with supply and return VGCHES temperatures and the VGCHES temperatures at locations shown on the drawings. The report shall include calculations which will provide the capacity when operating during the peak design conditions listed on the drawings.

3.5.3 Pipe Identification

Geothermal well sites shall be shown on as-built drawings and by global positioning satellite coordinates.

3.6 ON-SITE TRAINING

The VGCHES Designer shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 16 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The on-site training shall cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 15741N

WATER SOURCE HEAT PUMP SYSTEMS
02/03

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.18	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
ANSI B16.23	(1992; Errata 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 330	(1998) Ground Source Closed-Loop Heat Pumps

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Hdbk-IP	(1995) Commercial Institutional Ground-Source Heat Pump
ASHRAE 52.1	(1992) Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

ASME INTERNATIONAL (ASME)

ASME B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B31.9	(1996) Building Services Piping
ASME B31.5	(1992; Addenda 1994) Refrigeration Piping
ASME BPVC	(2000) Boiler and Pressure Vessel Codes

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2001) Water Pressure Reducing Valves

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 126	(1995) Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM B 32	(2000) Solder Metal
ASTM B 42	(1998; Rev. A) Seamless Copper Pipe, Standard Sizes
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 88	(1999) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM B 280	(1999) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B 306	(1999) Copper Drainage Tube (DWV)
ASTM D 92	(198; Rev. A) Flash and Fire Points by Cleveland Open Cup
ASTM D 1177	(1994) Freezing Point of Aqueous Engine Coolants
ASTM D 2447	(1999) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2513	(1999; Rev. A) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2683	(1998) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 3035	(1995) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D 3261	(1997) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350	(1999) Polyethylene Plastics Pipe and Fittings Materials

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

FCCCHR List (2002) List of Approved Backflow Prevention Assemblies

INTERNATIONAL GROUND SOURCE HEAT PUMP ASSOCIATION (IGSHPA)

IGSHPA-1	(1991) Grouting Procedures for Ground-Source Heat Pump Systems
IGSHPA-2	(1988) Closed-Loop/Ground-Source Heat Pump System/Installation Guide

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(2002) Butterfly Valves
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Cast Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1994) Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds	(1995; Addendum 1997) HVAC Duct Construction Standards - Metal and Flexible

UNDERWRITERS LABORATORIES (UL)

UL 94	(1996; Revisions Through 1997) Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 SYSTEM DESCRIPTION

Provide new heat pump systems complete and ready for operation. Systems include heat pumps, system equipment and condenser. Installation of HVAC system including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.9, ASME B31.5, ASHRAE Hdbk-IP, IGSHPA-1,

IGSHPA-2, NFPA 70, as supplemented and modified by this section. Provide ground coupled condenser loop piping by the requirements of this section.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01331 SUBMITTAL REQUIREMENTS FOR DESIGN/BUILD:

SD-02 Shop Drawings

Ground heat exchanger piping system as-Built drawings; G

SD-03 Product Data

Product data for integral or appurtenant space temperature controls (STC) supplied with the listed equipment shall include shall include point-to-point electrical wiring diagrams for each STC.

Water-source water-to-air heat pumps; G

Ground heat exchanger piping system; G

Valves

Specialty valves; G

Expansion tanks

Air separators

SD-06 Test Reports

Piping welds NDE report

Water-source water-to-air heat pumps - field acceptance test plan; G

Water-source water-to-air heat pumps - field acceptance test report; G

SD-07 Certificates

Employer's record documents

SD-08 Manufacturer's Instructions

Water-source water-to-air heat pumps - installation instructions

SD-10 Operation and Maintenance Data

Water-source water-to-air heat pumps, Data Package 2; G

Submit in accordance with Section 01781, "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

1.4.1 Ground heat exchanger piping system As-Built Drawings

Provide dimensioned as-built drawings of each complete ground heat exchanger piping system, depicting its relationship to other utilities and buildings in its proximity before burying, covering, or concealing. Drawings shall be of a quality equivalent to the contract design drawings. The as-built drawings of the installed ground heat exchanger piping system shall be laminated or stored in a clear plastic envelope and affixed visibly to the heat pump unit or on the wall in the mechanical room if serving a system of multiple heat pumps. A permanent label shall be affixed to each heat pump unit indicating basic information for that unit. The information shall include: nominal flow rate l/s (gpm), pressure drop kPa (feet), temperature drop/rise degree C (degree F), and capacity W (Btu/hr).

1.4.2 Qualifications of Ground Heat Exchanger Fabricators

The only acceptable method for joining buried pipe systems is by a heat fusion process. Submit documentation substantiating the following qualifications: ground heat exchanger fabricators shall have completed a heat fusion school in which each participant has performed a heat fusion procedure under direct supervision of an approved manufacturing certification program, or a DOT certified heat fusion technician.

1.4.3 Qualifications of Ground Heat Exchanger Installers

Submit documentation substantiating the following qualifications: installers shall have completed an approved manufacturer's certification program and shall have successfully completed at least two projects with ground heat exchanger work similar in size and complexity to that required for this project within the last 4 years.

1.4.4 Qualifications of Ground Heat Exchanger Designer

Professional engineer certification (PE) licensed and certified ground coupled system designer (CGD) certification is desirable.

PART 2 PRODUCTS

2.1 EQUIPMENT

Equipment using refrigerants R-11, R-12, R-113, R-114, R-115, R-500, or refrigerants with ozone depletion factor (ODF) greater than 0.05 will not be permitted.

2.1.1 Water-Source Water-to-Air Heat Pumps (WAHP)

Provide ground-coupled closed-loop water-to-air heat pump (extended range) units factory assembled, designed, tested, and rated in accordance with ARI 330. Units shall be ARI certified, or listed in ARI directory. Units shall include fans, refrigerant-to-air heat exchangers, filters, dampers,

compressor, reversing valve, expansion valve, refrigerant-to-water heat exchangers, desuperheater, hose kits, and controls. A permanent label shall be affixed to each heat pump unit indicating basic information for that unit. The information shall include: nominal flow rate l/s (gpm), pressure drop kPa (feet), temperature drop/rise degree C (degree F), and capacity W (Btu/hr).

a. Cabinet: Provide manufacturer's standard galvanized steel cabinet finished with corrosion resistant epoxy coating or lacquer acrylic. Provide access panels for inspection and access to internal parts. Insulate cabinet with minimum 12 mm (1/2 inch) multi-density, fiberglass insulation with exposed edges sealed or tucked under flanges to prevent introduction of fibers into the airstream. Female threaded pipe condensate drain connections, supply water connections, and return water connections shall be copper threaded fittings mechanically fastened to the cabinet. Water piping shall be insulated. Construct cabinet with compartments and locate the compressor, reversing valve, and water coil out of the airstream. Insulate the divider between the compressor and fan sections. The control box shall be located within the unit.

b. Fans: Provide centrifugal type, direct drive fans with permanently lubricated motors. Motors shall be permanent split capacitor (PSC) type with thermal overload protection.

c. Refrigerant-to-Air Heat Exchanger: Provide coil constructed of rifled copper tubes with plate aluminum fins designed for refrigerant working pressure of 3102 kPa (). The condensate drain pan shall be epoxy coated and insulated. Provide internal traps on vertical units. Provide drain pan with overflow protection.

d. Filter Section: Provide replaceable (throwaway) 25 mm (1 inch) thick UL listed fiberglass type filters with a mean efficiency of 2 5 percent when tested in accordance with ASHRAE 52.1. Mount filters in filter frames and provide access panels or doors for removal and replacement of filters. Filters maybe installed in the return duct.

e. Compressor: Provide hermetically sealed type compressor, installed on vibration isolators enclosed in an acoustically treated enclosure. Provide high and low pressure switches, low suction temperature cut-out, motor thermal overload protection, 5 minute anti-recycle timer, and start capacitor kit. Provide capability to reset compressor lockout circuit at the remote thermostat and at the disconnect. Provide units with factory installed sound attenuation package.

f. Reversing Valve: Provide solenoid activated refrigerant reversing valves energized only during the cooling mode and designed to fail in the heating position.

g. Refrigerant-to-Water Heat Exchangers: Provide refrigerant-to-water heat exchangers of coaxial type, with inner cupronickel

water tube and outer steel refrigerant tube. Heat exchanger shall be tested and rated for 3102 kPa (450 psi) refrigerant working pressure. A parallel capillary tube/thermal expansion valve assembly shall provide superheat over 10 to 43 degree C (50 to 110 degree F) liquid temperature range.

h. Field-Installed Domestic Hot Water Desuperheater: Provide units factory assembled, designed, tested, and rated. Units shall include double-wall vented refrigerant-to-water heat exchanger, water pump powered by a sealed magnetic drive motor, water line thermostat, secondary safety thermostat to prevent scalding, internal fuse, internally mounted disconnect switch, air bleed port, and refrigerant ports. Units shall be UL listed. Units shall be provided by the ground source closed loop heat pump manufacturer.

i. Emergency Heater: Provide UL or ETL listed, electric resistance heater with internal fusing integral with heat pump unit; fan shall run until heater cools. Locate downstream of indoor coil.

j. Hose Kits: Kits shall include two 0.6 m (2 foot) long metal braided hoses with swivel connectors on one end, an manual flow control valve with test ports, constant flow fitting two shutoff ball valves with memory stops (one with test port), blow down ball valve, and Y-strainer. Hoses shall be fire rated to meet UL 94. Hoses shall have a maximum working pressure of 2067 kPa (300 psi).

k. Hanger Kits: Provide horizontal units with hanger kits consisting of galvanized steel brackets, bolts, washers, and vibration isolators. The hanger kit shall be designed to support the unit from below and suspend from threaded rods.

l. Controls: Controls and safety devices shall be factory wired and mounted within the control box of the unit cabinet.

(1) Provide 24 volt electromechanical controls supplied with a low voltage transformer, controls for compressor, reversing valve, and fan motor operation. Controls shall include a random start relay, a night setback relay, a compressor cycling relay for demand load shedding, and a condensate overflow switch. Provide a low voltage terminal block for field control wiring.

m. Provide industry standard UL listed thermostat with dual mercury bulb design on a single bi-metal coil. Thermostat shall have fan auto-on switch, heat-off-cool switch and supplementary electric heat control.

2.1.2 Pumps

2.1.2.1 In-Line Pumps

Provide pumps constructed of manufacturer's standard materials suitable for chilled water and hot water heating systems. Pumps shall have mechanical seals and drip-proof electric motors.

2.2 ELECTRICAL

2.2.1 Electrical Motors, Controllers, Contactors, and Disconnects

Furnish with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to Section 16402N, "Interior Distribution System." Provide electrical connections under Section 16402N, "Interior Distribution System." Provide controllers and contactors with maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

2.2.2 Electrical Work

Provide in accordance with Section 16402N, "Interior Distribution System." Provide control wiring. Provide control wiring in this section, in accordance with NFPA 70.

2.3 ABOVEGROUND PIPING SYSTEMS

Provide the following pipe and fittings. Provide dielectric fittings, unions, or flanges between steel piping and copper tubing for all piping sizes; except that copper alloy valves and strainers may be used without dielectric fittings, unions, or flanges. Water piping sizes 100 mm (4 inches) and smaller shall be copper tubing.

2.3.1 Copper Tubing Systems

Provide copper tubing for the following systems.

a. Copper condensate drain piping from drain pans.

b. Copper refrigerant tubing.

c. Condenser water piping aboveground or within mechanical space.

2.3.1.1 Copper Condensate Drain Piping

Provide copper tubing in accordance with ASTM B 88M ASTM B 88, Type L or M for piping sizes 25 mm (one inch) and smaller. Provide ASTM B 306 copper tubing and ANSI B16.23 solder joint fittings for piping sizes larger than

25 mm (one inch). In lieu of copper tubing, 32 mm (1.25 inch) Schedule 40 polyvinyl chloride (PVC) plastic pipe, fittings, and solvent cement may be provided.

2.3.1.2 Copper Refrigerant Tubing

Provide ASTM B 280, cleaned, dehydrated, and sealed. Provide ASME B16.22 solder joint refrigerant fittings and adapters. Provide silver brazing alloy solder and silver brazing alloy flux. During brazing operations bleed a small amount of dry oil-free nitrogen continuously through the refrigerant tubing. Provide ASME B16.26flared fittings.

2.3.1.3 Soldered Joint Copper Tubing Systems

For condenser water piping and chilled/hot water piping, provide ASTM B 88M, Type L or M for aboveground piping, Type K for buried piping, with ANSI B16.18 or ASME B16.22 solder joint fittings, unions, and flanges; provide adapters as required. Provide ASTM B 42 copper pipe nipples with threaded end connections. Provide ASTM B 32, 95-5 tin-antimony (Sn-Pb) solder.

2.3.2 Valves

Valves shall have flanged end connections, except valves smaller than 65 mm () may have threaded end connections with a union on one side of the valve. Solder end connections may be used for connections between copper alloy valves and copper tubing.

2.3.2.1 Gate Valves

MSS SP-80, Class 862 (125), except sizes 65 mm (2.5 inches) and larger shall conform to MSS SP-70, Class 862 (125).

2.3.2.2 Globe and Angle Valves

MSS SP-80, Class 862 (125), except sizes 65 mm (2.5 inches) and larger shall conform to MSS SP-85, Class 862 (125).

2.3.2.3 Check Valves

MSS SP-80, Class 862 (125), swing check; except sizes 65 mm (2.5 inches) and larger shall conform to MSS SP-71, Class 862 (125).

2.3.2.4 Butterfly Valves

MSS SP-67, except sizes 65 mm (2.5 inches) and larger shall have lugged or wafer body designed for installation between ASME Class 1034 (150) flanges. Valves shall have two-position lever handles.

2.3.2.5 Ball Valves

Full port design, copper alloy body, except sizes 65 mm (2.5 inches) and larger shall be cast-iron body. Valves shall have two-position lever handles unless indicated otherwise. Ball valves may be provided in lieu of butterfly valves and gate valves.

2.3.2.6 Vent Valves

Provide manual vent valves designed to be operated manually with screwdriver or thumbscrew, 6 mm (1/8 inch) NPS connection. The valve material shall be compatible with the working fluid (antifreeze).

2.3.2.7 Water Relief Valves

Provide water relief valves as indicated, and in accordance with ASME BPVC. Bronze body, test level, ASME rated. Pressure relief at 207 kPa (30 psi).

2.3.3 Specialty Valves

2.3.3.1 Water Pressure Reducing Valves

ASSE 1003, copper alloy body, automatic reseating, with test lever.

2.3.3.2 Water Temperature Regulating Valves

Provide copper alloy body, direct acting, pilot operated, for the intended service.

2.3.3.3 Flow Control Balancing Valves

Copper alloy or cast iron body, copper alloy, or stainless internal working parts, and integral pointer that indicates the degree of valve opening. Valves shall be suitable for 862 kPa (gage) (125 psi) at 87.8 degrees C (190 degrees F) hot water. Valve shall function as a service valve when in fully closed position. Valve body shall have factory-installed tappings for differential pressure meter connections for verification of pressure differential across valve orifice. Meter connections shall have positive check valves or shutoff valves. Each valve shall have metal tag showing the liters per second (gallons per minute) flow for each differential pressure reading.

2.3.3.4 Backflow Prevention Assemblies

Provide reduced pressure principle type backflow prevention assemblies which are approved by and have a current "Certificate of Approval" from the FCCCHR List. Listing of the particular make, model/design, and size in the current FCCCHR List will be acceptable as the required proof.

2.4 GROUND HEAT EXCHANGER PIPING SYSTEM

Provide polyethylene pipe and fittings for the underground portions of the ground heat exchanger. Use of polyvinyl chloride (PVC) pipe and fittings is not permitted.

2.4.1 Polyethylene Pipe

Pipe shall be manufactured from virgin high density polyethylene extrusion material in accordance with ASTM D 2513 with PE345434C or PE355434C cell classification and UV stabilizer of C, D, or E as specified in ASTM D 3350. Provide ASTM D 3035 pipe with a standard dimension ratio (SDR) of 11.0 for

pipe less than 32 mm (1.25 inches) diameter. Provide ASTM D 2447, Schedule 40 or ASTM D 3035 pipe with a minimum SDR of 13.5 for pipe 32 mm (1.25 inches) diameter or greater, and a minimum SDR of 17.0 for pipe 75 mm (3 inches) diameter or greater. Provide ASTM D 3035 pipe in vertical bores greater than 60 m (200 feet) deep with a SDR of 11.0.

2.4.2 Fittings

Provide ASTM D 3261 butt and saddle fusion fittings and ASTM D 2683socket fusion fittings manufactured in accordance with ASTM D 2513. Barbed fittings and hose clamps are not permitted in polyethylene pipe systems.

2.4.2.1 U-bends

Provide factory-fused, injection-molded 180 degree U-bend assemblies equipped with anti-buoyancy devices.

2.4.2.2 Threaded Transition Fittings

Provide ASTM D 2513 reinforced threaded steel-to-polyethylene fittings. Fittings shall have a factory applied external epoxy coating.

2.5 PIPING ACCESSORIES

2.5.1 Pipe Hangers and Supports

Provide MSS SP-58 and MSS SP-69. Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shields for insulated piping.

2.5.2 Strainers

ASTM A 126, Class B, flanged iron body, for 65 mm (2.5 inches) and larger. ASTM B 62, cast iron or bronze for 50 mm (2 inches) and smaller. Provide basket or Y type. Tee type is acceptable for water service. Provide screens constructed of bronze, monel metal, or 18-8 stainless steel, free area not less than 2.5 times pipe area, with perforations as follows:

a. 80 mm (3 inches) and smaller: 1.1 mm (0.045 inches) diameter perforations for liquids.

2.5.3 Pressure Gages

Provide single style pressure gage with 115 mm (4.5 inch) dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range for intended service.

2.5.4 Pressure/Temperature Test Provisions

2.5.4.1 Pete's Plug

Provide 15 mm (0.5 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

2.5.4.2 Testing Accessories

Provide one each of the following test items to the Contracting Officer:

a. 8 mm (0.25 inch) FPT by 3.2 mm (0.125 inch) diameter stainless steel pressure gage adapter probe for extra long test plug.

b. 90 mm (3.5 inch) diameter, one percent accuracy, compound pressure gage, 0 to 1378 kPa (0 to 200 psi) range.

2.5.5 Thermometers

Provide bi-metal dial type thermometers with stainless steel case, stem, and fixed thread connection; 75 mm (3 inch) diameter dial with glass face gasketed within the case; and accuracy within 2 percent of scale range. Provide scale range for intended service.

2.5.6 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid where indicated. Connectors shall be suitable for the intended service.

2.5.7 Expansion Tanks

Construct of steel for minimum working pressure of 862 kPa (gage) (125 psi). Tank shall have polypropylene or butyl lined diaphragm which keeps the air charge separated from the water.

2.5.8 Automatic Air Vents

2.5.9 Pipe Sleeves

Except as indicated otherwise, provide pipe sleeves as specified in this section. Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide 25 mm (one inch) minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

2.5.9.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.5.9.2 Sleeves Not in Masonry and Concrete

Provide 0.55 mm (26 gage) thick galvanized steel sheet pipe sleeves.

2.5.10 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.6 ACCESS DOORS FOR VALVES

Provide factory fabricated and primed flush face steel access doors including steel door frame equipped with continuous hinges and turn-screw-operated latch. Provide door frame installation in plaster and masonry walls.

2.7 AUXILIARY DRAIN PAN, DRAIN CONNECTIONS, AND DRAIN LINES

Provide galvanized steel auxiliary drain pans under units where indicated. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening. Traps and piping to drainage disposal points shall conform to Section 15400A, "Plumbing, General Purpose."

2.8 ANTIFREEZE PROTECTION

2.8.1 Properties

The fluid shall conform to the following requirements, and tests shall be performed in accordance with specified test methods on the fluid.

2.8.1.1 Flash Point

The flash point shall not be lower than 90 degrees C (194 degrees F), determined in accordance with ASTM D 92.

2.8.1.2 Biological Oxygen Demand (BOD)

For 5 days the BOD, at 10 degrees C (50 degrees F), shall not exceed 0.2 gram () oxygen per gram nor be less than 0.1 gram (0.0035 ounce) oxygen per gram.

2.8.1.3 Toxicity

The toxicity shall not be less than LD 50 (oral-rats) of 5 grams () per kilogram. The NFPA hazardous material rating for health shall not be more than 1 (slight).

2.9 CHEMICAL FEED TANK

2.9.1 Ground Heat Exchanger Piping

Provide corrosion inhibitors acceptable to heat pump manufacturers with concentrations suitable for each system and appropriate for the antifreeze used.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Heat Pump System

Maintenance access to each piece of equipment shall not be compromised by any type of piping, electrical conduit, or any other utility. Further, install equipment in accordance with the manufacturer's written installation instructions, including the following:

Water-source water-to-air heat pumps - installation instructions

3.2 ABOVEGROUND PIPING

Provide unions in piping to facilitate removal of heat pump for maintenance or replacement. Test, inspect, and approve piping before covering or concealing. Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing fittings; bushings will not be permitted. Install valves with stems horizontal or above. Provide flanges or unions at valves, traps, strainers, and connections to equipment; unions are not required in copper tubing piping systems.

a. Threaded Connections: Threaded joints shall be sealed with a sealant compatible with the circulating fluid; use of Teflon tape is not permitted. Do not thread metal pipe into plastic piping.

b. Pipe Hangers and Supports: Install in accordance with MSS SP-69. Provide additional pipe hangers and supports at in-line water pumps and flanged valves.

c. Piping to Receive Insulation: Provide temporary wood spacers between the pipe hangers and supports, and the pipe to properly slope the piping and establish final elevations. Provide temporary wood spacers of same thickness as insulation to be provided under Section 15080A, "Thermal Insulation for Mechanical Systems."

d. Cleaning of Piping: Keep interior and ends of new piping and existing piping, affected by Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

3.2.1 Flushing the Aboveground Piping

Before connection of the header to the polyethylene ground heat exchanger loops, flush the entire aboveground piping system thoroughly in accordance with IGSHPA-2 recommendations and leave filled with clean water. If the header is not immediately joined to the ground heat exchanger loop, the open ends shall be taped or capped.

3.3 GROUND HEAT EXCHANGER PIPING

Examine areas and conditions under which ground heat exchanger systems will be installed. Prior to excavation, trenching, or drilling, locate and mark buried utilities. Do not proceed with work until approved by the Contracting Officer. Avoid sharp bends in piping. Provide fittings for changes in direction when minimum bend radius, as recommended by the pipe manufacturer, is exceeded. Use only continuous pipe in sharp bends. Make changes in piping sizes through tapered concentric fittings. Leaks shall be "cut-out" and repaired in accordance with the pipe manufacturer's recommendations. Direct buried threaded connections are not permitted.

3.3.1 Vertical Well Fields

Each U-bend loop shall be assembled, laid out straight, taped to reduce springback, and water pressure tested at 689 kPa (100 psi) for leaks and flow by IGSHPA-2 recommended procedures before the hole is bored. Vertical bores shall be 1.5 m (5 feet) deeper than the length of the loop and shall be clean (no casing) and of sufficient diameter to facilitate the installation of the U-bend assembly and a third pipe for pressure grouting. Fill the loop with water and pressurize to 276 kPa (40 psi) to prevent the pipe from being crushed by backfill material. Backfill the bores from the bottom up with a grout material and grouting process in conformance with IGSHPA-1 to ensure pipe contact and compliance with local and State

requirements for sealing. The bores shall not contain large, sharp, or jagged rocks or debris. Take reasonable and prudent care during installation and backfilling to not crush, cut, or kink the pipe.

3.3.2 Polyethylene Piping

Install piping in accordance with manufacturer's written instructions. During installation, keep trash, soil, and foreign objects out of the pipe. Tape or cap ends of the pipe until the pipe is joined to the circuit. The vertical loop take-off tee fittings may be made using tee fittings or the saddle fusion process on header piping 32 mm (1.25 inches) diameter and above. Completely remove the cutout on the saddle tees. Use bell reductions at pipe reductions. Use reducing socket tees when fabricating socket type reducing headers. Avoid sharp bends in piping. Consult pipe manufacturer for minimum bend radius. Install elbow fittings at changes in pipe direction that are tighter than the minimum recommended bend radius. Use only continuous pipe in vertical U-bend loops.

3.3.3 Heat Fusion Process

Joining shall be either by butt, socket, or saddle (for sidewall applications only) fusion in accordance with the manufacturer's Heat Qualification Guide. Use socket fusion joints for pipe of any size. Butt fusion joints may be used for pipe greater than 50 mm () diameter. Different plastics or grades of plastic shall not be fused together.

3.3.4 Pressurizing

After assembly of the entire ground loop system, fill the system with water and pressure test to 689 kPa (). Visually inspect welds prior to backfill of the trenches.

3.3.5 Pipe Identification

Install metalized (detectable) warning and identification tape above each horizontal pipe run. Install tape a minimum of 152 mm () below finish grade. Install mechanical identification of vertical bore holes and connecting headers.

3.3.6 Threaded Fittings

Threaded joints shall be sealed with a sealant compatible with the circulating fluid; use of lubricating tape for sealing is not permitted. Do not thread metal pipe into plastic pipe or vice versa. Direct buried threaded joints are not permitted. Use threaded joints above grade, within mechanical spaces, or within valve pits.

3.4 FLUSHING GROUND HEAT EXCHANGER

Before connection of the plastic ground heat exchanger loops to the header, flush each loop thoroughly in accordance with IGSHPA-2 recommendations and leave filled with clean water. If the loop is not immediately joined to the header, it shall be taped or capped.

3.5 ADJUSTMENTS

Adjust controls and equipment so as to give satisfactory operation. Adjust entire water temperature control system and place in operation so that water quantities circulated are as indicated. Adjust and balance air duct systems so that air quantities at outlets are as indicated and so that distribution from supply outlets is free from drafts and has uniform velocity over the face of each outlet.

3.6 INSTRUCTING OPERATING PERSONNEL

Upon completion of work and at time designated by Contracting Officer, provide services of water source heat pump manufacturer's technical representative for period of not less than one 8-hour working day for instruction of Government operating personnel in proper operation and maintenance of equipment.

3.7 FIELD QUALITY CONTROL

Upon completion and before final acceptance of work, test each system in service to demonstrate compliance with the contract requirements. Adjust controls and balance systems prior to final acceptance of completed systems. Test controls through every cycle of operation. Test safety controls to demonstrate performance of required function. Correct defects in work provided by Contractor and repeat tests. Furnish water, electricity, instruments, connecting devices, and personnel for tests. Flush and clean piping before placing in operation. Clean equipment, piping, strainers, ducts, and filters.

3.7.1 Piping Systems Except for Ground Heat Exchanger and Refrigerant

Before insulating, hydrostatically test each new piping system at not less than 1278 kPa (188 psi). Maintain pressure for 2 hours with no leakage or reduction in gage pressure. Obtain approval before applying insulation.

3.7.2 Flow Test of Ground Heat Exchanger Piping

Before backfilling the trenches, flush and purge systems of air and flow test to ensure all portions of the heat exchanger are properly flowing using the procedures recommended by IGSHPA-2. Utilize a portable temporary purging unit consisting of the following:

a. High volume, high head purge pump

b. Open reservoir

c. Filter assembly with bypass

d. Flow meter

e. Pressure gage

f. Connecting piping

g. Connecting hoses

Using a purge pump and the procedures recommended by IGSHPA-2, flush and purge each ground heat exchanger system until free of air, dirt, and debris. A velocity of 0.6 m/sec () is required in pipe sections to remove the air.

Perform the flushing and purging operation with the water source heat pumps isolated by shutoff valves from the ground heat exchanger system. Allow purge pump to run 15 minutes after the last air bubbles have been removed. After the ground heat exchanger is completely flushed of air and debris, open the isolation valves and permit circulation through the heat pumps until the entire system is flushed and purged.

Utilizing the purging unit and the procedures recommended by IGSHPA-2, conduct a pressure and flow test on the ground heat exchanger to ensure the system is free of blockage. If the flow test indicates blockage, locate the blockage using the manufacturer's recommendation, remove the blockage, then repeat the purge procedure and conduct the pressure and flow test again until all portions of the system are free flowing. The flow test shall be observed and approved by the Contracting Officer.

Form 1, "Ground Heat Exchanger Inspection and Test Report" located below, shall be completed for each system by the Contractor after completion of the flow and injection of required antifreeze to the system and before the systems can be backfilled.

FORM 1

GROUND HEAT EXCHANGER (GHX) INSPECTION AND TEST REPORT

NOTE: Use separate form for each GHX loop system.

Building:_____ Inspection Date:_____

Ground Heat Exchanger No. or Description:_____

List the WSHP Unit No.'s served by this GHX: _____

Ground Heat Exchanger Design Water Flow - _____ liters/sec (gpm)

Calculated purging flow and press to achieve 0.61 m (2 feet/sec)

Purging: Flow _____ liters/sec (gpm) Head _____ kPa (psi), Duration of test _____ min.

Hydrostatic test pressure _____ kPa (psi); Duration _____ min.

Did the system pass the pressure test? _____

Is antifreeze required in system?____ If yes, was antifreeze measured?____

Has a dimensioned drawing been prepared, completely and accurately showing the layout of the ground heat exchanger? _____

Does the layout differ substantially from the contract documents? _____
If so is the deviation approved? _____

Depth of installed vertical loops is _____ m (feet). (Design is ____ m (feet).)

Depth of horizontal piping is _____ m (feet). (Design is _____ m (feet).)

Are the trenches clear of sharp bends, rocks, or other sharp objects that could restrict flow?_____

Are all joints heat fused (butt-, socket-, or saddle-fusion)?_____
Do the joints have the proper amount of roll-out?_____

Has the piping material been cut-out and properly removed from saddle-fusion tees?_____

Was the system backfilled properly with good clean backfill material?_____

Comments:_____

Inspected and approved this _____ date by _____

Title: _____

3.7.3 Refrigerant Piping Pressure Test and Evacuation

Perform the following when field piping connections are provided.

a. Pressure Test: Test refrigerant piping using dry, oil-free nitrogen, and prove tight at 2068 kPa (300 psi) on the high side and 1027 kPa (150 psi) on the low side. Maintain pressure for 2 hours with no leakage or reduction in gage pressure.

b. Evacuation: Using high vacuum pump and certified micron gage, reduce absolute pressure on both sides of system simultaneously to 300 microns (300 microns). After reaching this point charge system with proper refrigerant until pressure of 0 kPa (0 psi) is obtained. Repeat evacuation-charging procedure for two more cycles, totaling to three evacuation-charging cycles. On final evacuation, secure pump and maintain 300 microns (300 microns) for 2 hours before charging with required final refrigerant.

3.7.4 Equipment Tests

3.7.4.1 Field Testing

Test each item of equipment in operation for continuous period of not less than 24 hours under every condition of operation in accordance with each equipment manufacturer's recommendation. Verify that each item of equipment operating parameters are within limits recommended by the manufacturer.

3.7.4.2 Field Test Plans

Furnish water-source heat pump field test plans developed by each equipment manufacturer detailing recommended field test procedures for each item of equipment. Field test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment will not be acceptable. The Contracting Officer will review and approve the field test plan for each item of equipment listed below prior to commencement of field testing of the equipment.

a. Equipment Items to Test:

Water-source water-to-air heat pumps - field acceptance test plan

b. Coordinated Testing: Indicate in each field test plan when work required by this section requires coordination with test work required by other specification sections. Furnish test procedures for the simultaneous or integrated testing of equipment controls which interlock and interface with controls factory prewired or external controls for the equipment.

c. Prerequisite Testing: Equipment for which performance testing is dependent upon the completion of the work covered by Section 15950A," Heating, Ventilating and Air Conditioning (HVAC) Control Systems"

shall have that work completed as a prerequisite to testing work under this section. Indicate in each field test plan when such prerequisite work is required.

d. Test Procedure: Indicate in each field test plan each equipment manufacturer's published installation, start-up, and field acceptance test procedures. Include in each test plan a detailed step-by-step procedure for testing automatic controls provided by the manufacturer. Each test plan shall include the required test reporting forms to be completed by the Contractor's testing representatives. Structure procedures to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control. Controllers shall be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.

e. Performance Variables: Each test plan shall list performance variables that are required to be measured or tested as part of the field test. Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings. Furnish with each test procedure a description of acceptable results that have been verified. Identify the acceptable limits or tolerances within which each tested performance variable shall acceptably operate.

f. Job Specific: Each test plan shall be job specific and shall address the particular item of equipment and particular conditions which exist with this contract. Generic or general preprinted test procedures are not acceptable.

g. Specialized Components: Each test plan shall include procedures for field testing and field adjusting specialized components, such as hot gas bypass control valves, or pressure valves.

3.7.4.3 Field Test Reports

a. Equipment Items to Test:

Water-source water-to-air heat pumps - field acceptance test report.

b. Manufacturer's Recommended Test: Conduct the manufacturer's recommended field testing in compliance with the approved test plan specified above. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field testing.

c. Operational Test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every 2 hours. Use the test report forms for logging the operational variables.

d. Notice of Tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval.

e. Report Forms: Type data entries and writing on the test report forms. Completed test report forms for each item of equipment shall be reviewed, approved, and signed by the Contractor's test director and the QC Manager. The manufacturer's field test representative shall review, approve, and sign the report of the manufacturer's recommended test. Signatures shall be accompanied by the person's name typed.

f. Deficiency Resolution: The test requirements acceptably met; deficiencies identified during the tests shall be corrected in compliance with the manufacturer's recommendations and corrections retested to verify compliance.

3.7.5 Additional Field Testing

Requirements for testing, adjusting, and balancing (TAB) of ducts, piping, and equipment are specified in Section 15950A, "Heating, Ventilating and Air Conditioning (HVAC) Control Systems".

Balance air flows to that indicated in accordance with SMACNA HVAC Duct Const Stds, as supplemented and modified by this section. Submit written certificate to report the following:

a. Water source heat pump unit nameplate data, and actual voltage and ampere consumption.

b. Supply and return terminal airflow, and equipment used to measure airflow.

c. Water source heat pump liters/sec (cfm) and entering and leaving air temperatures.

d. Water source heat pump unit condenser water liters/sec (gpm) and entering and leaving temperatures.

e. Ambient outside air temperature, date, and person testing, balancing, and reporting.

-- End of Section --

SECTION 15810N

DUCTWORK AND DUCTWORK ACCESSORIES
09/99

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-- End of Section --

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
02/03

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-- End of Section --

SECTION 15950A

HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS
12/01

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2.4 ACTUATORS

2.5 DAMPERS

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2.5.1.2 Damper Types

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2.5.3 Damper End Switches

2.6 INSTRUMENTATION

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2.9.6 Thermostats (Manual)

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2.10 MANUAL SWITCHES

2.11 HVAC SYSTEM CONTROL PANELS

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2.11.4 Mounting and Labeling

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2.11.5.1 Panel Wiring

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2.11.5.3 Wiring Identification

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3.1 GENERAL INSTALLATION CRITERIA

3.1.1 Device Mounting Criteria

3.1.2 Wiring Criteria

3.1.2.1 Power-Line Surge Protection

3.1.2.2 Surge Protection for Transmitter and Control Wiring

3.1.2.3 Controller Output Loop Impedance Limitation

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 Room-Instrument Mounting

3.2.2 Manual Emergency Fan Shutdown Switches

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3.2.4 Foundations and Housekeeping Pads

3.2.5 Indication Devices Installed in Piping and Liquid Systems

3.3 CONTROL SEQUENCES OF OPERATION

3.3.1 System Requirements

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3.3.1.2 HVAC System Supply Fan Not Operating

3.3.1.3 HVAC System Ground Source Distribution Pump Operation

3.3.1.4 HVAC System Ground Source Distribution Pump Not Operating

3.3.2 Heating and Ventilating Sequence

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3.3.2.4 Emergency Fan Shutdown

3.3.3 Single-Zone with DX Heating/Cooling Coil No Return Fan

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3.3.3.2 Outside-Air Damper

3.3.3.3 Supply-Fan Control

3.3.3.4 Space-Temperature-Sequenced Heating and Cooling Control

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3.4.1 General Procedures

3.4.1.1 Evaluations

3.4.1.2 Item Check

3.4.1.3 Weather-Dependent Test Procedures

3.4.1.4 Configuration

3.4.1.5 Two-Point Accuracy Check

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3.4.1.8 Controller Stations

3.4.1.9 Controller-Tuning Procedure

3.4.1.10 Controller Manual-Tuning Procedure

3.4.1.11 Setting the Controller

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3.4.3 Heating and Ventilating

3.4.4 Single-Zone with Evaporator/Condenser Coil; No Return Fan

3.5 BALANCING, COMMISSIONING, AND TESTING

3.5.1 Coordination with HVAC System Balancing

3.5.2 Control System Calibration, Adjustments, and Commissioning

3.5.3 Performance Verification Test

3.5.4 Posted and Panel Instructions

3.6 TRAINING

3.6.1 Training-Course Requirements

3.6.2 Training-Course Content

-- End of Section --

SECTION 15990A

TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS
04/03

PART 1 GENERAL

1.1 REFERENCES

1.2 SUBMITTALS

1.3 SIMILAR TERMS

1.4 TAB STANDARD

1.5 QUALIFICATIONS

1.5.1 TAB Firm

1.5.2 TAB Specialist

1.6 TAB SPECIALIST RESPONSIBILITIES

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(Not Applicable)

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3.1 DESIGN REVIEW

3.2 TAB RELATED HVAC SUBMITTALS

3.3 TAB SCHEMATIC DRAWINGS AND REPORT FORMS

3.4 DUCTWORK LEAK TESTING

3.5 TESTING, ADJUSTING, AND BALANCING

3.5.1 TAB Procedures

3.5.2 Systems Readiness Check

3.5.3 Preparation of TAB Report

3.5.4 TAB Verification

3.5.5 Marking of Setting

3.5.6 Identification of Test Ports

-- End of Section --

SECTION 15995A

COMMISSIONING OF HVAC SYSTEMS
12/01

PART 1 GENERAL

1.1 SUBMITTALS

Section added per John Allison, M-Ja-3.

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PART 3 EXECUTION

3.1 COMMISSIONING TEAM AND CHECKLISTS

3.2 TESTS

3.2.1 Pre-Commissioning Checks

3.2.2 Functional Performance Tests

-- End of Section --

SECTION 16415A

ELECTRICAL WORK, INTERIOR
06/02

PART 1 GENERAL

Relevant Sections have been inserted into 16415A from 16402N. Sections 16050N and 16402N have been deleted per Don Boley.

1.1 REFERENCES

1.2 GENERAL

1.2.1 Rules

1.2.2 Coordination

1.2.3 Special Environments

1.2.3.1 Weatherproof Locations

1.2.4 Standard Products

1.2.5 Nameplates

1.2.5.1 Identification Nameplates

1.2.6 As-Built Drawings

1.3 SUBMITTALS

1.4 WORKMANSHIP

PART 2 PRODUCTS

2.1 CABLES AND WIRES

2.1.1 Insulation

2.1.2 Bonding Conductors

2.1.3 Service Entrance Cables

2.1.4 Non-Metallic Sheathed Cable

2.2 CONDUIT

2.2.1 Rigid Metallic Conduit

2.2.2 Rigid Nonmetallic Conduit

2.3 CONDUIT AND DEVICE BOXES AND FITTINGS

2.3.1 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

2.3.2 Boxes, Switch (Enclosed), Surface-Mounted

2.3.3 Fittings for Conduit and Outlet Boxes

2.3.4 Fittings, PVC, for Use with Rigid PVC Conduit

2.4 CONNECTORS, WIRE PRESSURE

2.4.1 For Use With Copper Conductors

2.5 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

2.5.1 Ground Rods

2.6 ENCLOSURES

2.6.1 Cabinets and Boxes

2.6.2 Circuit Breaker Enclosures

2.7 LOW-VOLTAGE FUSES AND FUSEHOLDERS

2.7.1 Fuses, Low Voltage Cartridge Type

2.7.2 Fuses, Class R

2.8 LOAD CENTERS FOR HOUSING UNITS

2.8.1 Load Center Buses

2.8.2 Circuit Breakers

2.8.2.1 Molded-Case Circuit Breakers

a. Construction

b. Ratings

c. Thermal-Magnetic Trip Elements

2.8.2.2 Multipole Breakers

2.8.2.3 Arc-Fault Circuit-Interrupters

2.8.2.4 Circuit Breakers with GFI

2.8.2.5 HACR Rated Breakers

2.9 SWITCHES

2.9.1 Toggle Switches

2.9.2 Disconnect Switches

2.10 RECEPTACLES

2.10.1 Switched Duplex Receptacles

2.10.2 Weatherproof Receptacles

2.10.3 Ground-Fault Circuit Interrupter Receptacles

2.10.4 Range Receptacles

2.10.5 Dryer Receptacles

2.11 DEVICE PLATES

2.12 AIR-VAPOR BARRIER BOXES

Provide air-vapor barrier box for all electrical boxes installed in exterior walls. The air-vapor barrier box shall be made of thicker polyethylene and rigid in construction. It shall resist cuts and tears during installation. The box shall have a hinged feature to facilitate in easy installation of any standard electrical box. The box shall be sturdy and reinforced, capable of withstanding the pressure needed to make a complete seal with the air vapor barrier material. The box shall not allow any contact between air-vapor barrier materials. Minimum dimensions of the box shall be 165mm x 191mm x 73mm (6-1/2x7-1/2-2-7/8).

2.13 DEVICE PLATES

2.14 SERVICE ENTRANCE EQUIPMENT

2.15 METER BASE

2.16 SPLICE, CONDUCTOR

2.17 SMOKE DETECTORS

Provide single station photoelectric smoke detector in each sleeping room, outside of each separate sleeping area in the immediate vicinity of the sleeping rooms and on each level of the housing unit. Each detector shall contain an alarm sounder capable of producing minimum 85 dBA at 3050mm (10 ft), test button and visible indicating lamp. Lamp shall indicate when the detector is in normal standby mode and provide a different indication when the detector is in alarm. The detector shall provide indication of any malfunction. All detectors within the housing unit shall be interconnected in multiple-station configuration so that when any detector is activated all alarm sounders shall operate. Detector shall operate at 120 VAC. Provide a separate circuit from the Housing unit's Load Center. Provide detectors with 9-volt alkaline standby battery. Locate and install detector in accordance with NFPA 72.

2.18 CARBON MONOXIDE DETECTOR

Provide single station carbon monoxide detectors centrally located outside of each separate sleeping area in the immediate vicinity of the sleeping rooms and on each level of the housing unit. Detector shall operate at 120 VAC. Provide a separate circuit from the Housing unit's Load Center. Provide detectors with 9-volt alkaline standby battery. Operating ambient temperature shall be 32 degrees to 120 degrees Fahrenheit. Detector shall contain an alarm sounder capable of producing minimum 85 dBA at 3050mm (10 ft) and Red LED for visual alarm. Detector shall be equipped with continuous digital display and peak level memory Detector shall also contain yellow or amber LED for malfunction indication and white or green indicator light for Power on indication, while operating at 120V. Provide a manually operated alarm test and reset button. Pressing the button shall silence the alarm, and reset the detector. Alarm shall resound within 6 minutes of CO level remains at or above 70 ppm. Locate and install detector in accordance with NFPA 720.

2.19 TELEPHONE SYSTEM

2.19.1 Telephone Outlets

2.19.2 Cover Plates

2.19.3 Cables

2.19.4 Telephone Terminal Box

2.20 CABLE ACCESS TELEVISION (CATV) SYSTEM

2.20.1 CATV outlets

2.20.2 Cover Plates

2.20.3 Cables

2.20.4 CATV Terminal Box

2.21 FIRE STOPPING MATERIALS

PART 3 EXECUTION

3.1 GROUNDING

3.1.1 Ground Rods

3.1.2 Grounding Conductors

3.2 WIRING METHODS

3.2.1 Conduit and Tubing Systems

3.2.1.1 Pull Wires

3.2.1.2 Below Slab-on-Grade or in the Ground

3.2.1.3 Installing in Slabs Including Slabs on Grade

3.2.1.4 Changes in Direction of Runs

3.2.1.5 Supports

3.2.1.6 Exposed Raceways

3.2.2 Cables and Conductors

3.2.2.1 Sizing

3.2.2.2 Cable Systems

3.2.2.3 Cable Splicing

3.2.2.4 Conductor Identification and Tagging

3.3 BOXES AND SUPPORTS

3.3.1 Box Applications

3.3.2 Brackets and Fasteners

3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

3.4 DEVICE PLATES

3.5 PAINTING AND FINISHING

3.6 FIELD TESTING

3.6.1 Safety

3.6.2 Ground-Resistance Tests

3.6.3 Cable Tests

3.6.3.1 Low Voltage Cable Tests

3.6.4 GFI Receptacle Test

3.6.5 Circuit Breaker Tests

3.6.5.1 Circuit Breakers, Low Voltage

3.6.5.2 Circuit Breakers, Molded Case

3.6.5.3 Arc-Fault Interrupter Test

3.7 SMOKE DETECTOR TEST

3.8 CARBON MONOXIDE DETECTOR TEST

3.9 OPERATING TESTS

3.10 ACCEPTANCE

-- End of Section --

SECTION 16510N

INTERIOR LIGHTING
02/03

PART 1 GENERAL

1.1 REFERENCES

1.2 RELATED REQUIREMENTS

1.3 DEFINITIONS

1.3.1 Average Life

1.3.2 Total Harmonic Distortion (THD)

1.4 SUBMITTALS

1.5 QUALITY ASSURANCE

1.5.1 Fluorescent Electronic Ballasts

1.5.2 Lighting Fixtures, Complete With Lamps and Ballasts

1.5.3 Information Card

1.6 ELECTRONIC BALLAST WARRANTY

PART 2 PRODUCTS

2.1 FLUORESCENT LIGHTING FIXTURES

2.1.1 Fluorescent Lamp Electronic Ballasts

2.1.1.1 T-8 Lamp Ballast

2.1.1.2 F17T8 Lamp Ballast

2.1.2 Fluorescent Lamps

2.1.3 Compact Fluorescent Fixtures

2.1.4 Open-Tube Fluorescent Fixtures

2.2 INCANDESCENT LIGHTING FIXTURES

2.2.1 Incandescent Lamps

2.2.2 Incandescent Dimmer Switch

2.3 RECESS- AND FLUSH-MOUNTED FIXTURES

2.4 SUSPENDED FIXTURES

2.5 SECURITY FLOOD LIGHT WITH MOTION DETECTOR AND PHOTOCELL

The security flood light fixture and sensor head shall be constructed of non-metallic materials. The fixture shall be UL listed for outdoor installation. The sensor shall be capable of detecting motion at 100 degrees and up to 21.3 meters (70 feet). The time and sensitivity settings of the sensor shall be adjustable. The fixture shall contain two sockets and shall accommodate Par 38 incandescent lamps per socket. The maximum wattage of the lamps shall be 150 watts.

Paragraph 2.6 Time Switch was deleted per Don Boley.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Lamps

3.1.2 Lighting Fixtures

-- End of Section --