



**RFP No. W912EP-16-R-0010**

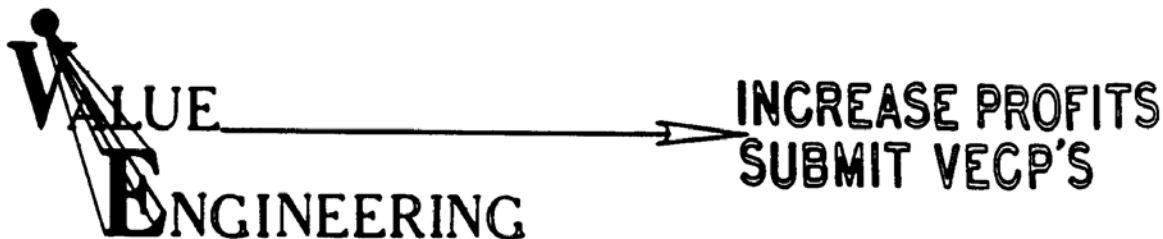
**US Army Corps  
of Engineers  
Jacksonville District**

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**Herbert Hoover Dike Rehabilitation  
Structure Replacements  
S-291 (IP-3) Reconstruction**

**Glades County, Florida**

**Technical Information  
and Specifications  
Volume 2 of 2**



**See Volume 1 of 2 for Issue Date**

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-- End of Project Table of Contents --

# The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.

```

PROGRAM = datasheet95, VERSION = 8.1
1      National Geodetic Survey,   Retrieval Date = JUNE 21, 2013
AE6412 *****
AE6412 DESIGNATION - A 438
AE6412 PID - AE6412
AE6412 STATE/COUNTY- FL/GLADES
AE6412 COUNTRY - US
AE6412 USGS QUAD - OKEECHOBEE SW (1972)
AE6412
AE6412 *CURRENT SURVEY CONTROL
AE6412
AE6412* NAD 83(2011) POSITION- 27 03 40.49608(N) 080 58 21.86022(W) ADJUSTED
AE6412* NAD 83(2011) ELLIP HT- -16.295 (meters) (06/27/12) ADJUSTED
AE6412* NAD 83(2011) EPOCH - 2010.00
AE6412* NAVD 88 ORTHO HEIGHT - 9.496 (meters) 31.15 (feet) ADJUSTED
AE6412
AE6412 NAD 83(2011) X - 891,811.180 (meters) COMP
AE6412 NAD 83(2011) Y - -5,613,386.960 (meters) COMP
AE6412 NAD 83(2011) Z - 2,884,253.442 (meters) COMP
AE6412 LAPLACE CORR - -3.69 (seconds) DEFLEC12A
AE6412 GEOID HEIGHT - -25.78 (meters) GEOID12A
AE6412 DYNAMIC HEIGHT - 9.481 (meters) 31.11 (feet) COMP
AE6412 MODELED GRAVITY - 979,098.9 (mgal) NAVD 88
AE6412
AE6412 VERT ORDER - FIRST CLASS II
AE6412
AE6412 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)
AE6412 Type Horiz Ellip Dist(km)
AE6412 -----
AE6412 NETWORK 0.42 0.69
AE6412 -----
AE6412 MEDIAN LOCAL ACCURACY AND DIST (018 points) 0.61 0.75 25.45
AE6412 -----
AE6412 NOTE: Click here for information on individual local accuracy
AE6412 values and other accuracy information.
AE6412
AE6412
AE6412.The horizontal coordinates were established by GPS observations
AE6412.and adjusted by the National Geodetic Survey in June 2012.
AE6412
AE6412.NAD 83(2011) refers to NAD 83 coordinates where the reference
AE6412.frame has been affixed to the stable North American tectonic plate. See
AE6412.NA2011 for more information.
AE6412
AE6412.The horizontal coordinates are valid at the epoch date displayed above
AE6412.which is a decimal equivalence of Year/Month/Day.
AE6412
AE6412.The orthometric height was determined by differential leveling and
AE6412.adjusted by the NATIONAL GEODETIC SURVEY
AE6412.in January 2002.
AE6412
AE6412.Photographs are available for this station.
AE6412

```

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AE6412.The X, Y, and Z were computed from the position and the ellipsoidal ht.  
 AE6412  
 AE6412.The Laplace correction was computed from DEFLEC12A derived deflections.  
 AE6412  
 AE6412.The ellipsoidal height was determined by GPS observations  
 AE6412.and is referenced to NAD 83.  
 AE6412  
 AE6412.The dynamic height is computed by dividing the NAVD 88  
 AE6412.geopotential number by the normal gravity value computed on the  
 AE6412.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45  
 AE6412.degrees latitude (g = 980.6199 gals.).  
 AE6412  
 AE6412.The modeled gravity was interpolated from observed gravity values.  
 AE6412  
 AE6412. The following values were computed from the NAD 83(2011) position.  
 AE6412  

AE6412;		North	East	Units	Scale Factor	Converg.
AE6412;SPC FL E	-	302,190.570	202,704.166	MT	0.99994127	+0 00 44.6
AE6412;SPC FL E	-	991,436.90	665,038.58	sFT	0.99994127	+0 00 44.6
AE6412;UTM 17	-	2,993,219.445	502,703.243	MT	0.99960009	+0 00 44.6

AE6412!		Elev Factor	x	Scale Factor	=	Combined Factor
AE6412!SPC FL E	-	1.00000256	x	0.99994127	=	0.99994383
AE6412!UTM 17	-	1.00000256	x	0.99960009	=	0.99960265

SUPERSEDED SURVEY CONTROL

AE6412	NAD 83(2007)-	27 03 40.49627(N)	080 58 21.86096(W)	AD(	) 0
AE6412	ELLIP H (02/10/07)	-16.278 (m)		GP(	)
AE6412	NAD 83(1999)-	27 03 40.49620(N)	080 58 21.86127(W)	AD(	) 1
AE6412	ELLIP H (12/12/02)	-16.218 (m)		GP(	) 4 1
AE6412	NAVD 88 (12/12/02)	9.50 (m)	31.2 (f)	LEVELING	3
AE6412	NAVD 88 (03/26/98)	9.509 (m)	31.20 (f)	SUPERSEDED	2 1

AE6412.Superseded values are not recommended for survey control.  
 AE6412  
 AE6412.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.  
 AE6412.[See file dsdata.txt](#) to determine how the superseded data were derived.  
 AE6412  
 AE6412\_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK0270393219(NAD 83)  
 AE6412  
 AE6412\_MARKER: DV = VERTICAL CONTROL DISK  
 AE6412\_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT  
 AE6412\_STAMPING: A 438 1995  
 AE6412\_MARK LOGO: NGS  
 AE6412\_PROJECTION: RECESSED 13 CENTIMETERS  
 AE6412\_MAGNETIC: N = NO MAGNETIC MATERIAL  
 AE6412\_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO  
 AE6412+STABILITY: SURFACE MOTION  
 AE6412\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR  
 AE6412+SATELLITE: SATELLITE OBSERVATIONS - February 16, 2011  
 AE6412  

AE6412	HISTORY	-	Date	Condition	Report By
AE6412	HISTORY	-	1995	MONUMENTED	FLDEP
AE6412	HISTORY	-	20010611	GOOD	EMCINC
AE6412	HISTORY	-	2002	GOOD	MAPTEC
AE6412	HISTORY	-	20030211	GOOD	FLDEP
AE6412	HISTORY	-	20080916	GOOD	FLDEP
AE6412	HISTORY	-	20110124	GOOD	MCKIM
AE6412	HISTORY	-	20110216	GOOD	MCKIM

 AE6412

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AE6412 STATION DESCRIPTION  
AE6412  
AE6412'DESCRIBED BY FL DEPT OF ENV PRO 1995 (LGB)  
AE6412'THE MARK IS ABOUT 10.6 MI (17.1 KM) NORTHEAST OF LAKEPORT IN SECTION  
AE6412'25, TOWNSHIP 39 SOUTH, RANGE 33 EAST. TO REACH THE MARK FROM THE  
AE6412'INTERSECTION OF STATE ROAD 78 AND STATE ROAD 74 IN LAKEPORT, GO  
AE6412'NORTHEAST ON STATE ROAD 78 FOR 10.5 MI (16.9 KM) TO THE WEST END OF  
AE6412'THE BRIDGE OVER CANAL C 40 (INDIAN RIVER CANAL) AND A LOCKED GATE ON  
AE6412'THE RIGHT, TURN RIGHT PASSING THROUGH THE GATE, GO SOUTH ON THE LEVEE  
AE6412'ROAD FOR 0.45 MI (0.72 KM) TO A SHARP TURN TO THE RIGHT AND THE MARK  
AE6412'SET IN THE TOP OF A CONCRETE MONUMENT IN THE APPROXIMATE CENTERLINE OF  
AE6412'THE LEVEE ROAD ON TOP OF THE LEVEE AND RECESSED 0.5 FT (15.2 CM) BELOW  
AE6412'THE LEVEL OF THE GROUND. LOCATED 124.0 FT (37.8 M) EAST OF THE TOP  
AE6412'SCARP OF CANAL C 40, 112.5 FT (34.3 M) EAST OF A CARSONITE WITNESS  
AE6412'POST AND 68.7 FT (20.9 M) WEST OF A METAL GAURDRAIL. NOTE ALL GATES ON  
AE6412'LEVEE ARE LOCKED, FOR KEY CONTACT CARL ZEISS, SOUTH FLORIDA WATER  
AE6412'MANAGEMENT DISTRICT, WEST PALM BEACH, FL. PHONE NUMBER (407)  
AE6412'686-8800.  
AE6412  
AE6412 STATION RECOVERY (2001)  
AE6412  
AE6412'RECOVERY NOTE BY EMC INCORPORATED 2001 (WJB)  
AE6412'RECOVERED AS DESCRIBED.  
AE6412  
AE6412 STATION RECOVERY (2002)  
AE6412  
AE6412'RECOVERY NOTE BY MAPTECH INCORPORATED 2002 (WJB)  
AE6412'RECOVERED BY DESCRIPTION.  
AE6412  
AE6412 STATION RECOVERY (2003)  
AE6412  
AE6412'RECOVERY NOTE BY FL DEPT OF ENV PRO 2003 (SS)  
AE6412'RECOVERED IN GOOD CONDITION.  
AE6412'  
AE6412  
AE6412 STATION RECOVERY (2008)  
AE6412  
AE6412'RECOVERY NOTE BY FL DEPT OF ENV PRO 2008 (BPJ)  
AE6412'RECOVERED AS DESCRIBED.  
AE6412  
AE6412 STATION RECOVERY (2011)  
AE6412  
AE6412'RECOVERY NOTE BY MCKIM AND CREED 2011 (CJB)  
AE6412'RECOVERED IN GOOD CONDITION.  
AE6412  
AE6412 STATION RECOVERY (2011)  
AE6412  
AE6412'RECOVERY NOTE BY MCKIM AND CREED 2011 (CJB)  
AE6412'RECOVERED IN GOOD CONDITION.

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

1 National Geodetic Survey, Retrieval Date = JUNE 21, 2013

AE6418 \*\*\*\*\*

AE6418 DESIGNATION - F 438

AE6418 PID - AE6418

AE6418 STATE/COUNTY- FL/GLADES

AE6418 COUNTRY - US

AE6418 USGS QUAD - BRIGHTON (1972)

AE6418

AE6418 \*CURRENT SURVEY CONTROL

AE6418

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AE6418\* NAD 83(1986) POSITION- 27 08 21. (N) 081 03 10. (W) SCALED

AE6418\* NAVD 88 ORTHO HEIGHT - 8.540 (meters) 28.02 (feet) ADJUSTED

AE6418

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AE6418 GEOID HEIGHT - -25.78 (meters) GEOID12A

AE6418 DYNAMIC HEIGHT - 8.527 (meters) 27.98 (feet) COMP

AE6418 MODELED GRAVITY - 979,104.5 (mgal) NAVD 88

AE6418

AE6418 VERT ORDER - SECOND CLASS I

AE6418

AE6418.The horizontal coordinates were scaled from a topographic map and have

AE6418.an estimated accuracy of +/- 6 seconds.

AE6418.

AE6418.The orthometric height was determined by differential leveling and

AE6418.adjusted by the NATIONAL GEODETIC SURVEY

AE6418.in March 1998.

AE6418

AE6418.The dynamic height is computed by dividing the NAVD 88

AE6418.geopotential number by the normal gravity value computed on the

AE6418.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

AE6418.degrees latitude (g = 980.6199 gals.).

AE6418

AE6418.The modeled gravity was interpolated from observed gravity values.

AE6418

AE6418;	North	East	Units	Estimated Accuracy
AE6418;SPC FL E -	310,830.	194,770.	MT	(+/- 180 meters Scaled)

AE6418

AE6418 SUPERSEDED SURVEY CONTROL

AE6418

AE6418.No superseded survey control is available for this station.

AE6418

AE6418\_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML947018(NAD 83)

AE6418

AE6418\_MARKER: DV = VERTICAL CONTROL DISK

AE6418\_SETTING: 31 = SET IN A PAVEMENT SUCH AS STREET, SIDEWALK, CURB, ETC.

AE6418\_SP\_SET: BRIDGE CURB

AE6418\_STAMPING: F 438 1995

AE6418\_MARK LOGO: NGS

AE6418\_MAGNETIC: N = NO MAGNETIC MATERIAL

AE6418\_STABILITY: D = MARK OF QUESTIONABLE OR UNKNOWN STABILITY

AE6418

AE6418	HISTORY	- Date	Condition	Report By
AE6418	HISTORY	- 1995	MONUMENTED	FLDEP

AE6418

AE6418 STATION DESCRIPTION

AE6418

AE6418'DESCRIBED BY FL DEPT OF ENV PRO 1995 (LGB)

AE6418'THE MARK IS ABOUT 22.0 MI (35.4 KM) SOUTHEAST OF LAKE PLACID, 14.0 MI

AE6418'(22.5 KM) SOUTHWEST OF OKEECHOBEE IN SECTION 30, TOWNSHIP 38 SOUTH,

AE6418'RANGE 33 EAST. TO REACH THE MARK FROM THE INTERSECTION OF STATE ROAD

AE6418'70 AND COUNTY ROAD 721 WEST OF OKEECHOBEE, GO SOUTH ON COUNTY ROAD 721

AE6418'FOR 3.8 MI (6.1 KM) TO THE SOUTH END OF THE BRIDGE OVER CANAL C 40

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AE6418'(INDIAN PRAIRIE CANAL) AND A LOCKED GATE ON THE LEFT, TURN LEFT  
AE6418'PASSING THROUGH THE GATE, GO SOUTHEAST ON WEST LEVEE ROAD FOR 3.4 MI  
AE6418'(5.5 KM) TO A BRIDGE OVER CANAL C 40 AND THE MARK SET FLUSH IN THE  
AE6418'NORTHWEST CORNER OF THE CONCRETE CURB OF THE BRIDGE. LOCATED 65.2 FT  
AE6418'(19.9 M) NORTHEAST OF THE APPROXIMATE CENTERLINE OF THE DIM TRACK ROAD  
AE6418'ON TOP OF THE LEVEE, 14.5 FT (4.4 M) WEST OF THE APPROXIMATE  
AE6418'CENTERLINE OF THE BRIDGE OVER CANAL C 40 AND 2.0 FT (0.6 M) NORTH OF A  
AE6418'CARSONITE WITNESS POST. NOTE ALL GATES ON LEVEE ARE LOCKED, FOR KEY  
AE6418'CONTACT CARL ZEISS, SOUTH FLORIDA WATER MANAGEMENT DISTRICT, WEST PALM  
AE6418'BEACH, FL. PHONE NUMBER (407) 686-8800.



## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

1 National Geodetic Survey, Retrieval Date = JUNE 21, 2013  
 AE6414 \*\*\*\*\*  
 AE6414 DESIGNATION - FCE 4544  
 AE6414 PID - AE6414  
 AE6414 STATE/COUNTY- FL/GLADES  
 AE6414 COUNTRY - US  
 AE6414 USGS QUAD - BRIGHTON SE (1983)  
 AE6414  
 AE6414 \*CURRENT SURVEY CONTROL  
 AE6414  
 AE6414\* NAD 83(1986) POSITION- 27 05 34. (N) 081 00 23. (W) SCALED  
 AE6414\* NAVD 88 ORTHO HEIGHT - 7.876 (meters) 25.84 (feet) ADJUSTED  
 AE6414  
 AE6414 GEOID HEIGHT - -25.79 (meters) GEOID12A  
 AE6414 DYNAMIC HEIGHT - 7.864 (meters) 25.80 (feet) COMP  
 AE6414 MODELED GRAVITY - 979,100.1 (mgal) NAVD 88  
 AE6414  
 AE6414 VERT ORDER - SECOND CLASS I  
 AE6414  
 AE6414.The horizontal coordinates were scaled from a topographic map and have  
 AE6414.an estimated accuracy of +/- 6 seconds.  
 AE6414.  
 AE6414.The orthometric height was determined by differential leveling and  
 AE6414.adjusted by the NATIONAL GEODETIC SURVEY  
 AE6414.in March 1998.  
 AE6414  
 AE6414.The dynamic height is computed by dividing the NAVD 88  
 AE6414.geopotential number by the normal gravity value computed on the  
 AE6414.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45  
 AE6414.degrees latitude (g = 980.6199 gals.).  
 AE6414  
 AE6414.The modeled gravity was interpolated from observed gravity values.  
 AE6414  
 AE6414;  
 AE6414;SPC FL E - North East Units Estimated Accuracy  
 AE6414; 305,680. 199,370. MT (+/- 180 meters Scaled)  
 AE6414  
 AE6414 SUPERSEDED SURVEY CONTROL  
 AE6414  
 AE6414.No superseded survey control is available for this station.  
 AE6414  
 AE6414\_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RMK993967(NAD 83)  
 AE6414  
 AE6414\_MARKER: DD = SURVEY DISK  
 AE6414\_SETTING: 38 = SET IN THE ABUTMENT OR PIER OF A LARGE BRIDGE  
 AE6414\_SP\_SET: FLOOD CONTROL GATE  
 AE6414\_STAMPING: FCE 4544 1994 JAX FLA  
 AE6414\_MARK LOGO: USE  
 AE6414\_MAGNETIC: N = NO MAGNETIC MATERIAL  
 AE6414\_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL  
 AE6414\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR  
 AE6414+SATELLITE: SATELLITE OBSERVATIONS - February 08, 1995  
 AE6414  
 AE6414 HISTORY - Date Condition Report By  
 AE6414 HISTORY - 1994 MONUMENTED USE  
 AE6414 HISTORY - 19950208 GOOD FLDEP  
 AE6414 HISTORY - 20081002 GOOD MOREKL  
 AE6414  
 AE6414 STATION DESCRIPTION  
 AE6414  
 AE6414'DESCRIBED BY FL DEPT OF ENV PRO 1995 (LGB)  
 AE6414'THE MARK IS ABOUT 10.6 MI (17.1 KM) NORTHEAST OF LAKEPORT IN SECTION

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AE6414'15, TOWNSHIP 39 SOUTH, RANGE 33 EAST. TO REACH THE MARK FROM THE  
AE6414'INTERSECTION OF STATE ROAD 78 AND STATE ROAD 74 IN LAKEPORT, GO  
AE6414'NORTHEAST ON STATE ROAD 78 FOR 10.5 MI (16.9 KM) TO THE WEST END OF  
AE6414'THE BRIDGE OVER CANALC 40 (INDIAN RIVER CANAL) AND A LOCKED GATE ON  
AE6414'THE LEFT, TURN LEFT PASSING THROUGH THE GATE, GO NORTH ON WEST LEVEE  
AE6414'ROAD FOR 2.45 MI (3.94 KM) TO A LOCKED GATE, PASSING THROUGH THE GATE  
AE6414'CONTINUE NORTH ON THE LEVEE ROAD FOR 0.1 MI (0.2 KM) TO FLOOD CONTROL  
AE6414'GATE S 72 ON THE RIGHT AND THE MARK SET FLUSH IN THE SOUTHEAST CORNER  
AE6414'OF THE STRUCTURE. LOCATED 61.4 FT (18.7 M) SOUTHWEST OF THE SOUTHEAST  
AE6414'CORNER OF THE STRUCTURE, 17.2 FT (5.2 M) SOUTH OF A CONCRETE GATE  
AE6414'CONTROL COLUMN AND 9.3 FT (2.8 M) SOUTH OF THE APPROXIMATE CENTERLINE  
AE6414'OF THE BRIDGE OVER THE STRUCTURE. NOTE ALL GATES ON LEVEE ARE LOCKED,  
AE6414'FOR KEY CONTACT CARL ZEISS, SOUTH FLORIDA WATER MANAGEMENT DISTRICT,  
AE6414'WEST PALM BEACH, FL. PHONE NUMBER (407) 686-8800.

AE6414

STATION RECOVERY (2008)

AE6414

AE6414'RECOVERY NOTE BY MORGAN AND EKLUND INC 2008

AE6414'RECOVERED IN GOOD CONDITION.

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

1 National Geodetic Survey, Retrieval Date = JUNE 21, 2013

AJ6177 \*\*\*\*\*

AJ6177 DESIGNATION - M 523

AJ6177 PID - AJ6177

AJ6177 STATE/COUNTY- FL/GLADES

AJ6177 COUNTRY - US

AJ6177 USGS QUAD - OKEECHOBEE SW (1972)

AJ6177

AJ6177 \*CURRENT SURVEY CONTROL

AJ6177

AJ6177*	NAD 83(2011) POSITION-	27 05 09.84039(N) 080 56 40.46263(W)	ADJUSTED
AJ6177*	NAD 83(2011) ELLIP HT-	-16.183 (meters) (06/27/12)	ADJUSTED
AJ6177*	NAD 83(2011) EPOCH	- 2010.00	
AJ6177*	NAVD 88 ORTHO HEIGHT	- 9.801 (meters) 32.16 (feet)	ADJUSTED
AJ6177	NAD 83(2011) X	- 894,373.581 (meters)	COMP
AJ6177	NAD 83(2011) Y	- -5,611,711.984 (meters)	COMP
AJ6177	NAD 83(2011) Z	- 2,886,702.090 (meters)	COMP
AJ6177	LAPLACE CORR	- -3.49 (seconds)	DEFLEC12A
AJ6177	GEOID HEIGHT	- -25.98 (meters)	GEOID12A
AJ6177	DYNAMIC HEIGHT	- 9.786 (meters) 32.11 (feet)	COMP
AJ6177	MODELED GRAVITY	- 979,093.3 (mgal)	NAVD 88

AJ6177

AJ6177 VERT ORDER - FIRST CLASS II

AJ6177

AJ6177 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)

AJ6177 Type Horiz Ellip Dist(km)

AJ6177 -----

AJ6177	NETWORK	1.21	1.94
AJ6177	MEDIAN LOCAL ACCURACY AND DIST (002 points)	0.89	1.42 1.61

AJ6177 -----

AJ6177 NOTE: Click [here](#) for information on individual local accuracy values and other accuracy information.

AJ6177

AJ6177

AJ6177.The horizontal coordinates were established by GPS observations

AJ6177.and adjusted by the National Geodetic Survey in June 2012.

AJ6177

AJ6177.NAD 83(2011) refers to NAD 83 coordinates where the reference

AJ6177.frame has been affixed to the stable North American tectonic plate. See

AJ6177.[NA2011](#) for more information.

AJ6177

AJ6177.The horizontal coordinates are valid at the epoch date displayed above

AJ6177.which is a decimal equivalence of Year/Month/Day.

AJ6177

AJ6177.The orthometric height was determined by differential leveling and

AJ6177.adjusted by the NATIONAL GEODETIC SURVEY

AJ6177.in January 2002.

AJ6177

AJ6177.[Photographs](#) are available for this station.

AJ6177

AJ6177.The X, Y, and Z were computed from the position and the ellipsoidal ht.

AJ6177

AJ6177.The Laplace correction was computed from DEFLEC12A derived deflections.

AJ6177

AJ6177.The ellipsoidal height was determined by GPS observations

AJ6177.and is referenced to NAD 83.

AJ6177

AJ6177.The dynamic height is computed by dividing the NAVD 88

AJ6177.geopotential number by the normal gravity value computed on the

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AJ6177.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45  
 AJ6177.degrees latitude (g = 980.6199 gals.).  
 AJ6177  
 AJ6177.The modeled gravity was interpolated from observed gravity values.  
 AJ6177  
 AJ6177. The following values were computed from the NAD 83(2011) position.  
 AJ6177  

AJ6177;		North	East	Units	Scale Factor	Converg.
AJ6177;SPC FL E	-	304,941.261	205,496.888	MT	0.99994155	+0 01 30.9
AJ6177;SPC FL E	-	1,000,461.45	674,201.04	sFT	0.99994155	+0 01 30.9
AJ6177;UTM 17	-	2,995,969.198	505,495.013	MT	0.99960037	+0 01 30.9

 AJ6177  

AJ6177!		Elev Factor	x	Scale Factor	=	Combined Factor
AJ6177!SPC FL E	-	1.00000254	x	0.99994155	=	0.99994409
AJ6177!UTM 17	-	1.00000254	x	0.99960037	=	0.99960291

 AJ6177  
 AJ6177 SUPERSEDED SURVEY CONTROL  
 AJ6177  

AJ6177	NAD 83(2007)-	27 05 09.84055(N)	080 56 40.46331(W)	AD(	)	0
AJ6177	ELLIP H (02/10/07)	-16.165 (m)		GP(	)	
AJ6177	NAD 83(1999)-	27 05 09.84050(N)	080 56 40.46367(W)	AD(	)	1
AJ6177	ELLIP H (12/12/02)	-16.120 (m)		GP(	)	4 1
AJ6177	NAVD 88 (12/12/02)	9.80 (m)	32.2	(f)	LEVELING	3

 AJ6177  
 AJ6177.Superseded values are not recommended for survey control.  
 AJ6177  
 AJ6177.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.  
 AJ6177.[See file dsdata.txt](#) to determine how the superseded data were derived.  
 AJ6177  
 AJ6177\_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK0549595969(NAD 83)  
 AJ6177  
 AJ6177\_MARKER: DD = SURVEY DISK  
 AJ6177\_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT  
 AJ6177\_STAMPING: M 523 2001 CERP  
 AJ6177\_MARK LOGO: USACE  
 AJ6177\_PROJECTION: RECESSED 10 CENTIMETERS  
 AJ6177\_MAGNETIC: O = OTHER; SEE DESCRIPTION  
 AJ6177\_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO  
 AJ6177+STABILITY: SURFACE MOTION  
 AJ6177\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR  
 AJ6177+SATELLITE: SATELLITE OBSERVATIONS - April 10, 2002  
 AJ6177  

AJ6177	HISTORY	-	Date	Condition	Report By
AJ6177	HISTORY	-	20010511	MONUMENTED	EMCINC
AJ6177	HISTORY	-	20020410	GOOD	MAPTEC

 AJ6177  
 AJ6177 STATION DESCRIPTION  
 AJ6177  
 AJ6177'DESCRIBED BY EMC INCORPORATED 2001 (CHP)  
 AJ6177'THE STATION IS LOCATED APPROXIMATELY 18.4 KILOMETERS (11.4 MILES)  
 AJ6177'SOUTHWEST OF  
 AJ6177'OKEECHOBEE, FLORIDA ON THE HERBERT HOOVER LEVEE.  
 AJ6177'LOCATED ON THE OKEECHOBEE SOUTHWEST QUAD SECTION 17, TOWNSHIP 39  
 AJ6177'SOUTH,  
 AJ6177'RANGE 34 EAST.  
 AJ6177'  
 AJ6177'OWNERSHIP SOUTH FLORIDA WATER MANAGEMENT DISTRICT  
 AJ6177'  
 AJ6177'TO REACH THE STATION FROM THE INTERSECTION OF U.S. HIGHWAY 441 AND  
 AJ6177'STATE ROAD 78 IN  
 AJ6177'OKEECHOBEE, FLORIDA GO SOUTHWEST ON STATE ROAD 78 FOR 11.45 KILOMETERS

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

[illegible]

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

1 National Geodetic Survey, Retrieval Date = JUNE 21, 2013

AE6398 \*\*\*\*\*

AE6398 DESIGNATION - P 437

AE6398 PID - AE6398

AE6398 STATE/COUNTY- FL/GLADES

AE6398 COUNTRY - US

AE6398 USGS QUAD - BRIGHTON SE (1983)

AE6398

AE6398 \*CURRENT SURVEY CONTROL

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AE6398\* NAD 83(1986) POSITION- 27 04 28. (N) 081 06 47. (W) SCALED

AE6398\* NAVD 88 ORTHO HEIGHT - 7.751 (meters) 25.43 (feet) ADJUSTED

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AE6398

AE6398 GEOID HEIGHT - -25.33 (meters) GEOID12A

AE6398 DYNAMIC HEIGHT - 7.739 (meters) 25.39 (feet) COMP

AE6398 MODELED GRAVITY - 979,115.4 (mgal) NAVD 88

AE6398

AE6398 VERT ORDER - SECOND CLASS I

AE6398

AE6398.The horizontal coordinates were scaled from a topographic map and have

AE6398.an estimated accuracy of +/- 6 seconds.

AE6398.

AE6398.The orthometric height was determined by differential leveling and

AE6398.adjusted by the NATIONAL GEODETIC SURVEY

AE6398.in March 1998.

AE6398

AE6398.The dynamic height is computed by dividing the NAVD 88

AE6398.geopotential number by the normal gravity value computed on the

AE6398.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

AE6398.degrees latitude (g = 980.6199 gals.).

AE6398

AE6398.The modeled gravity was interpolated from observed gravity values.

AE6398

AE6398;	North	East	Units	Estimated Accuracy
AE6398;SPC FL E -	303,660.	188,790.	MT	(+/- 180 meters Scaled)

AE6398

AE6398 SUPERSEDED SURVEY CONTROL

AE6398

AE6398.No superseded survey control is available for this station.

AE6398

AE6398\_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RMK887946(NAD 83)

AE6398

AE6398\_MARKER: DV = VERTICAL CONTROL DISK

AE6398\_SETTING: 38 = SET IN THE ABUTMENT OR PIER OF A LARGE BRIDGE

AE6398\_SP\_SET: BRIDGE ABUTMENT

AE6398\_STAMPING: P 437 1995

AE6398\_MARK LOGO: NGS

AE6398\_MAGNETIC: N = NO MAGNETIC MATERIAL

AE6398\_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

AE6398\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AE6398+SATELLITE: SATELLITE OBSERVATIONS - 1995

AE6398

AE6398	HISTORY	- Date	Condition	Report By
AE6398	HISTORY	- 1995	MONUMENTED	FLDEP

AE6398

AE6398 STATION DESCRIPTION

AE6398

AE6398'DESCRIBED BY FL DEPT OF ENV PRO 1995 (LGB)

AE6398'THE MARK IS ABOUT 20.9 MI (33.6 KM) SOUTHWEST OF OKEECHOBEE, 6.9 MI

AE6398'(11.1 KM) NORTHWEST OF LAKEPORT IN SECTION 22, TOWNSHIP 39 SOUTH,

AE6398'RANGE 32 EAST. TO REACH THE MARK FROM THE INTERSECTION OF STATE ROAD

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AE6398'70 AND COUNTY ROAD 721 EAST OF OKEECHOBEE, GO SOUTH ON COUNTY ROAD 721  
AE6398'(RESERVATION ROAD N.E.) FOR 3.8 MI (6.1 KM) TO CANAL C 40 (INDIAN  
AE6398'PRAIRIE CANAL), CONTINUE SOUTH ON COUNTY ROAD 721 FOR 6.9 MI (11.1 KM)  
AE6398'TO THE JUNCTION OF COUNTY ROAD 721-A (HARNEY POND CANAL ROAD N.E.) ON  
AE6398'THE RIGHT, TURN RIGHT ON COUNTY ROAD 721-A AND GO WEST FOR 3.4 MI (5.5  
AE6398'KM) TO THE WEST END OF THE BRIDGE OVER CANAL C 41 (HARNEY POND CANAL)  
AE6398'AND THE MARK SET FLUSH IN THE NORTHWEST CONCRETE ABUTMENT OF THE  
AE6398'BRIDGE. LOCATED 48.4 FT (14.8 M) NORTHEAST OF THE APPROXIMATE  
AE6398'CENTERLINE OF THE LEVEE ROAD, 12.9 FT (3.9 M) NORTHWEST OF THE  
AE6398'APPROXIMATE CENTERLINE OF COUNTY ROAD 721-A AND 2.6 FT (0.8 M)  
AE6398'NORTHEAST OF A CARSONITE WITNESS POST.

# SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

1 National Geodetic Survey, Retrieval Date = JUNE 21, 2013

AJ6181 \*\*\*\*\*

AJ6181 DESIGNATION - R 523

AJ6181 PID - AJ6181

AJ6181 STATE/COUNTY- FL/GLADES

AJ6181 COUNTRY - US

AJ6181 USGS QUAD - OKEECHOBEE SW (1972)

AJ6181

AJ6181 \*CURRENT SURVEY CONTROL

AJ6181

AJ6181*	NAD 83(2011) POSITION-	27 02 05.38330(N)	080 59 41.77505(W)	ADJUSTED
AJ6181*	NAD 83(2011) ELLIP HT-	-15.628 (meters)	(06/27/12)	ADJUSTED
AJ6181*	NAD 83(2011) EPOCH	- 2010.00		
AJ6181*	NAVD 88 ORTHO HEIGHT	- 9.966 (meters)	32.70 (feet)	ADJUSTED
AJ6181				
AJ6181	NAD 83(2011) X	- 889,844.732 (meters)		COMP
AJ6181	NAD 83(2011) Y	- -5,615,047.467 (meters)		COMP
AJ6181	NAD 83(2011) Z	- 2,881,646.470 (meters)		COMP
AJ6181	LAPLACE CORR	- -3.59 (seconds)		DEFLEC12A
AJ6181	GEOID HEIGHT	- -25.59 (meters)		GEOID12A
AJ6181	DYNAMIC HEIGHT	- 9.951 (meters)	32.65 (feet)	COMP
AJ6181	MODELED GRAVITY	- 979,105.3 (mgal)		NAVD 88
AJ6181				
AJ6181	VERT ORDER	- FIRST	CLASS II	
AJ6181				
AJ6181	FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)			
AJ6181	Type		Horiz Ellip Dist(km)	
AJ6181				
AJ6181	NETWORK		0.86 1.37	
AJ6181				
AJ6181	MEDIAN LOCAL ACCURACY AND DIST (004 points)		0.75 1.18 2.40	
AJ6181				
AJ6181	NOTE: Click <a href="#">here</a> for information on individual local accuracy values and other accuracy information.			
AJ6181				
AJ6181				
AJ6181	The horizontal coordinates were established by GPS observations			
AJ6181	and adjusted by the National Geodetic Survey in June 2012.			
AJ6181				
AJ6181	NAD 83(2011) refers to NAD 83 coordinates where the reference			
AJ6181	frame has been affixed to the stable North American tectonic plate. See			
AJ6181	<a href="#">NA2011</a> for more information.			
AJ6181				
AJ6181	The horizontal coordinates are valid at the epoch date displayed above			
AJ6181	which is a decimal equivalence of Year/Month/Day.			
AJ6181				
AJ6181	The orthometric height was determined by differential leveling and			
AJ6181	adjusted by the NATIONAL GEODETIC SURVEY			
AJ6181	in January 2002.			
AJ6181				
AJ6181	<a href="#">Photographs</a> are available for this station.			
AJ6181				
AJ6181	The X, Y, and Z were computed from the position and the ellipsoidal ht.			
AJ6181				
AJ6181	The Laplace correction was computed from DEFLEC12A derived deflections.			
AJ6181				
AJ6181	The ellipsoidal height was determined by GPS observations			
AJ6181	and is referenced to NAD 83.			
AJ6181				
AJ6181	The dynamic height is computed by dividing the NAVD 88			
AJ6181	geopotential number by the normal gravity value computed on the			



## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AJ6181.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45  
 AJ6181.degrees latitude (g = 980.6199 gals.).  
 AJ6181  
 AJ6181.The modeled gravity was interpolated from observed gravity values.  
 AJ6181  
 AJ6181. The following values were computed from the NAD 83(2011) position.  
 AJ6181  

	North	East	Units	Scale Factor	Converg.
AJ6181;SPC FL E	- 299,262.986	200,502.292	MT	0.99994118	+0 00 08.3
AJ6181;SPC FL E	- 981,831.98	657,814.60	sFT	0.99994118	+0 00 08.3
AJ6181;UTM 17	- 2,990,292.860	500,502.121	MT	0.99960000	+0 00 08.3

 AJ6181  

	Elev Factor	x	Scale Factor	=	Combined Factor
AJ6181!SPC FL E	- 1.00000246	x	0.99994118	=	0.99994363
AJ6181!UTM 17	- 1.00000246	x	0.99960000	=	0.99960245

 AJ6181  
 AJ6181 SUPERSEDED SURVEY CONTROL  
 AJ6181  

AJ6181	NAD 83(2007)-	27 02 05.38346(N)	080 59 41.77575(W)	AD(	) 0
AJ6181	ELLIP H (02/10/07)	-15.610 (m)		GP(	)
AJ6181	NAD 83(1999)-	27 02 05.38337(N)	080 59 41.77608(W)	AD(	) 1
AJ6181	ELLIP H (12/12/02)	-15.558 (m)		GP(	) 4 1
AJ6181	NAVD 88 (12/12/02)	9.97 (m)	32.7	(f) LEVELING	3

 AJ6181  
 AJ6181.Superseded values are not recommended for survey control.  
 AJ6181  
 AJ6181.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.  
 AJ6181.[See file dsdata.txt](#) to determine how the superseded data were derived.  
 AJ6181  
 AJ6181\_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK0050290292(NAD 83)  
 AJ6181  
 AJ6181\_MARKER: F = FLANGE-ENCASED ROD  
 AJ6181\_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
   
 AJ6181\_STAMPING: R 523 2001 CERP  
 AJ6181\_MARK LOGO: USACE  
 AJ6181\_PROJECTION: RECESSED 12 CENTIMETERS  
 AJ6181\_MAGNETIC: O = OTHER; SEE DESCRIPTION  
 AJ6181\_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL  
 AJ6181\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR  
 AJ6181+SATELLITE: SATELLITE OBSERVATIONS - April 10, 2002  
 AJ6181\_ROD/PIPE-DEPTH: 23.1 meters  
 AJ6181  

	History	Date	Condition	Report By
AJ6181	HISTORY	- 20010513	MONUMENTED	EMCINC
AJ6181	HISTORY	- 20020410	GOOD	MAPTEC

 AJ6181  
 AJ6181 STATION DESCRIPTION  
 AJ6181  
 AJ6181'DESCRIBED BY EMC INCORPORATED 2001 (CHP)  
 AJ6181'THE STATION IS LOCATED APPROXIMATELY 13.7 KILOMETERS (8.5 MILES)  
 AJ6181'NORTHEAST OF LAKE PORT,  
 AJ6181'FLORIDA, ON THE HERBERT HOOVER LEVEE.  
 AJ6181'LOCATED ON THE OKEECHOBEE SOUTHWEST QUAD SECTION 35, TOWNSHIP 39 SOUTH  
 AJ6181', RANGE 33  
 AJ6181'EAST.  
 AJ6181'  
 AJ6181'OWNERSHIP SOUTH FLORIDA WATER MANAGEMENT DISTRICT  
 AJ6181'  
 AJ6181'TO REACH THE STATION FROM THE INTERSECTION OF COUNTY ROAD 74 AND STATE  
 AJ6181'ROAD 78 IN LAKE  
 AJ6181'PORT, FLORIDA GO NORTHEAST ON STATE ROAD 78 FOR 12.98 KILOMETERS (8.05

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AJ6181'MILES) TO AN ASPHALT  
AJ6181'ROAD ON RIGHT, THENCE SOUTHEAST 0.32 KILOMETERS (0.2 MILES) TO A GATE  
AJ6181'AT BRIDGE, THENCE  
AJ6181'CONTINUE SOUTHEAST 0.16 KILOMETERS (0.1 MILES) TO PUMP STATION S129,  
AJ6181'THENCE GO  
AJ6181'NORTHEAST 0.08 KILOMETERS (0.05 MILES) TO THE TOP OF LEVEE AND A GATE,  
AJ6181'THENCE CONTINUE  
AJ6181'NORTHEAST 0.72 KILOMETERS (0.45 MILES) TO THE MARK ON LEFT.  
AJ6181'  
AJ6181'THE STATION IS 37.3 METERS (124.0 FEET) SOUTHEAST OF A LONE PAIR OF 16  
AJ6181'INCH PALM TREES ON  
AJ6181'THE SOUTH TOP BANK OF CANAL, 3.5 METERS (11.5 FEET) NORTHWEST OF THE  
AJ6181'CENTER OF THE  
AJ6181'LEVEE, 1.0 METERS (3.3 FEET) SOUTHEAST OF A CARSONITE WITNESS POST.  
AJ6181'THE MARK IS A STAINLESS STEEL ROD INSIDE A 5-INCH LOGO COVER RECESSED  
AJ6181'0.1 METERS (0.3 FEET)  
AJ6181'BELOW GROUND. A MAGNET WAS PLACED INSIDE THE LOGO COVER.  
AJ6181'  
AJ6181'NOTE ACCESS TO THE DATUM POINT IS HAD THROUGH A 5-INCH LOGO CAP.  
AJ6181'  
AJ6181'  
AJ6181'  
AJ6181'  
  
AJ6181'STATION RECOVERY (2002)  
AJ6181'  
AJ6181'RECOVERY NOTE BY MAPTECH INCORPORATED 2002 (CHP)  
AJ6181'THE STATION IS LOCATED APPROXIMATELY 13.7 KILOMETERS (8.5 MILES)  
AJ6181'NORTHEAST OF LAKE PORT,  
AJ6181'FLORIDA, ON THE HERBERT HOOVER LEVEE.  
AJ6181'LOCATED ON THE OKEECHOBEE SOUTHWEST QUAD SECTION 35, TOWNSHIP 39 SOUTH  
AJ6181'', RANGE 33  
AJ6181'EAST.  
AJ6181'  
AJ6181'OWNERSHIP      SOUTH FLORIDA WATER MANAGEMENT DISTRICT  
AJ6181'  
AJ6181'TO REACH THE STATION FROM THE INTERSECTION OF COUNTY ROAD 74 AND STATE  
AJ6181'ROAD 78 IN LAKE  
AJ6181'PORT, FLORIDA GO NORTHEAST ON STATE ROAD 78 FOR 12.98 KILOMETERS (8.05  
AJ6181'MILES) TO AN  
AJ6181'ASPHALT  
AJ6181'ROAD ON RIGHT, THENCE SOUTHEAST 0.32 KILOMETERS (0.2 MILES) TO A GATE  
AJ6181'AT BRIDGE, THENCE  
AJ6181'CONTINUE SOUTHEAST 0.16 KILOMETERS (0.1 MILES) TO PUMP STATION S129,  
AJ6181'THENCE GO  
AJ6181'NORTHEAST 0.08 KILOMETERS (0.05 MILES) TO THE TOP OF LEVEE AND A GATE,  
AJ6181'THENCE CONTINUE  
AJ6181'NORTHEAST 0.72 KILOMETERS (0.45 MILES) TO THE MARK ON LEFT.  
AJ6181'  
AJ6181'THE STATION IS 37.3 METERS (124.0 FEET) SOUTHEAST OF A LONE PAIR OF 16  
AJ6181'INCH PALM TREES ON  
AJ6181'THE SOUTH TOP BANK OF CANAL, 3.5 METERS (11.5 FEET) NORTHWEST OF THE  
AJ6181'CENTER OF THE  
AJ6181'LEVEE, 1.0 METERS (3.3 FEET) SOUTHEAST OF A CARSONITE WITNESS POST.  
AJ6181'THE MARK IS A STAINLESS STEEL ROD INSIDE A 5-INCH LOGO COVER RECESSED  
AJ6181'0.1 METERS (0.3 FEET)  
AJ6181'BELOW GROUND. A MAGNET WAS PLACED INSIDE THE LOGO COVER.  
AJ6181'  
AJ6181'NOTE ACCESS TO THE DATUM POINT IS HAD THROUGH A 5-INCH LOGO CAP.  
AJ6181'  
AJ6181'  
AJ6181'STATION RECOVERY (2002)

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AJ6181'

AJ6181'RECOVERY NOTE BY MAPTECH, INCORPORATED 2002 (CP)

AJ6181'RECOVERED AS DESCRIBED.

AJ6181'

# SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

1 National Geodetic Survey, Retrieval Date = JUNE 21, 2013

AF6695 \*\*\*\*\*

AF6695 DESIGNATION - W 357

AF6695 PID - AF6695

AF6695 STATE/COUNTY- FL/OKEECHOBEE

AF6695 COUNTRY - US

AF6695 USGS QUAD - OKEECHOBEE NW (1972)

AF6695

AF6695 \*CURRENT SURVEY CONTROL

AF6695

AF6695*	NAD 83(2011) POSITION-	27 14 36.30331(N)	080 57 39.54604(W)	ADJUSTED
AF6695*	NAD 83(2011) ELLIP HT-	-17.037 (meters)	(06/27/12)	ADJUSTED
AF6695*	NAD 83(2011) EPOCH	- 2010.00		
AF6695*	NAVD 88 ORTHO HEIGHT	- 9.273 (meters)	30.42 (feet)	ADJUSTED
AF6695	NAD 83(2011) X	- 891,515.389 (meters)		COMP
AF6695	NAD 83(2011) Y	- -5,604,105.912 (meters)		COMP
AF6695	NAD 83(2011) Z	- 2,902,213.915 (meters)		COMP
AF6695	LAPLACE CORR	- -3.17 (seconds)		DEFLEC12A
AF6695	GEOID HEIGHT	- -26.35 (meters)		GEOID12A
AF6695	DYNAMIC HEIGHT	- 9.258 (meters)	30.37 (feet)	COMP
AF6695	MODELED GRAVITY	- 979,101.0 (mgal)		NAVD 88

AF6695

AF6695 VERT ORDER - FIRST CLASS II

AF6695

AF6695 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)

AF6695 Type Horiz Ellip Dist(km)

AF6695 -----

AF6695	NETWORK	2.25	2.80	
AF6695	MEDIAN LOCAL ACCURACY AND DIST (003 points)	1.59	1.88	1.61

AF6695

AF6695 NOTE: Click [here](#) for information on individual local accuracy values and other accuracy information.

AF6695

AF6695

AF6695.The horizontal coordinates were established by GPS observations

AF6695.and adjusted by the National Geodetic Survey in June 2012.

AF6695

AF6695.NAD 83(2011) refers to NAD 83 coordinates where the reference

AF6695.frame has been affixed to the stable North American tectonic plate. See

AF6695.[NA2011](#) for more information.

AF6695

AF6695.The horizontal coordinates are valid at the epoch date displayed above

AF6695.which is a decimal equivalence of Year/Month/Day.

AF6695

AF6695.The orthometric height was determined by differential leveling and

AF6695.adjusted by the NATIONAL GEODETIC SURVEY

AF6695.in June 1991.

AF6695

AF6695.The X, Y, and Z were computed from the position and the ellipsoidal ht.

AF6695

AF6695.The Laplace correction was computed from DEFLEC12A derived deflections.

AF6695

AF6695.The ellipsoidal height was determined by GPS observations

AF6695.and is referenced to NAD 83.

AF6695

AF6695.The dynamic height is computed by dividing the NAVD 88

AF6695.geopotential number by the normal gravity value computed on the

AF6695.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

AF6695.degrees latitude (g = 980.6199 gals.).

# SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

AF6695  
 AF6695.The modeled gravity was interpolated from observed gravity values.  
 AF6695  
 AF6695. The following values were computed from the NAD 83(2011) position.  
 AF6695  

AF6695;	North	East	Units	Scale Factor	Converg.
AF6695;SPC FL E	- 322,375.060	203,863.828	MT	0.99994136	+0 01 04.3
AF6695;SPC FL E	- 1,057,658.84	668,843.24	sFT	0.99994136	+0 01 04.3
AF6695;UTM 17	- 3,013,397.048	503,862.510	MT	0.99960018	+0 01 04.3

 AF6695  

AF6695!	Elev Factor	x	Scale Factor	=	Combined Factor
AF6695!SPC FL E	- 1.00000268	x	0.99994136	=	0.99994404
AF6695!UTM 17	- 1.00000268	x	0.99960018	=	0.99960286

 AF6695  
 AF6695 SUPERSEDED SURVEY CONTROL  
 AF6695  

AF6695	NAD 83(2007)-	27 14 36.30347(N)	080 57 39.54678(W)	AD(	) 0
AF6695	ELLIP H (02/10/07)	-17.019 (m)		GP(	)
AF6695	NAD 83(1999)-	27 14 36.30337(N)	080 57 39.54725(W)	AD(	) 1
AF6695	ELLIP H (12/12/02)	-17.022 (m)		GP(	) 2 2
AF6695	NAVD 88 (12/12/02)	9.27 (m)	30.4 (f)	LEVELING	3
AF6695	NGVD 29 (09/01/92)	9.637 (m)	31.62 (f)	ADJUSTED	1 2

 AF6695  
 AF6695.Superseded values are not recommended for survey control.  
 AF6695  
 AF6695.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.  
 AF6695.[See file dsdata.txt](#) to determine how the superseded data were derived.  
 AF6695  
 AF6695\_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNL0386213397(NAD 83)  
 AF6695  
 AF6695\_MARKER: DV = VERTICAL CONTROL DISK  
 AF6695\_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)   
 AF6695\_SP\_SET: STAINLESS STEEL ROD  
 AF6695\_STAMPING: W 357 1979  
 AF6695\_MARK LOGO: NGS  
 AF6695\_PROJECTION: FLUSH  
 AF6695\_MAGNETIC: N = NO MAGNETIC MATERIAL  
 AF6695\_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL  
 AF6695\_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR  
 AF6695+SATELLITE: SATELLITE OBSERVATIONS - September 09, 2008  
 AF6695\_ROD/PIPE-DEPTH: 9.75 meters  
 AF6695  

AF6695	HISTORY	- Date	Condition	Report By
AF6695	HISTORY	- 1979	MONUMENTED	NGS
AF6695	HISTORY	- 19950218	GOOD	FLDEP
AF6695	HISTORY	- 20010607	GOOD	EMCINC
AF6695	HISTORY	- 20010907	GOOD	FLDEP
AF6695	HISTORY	- 20020413	GOOD	MAPTEC
AF6695	HISTORY	- 20080909	GOOD	MOREKL

 AF6695  
 AF6695 STATION DESCRIPTION  
 AF6695  
 AF6695'DESCRIBED BY NATIONAL GEODETIC SURVEY 1979  
 AF6695'8.1 MI WEST FROM OKEECHOBEE.  
 AF6695'8.1 MILES WEST ALONG STATE HIGHWAY 70 FROM THE CITY HALL IN  
 AF6695'OKEECHOBEE, AT AND ACROSS THE ROAD FROM COUNTY ROAD C-670 LEADING  
 AF6695'NORTH, AT A PRIVATE ROAD LEADING SOUTH, 51 FEET SOUTH OF THE  
 AF6695'CENTERLINE OF THE HIGHWAY, 14 FEET EAST OF THE CENTERLINE OF THE  
 AF6695'PRIVATE ROAD AND 1 FOOT NORTH OF A FENCE CORNER.  
 AF6695  
 AF6695 STATION RECOVERY (1995)

## SECTION 00 31 21 CONTROL MONUMENT DESCRIPTIONS

[illegible]

## SECTION 00 33 50 WEATHER AND WATER STAGE DATA

1. The below stated water fluctuations are for informational purposes only and are not to be utilized in conjunction with any contract-related hydrographic surveying purposes as noted on the control drawing(s) of the contract plans. All elevations in this Section 00 33 50 are in feet, National Geodetic Vertical Datum of 1929 (feet, NGVD).
2. The Herbert Hoover Dike (HHD) Rehabilitation, Culvert Replacement, Culvert IP-3 Project is located in Levee 48 (L-48) along the Canal 40 (C-40) which is on the western end of Lake Okeechobee in Reach 8 of HHD. IP-3 is located in the Levee 59 (L-59) Borrow Canal where it intercepts C-40 at the northwestern portion of the L-48 IP-3 is approximately 400 feet downstream from Structure 72 (S-72) which is approximately 3.5 miles upstream (north) of Lake Okeechobee. Also, the IP-3 site is approximately 200 feet east of where the Levee 60 (L-60) Borrow Canal intercepts the C-40.
3. IP-3 is a double-barrel, corrugated metal pipe culvert with flap gates at the outlet and flashboards at the inlet. The purpose of this structure is to provide continuity for the L-59 Borrow Canal through the L-48
4. Water levels at the project locations are mainly affected by rainfall, evaporation, local runoff, water supply deliveries through C-40, groundwater levels (e.g., seepage from the C-40 Canal and the operation of Lake Okeechobee. Lake Okeechobee is managed by the Jacksonville District, U.S. Army Corps of Engineers (Corps) in accordance with the 2008 Lake Okeechobee Regulation Schedule (2008 LORS), which is shown in Figures 1 through 4. The lake's optimum range of elevations is between 12.5 and 15.5 feet, NGVD on a seasonally varying basis. This optimum elevation range may be exceeded due to rainfall events over the lake's watershed, and/or wind effects on the lake.
5. Historical average daily lake elevations from January 1932 through September 22, 2015 are provided graphically in Figure 5. The maximum average daily lake elevation of 18.77 feet, NGVD occurred on November 3, 1947. These average daily water elevations may be exceeded due to rainfall events over the lake's watershed, and/or wind effects on the lake. Exceedance curves for the Lake Okeechobee average daily water elevations

## SECTION 00 33 50 WEATHER AND WATER STAGE DATA

for the above-referenced period of record are contained in Figure 6. The graph contains the 10, 25, 50, 75 and 90 percent exceedance values through the calendar year. For example, for a given day in the calendar year, the "10% Exceedance" curve shows the water elevation at which 10 percent of the values on that day were greater for the period of record. These graphs may also be used as a rough indicator of the probable seasonal variations in elevations.

6. Historical average daily C-40 elevations as measured at S-72 tailwater are provided graphically in Figure 7 for the period of record from April 30, 2003 through October 13, 2015. A maximum elevation of 18.09 feet, NGVD occurred October 10, 2004.
7. Historical flows for S-72 are provided graphically in Figure 8 for the period from March 14, 2011 through October 13, 2015. A maximum flow of 3,404 cfs occurred on August 29, 2012.
8. Historical average daily L-59 Borrow Canal elevations as measured upstream from IP-3 for the period of record from May 9, 2003 through October 13, 2015 are provided graphically in Figure 9. A maximum elevation of 20.33 feet, NGVD occurred on November 16, 2006.
9. All hydrometeorological data in this Section 00 33 50 are provisional and subject to revision. The contractor should understand that historical water elevations and discharges are not necessarily indicative of future water elevations and discharges. The contractor should be able to obtain hydrometeorological data from the Corps' Jacksonville District Water Management Section's website, which can be found at: <http://www.saj.usace.army.mil/Missions/CivilWorks/WaterManagement.aspx> and South Florida Water Management District's website which can be found at: <http://www.sfwmd.gov>.
10. The contractor should not expect that work can be done under "no flow," "low flow" or dry conditions.
11. It shall be the contractor's responsibility to obtain information concerning rain and wind. Reference is made to the National Oceanic and Atmospheric Administration (NOAA)



## SECTION 00 33 50 WEATHER AND WATER STAGE DATA

publication entitled Local Climatological Data - Monthly Summary, which contains climatological and meteorological observations and data, including wind, rain, and temperature data for the project area. Subscription price and ordering information is available from the National Climatic Data Center, Federal Plaza, 151 Patton Avenue, Asheville, North Carolina 28801-5001. NOAA also has an internet information page at: <http://www.ncdc.noaa.gov/>.

12. The climate in the project area is subtropical and humid. The project area is subject to tropical storms and hurricanes from June through November, and to windy and/or rainy weather during any time of the year. Temperatures below freezing are rare. May is generally a transitional month in which storms that typically occur in June through September may begin. The typical rainfall from October through May is associated with mid-latitude systems (fronts and low-pressure systems) and is distributed in a spatially uniform pattern. Typical June through September rainfall is closely associated with convective activity. These rainfall events are normally of short duration and amounts are quite variable spatially. Occasionally, daily rainfall during the typical rainfalls of October through May could be quite heavy as mid-latitude systems penetrate into Florida. Weather forecasts as well as actual rainfall information from the National Weather Service Miami-South Florida forecast office can be accessed at: <http://www.srh.noaa.gov/mfl/>.

13. The following data are provided:

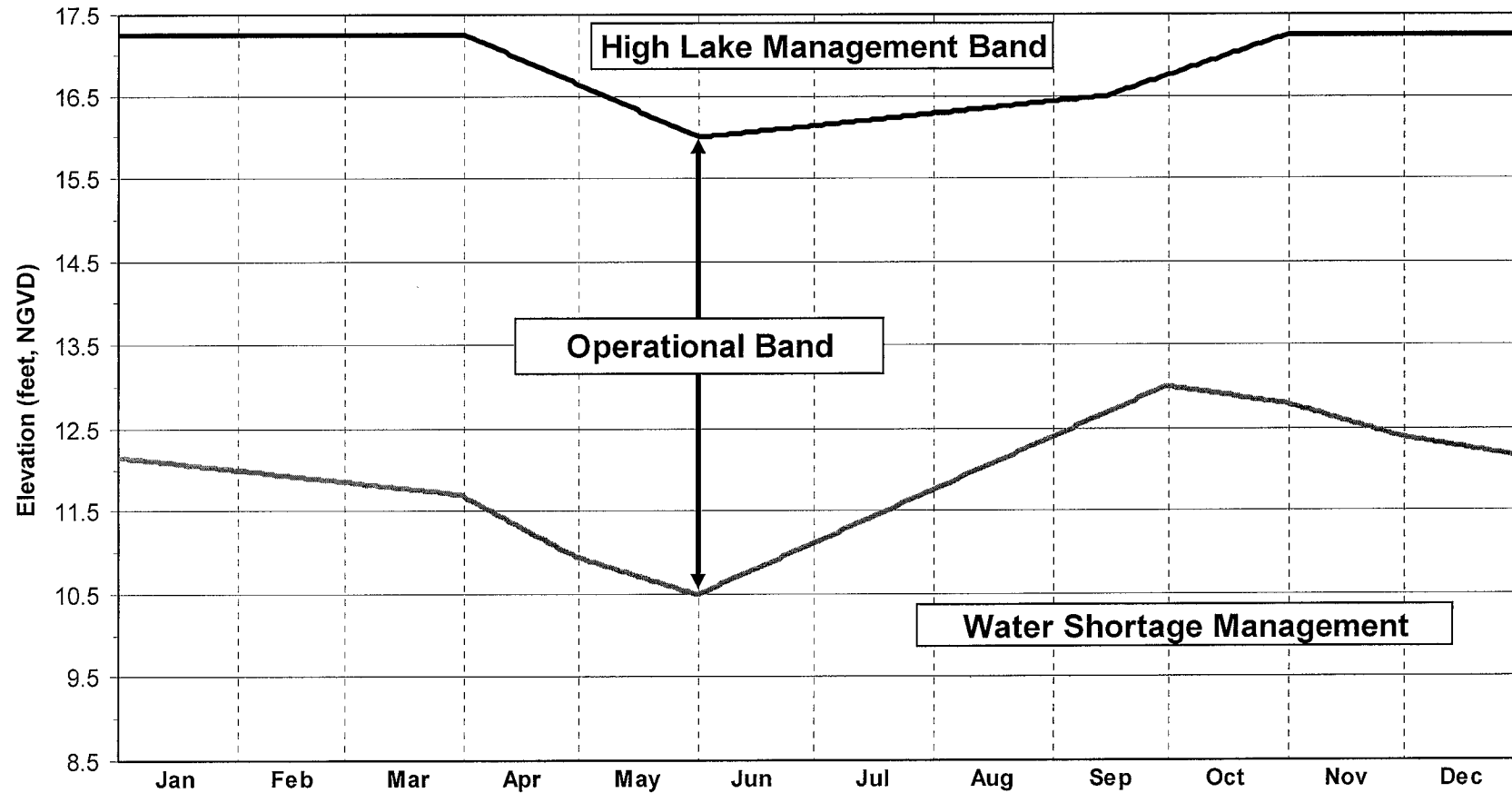
The average number of work days in each calendar month with precipitation greater than or equal to 0.50 inches is provided for the project areas in the below Table. This information is based on data obtained from Station Okeechobee, located at latitude 27.1508 N and longitude -80.8653 W. The data was obtained from Climatography of the United States No. 20 Monthly Station Climate Summaries for Florida, published by the National Climatic Data Center, NOAA, for the period of record 1981-2010. The values in this table have been rounded to the nearest whole number.

# SECTION 00 33 50 WEATHER AND WATER STAGE DATA

Average Number of Days per Month  
Converted to a 5 Day Work Week  
With Precipitation >= 0.50 Inches

Gage Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Okeechobee	1	1	2	2	2	4	4	5	4	2	1	1

# SECTION 00 33 50 WEATHER AND WATER STAGE DATA



## NOTES:

**High Lake Management Band:** Outlet canals may be maintained above their optimum water management elevations.

**Operational Band:** Outlet canals should be maintained within their optimum water management elevations.

**Water Shortage Management Band:** Outlet canals may be maintained below optimum water management elevations.

CENTRAL AND SOUTHERN FLORIDA PROJECT

2008 LAKE OKEECHOBEE

INTERIM REGULATION SCHEDULE

PART A

DATED: March 2008

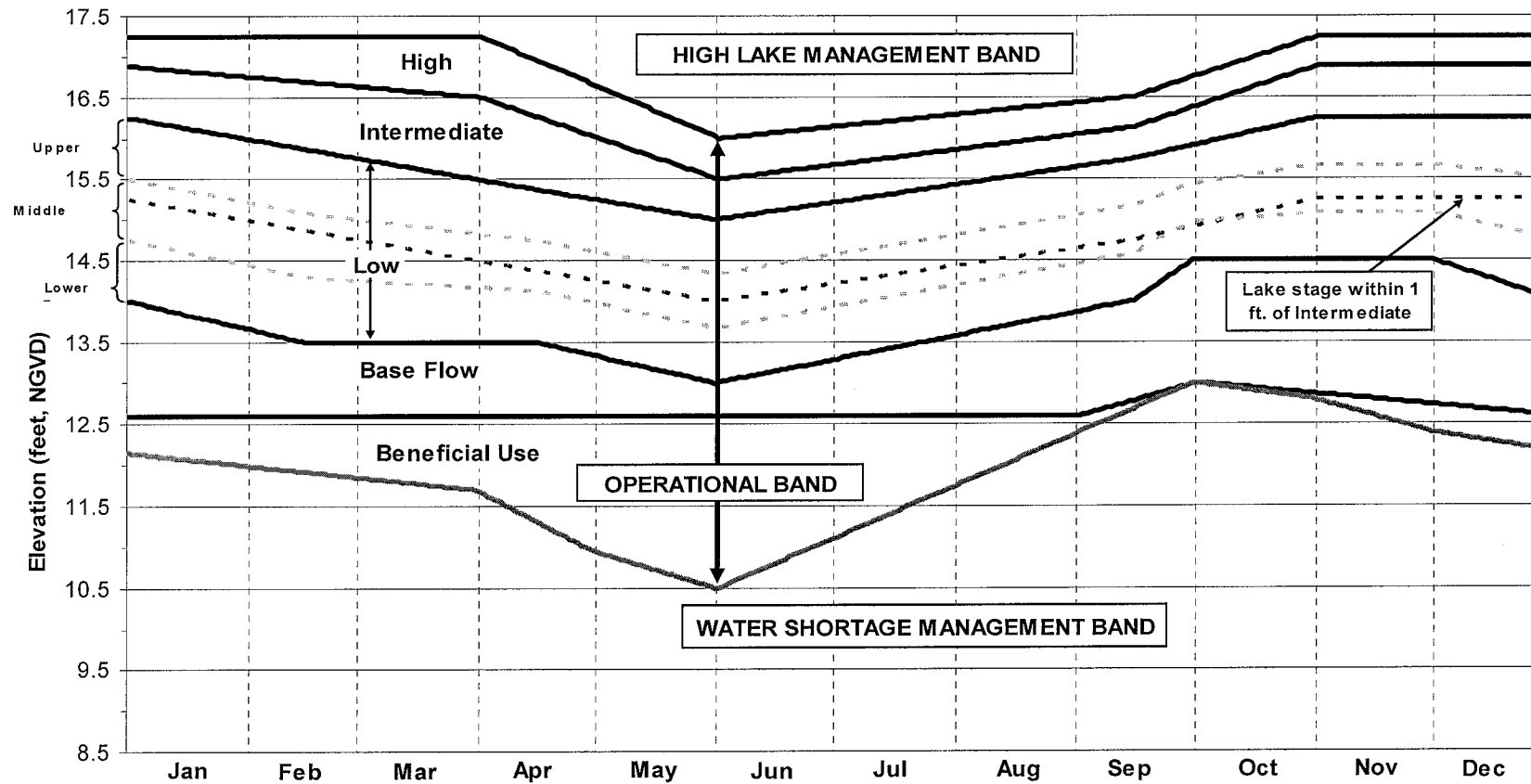
DEPARTMENT OF THE ARMY, JACKSONVILLE

DISTRICT

CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

FIGURE 1

# SECTION 00 33 50 WEATHER AND WATER STAGE DATA



## NOTES:

**High Lake Management Band:** Outlet canals may be maintained above their optimum water management elevations.

**Operational Band:** Outlet canals should be maintained within their optimum water management elevations.

**Water Shortage Management Band:** Outlet canals may be maintained below optimum water management elevations.

CENTRAL AND SOUTHERN FLORIDA PROJECT

2008 LAKE OKEECHOBEE  
INTERIM REGULATION SCHEDULE  
PART B

DATED: March 2008  
DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT  
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

FIGURE 2

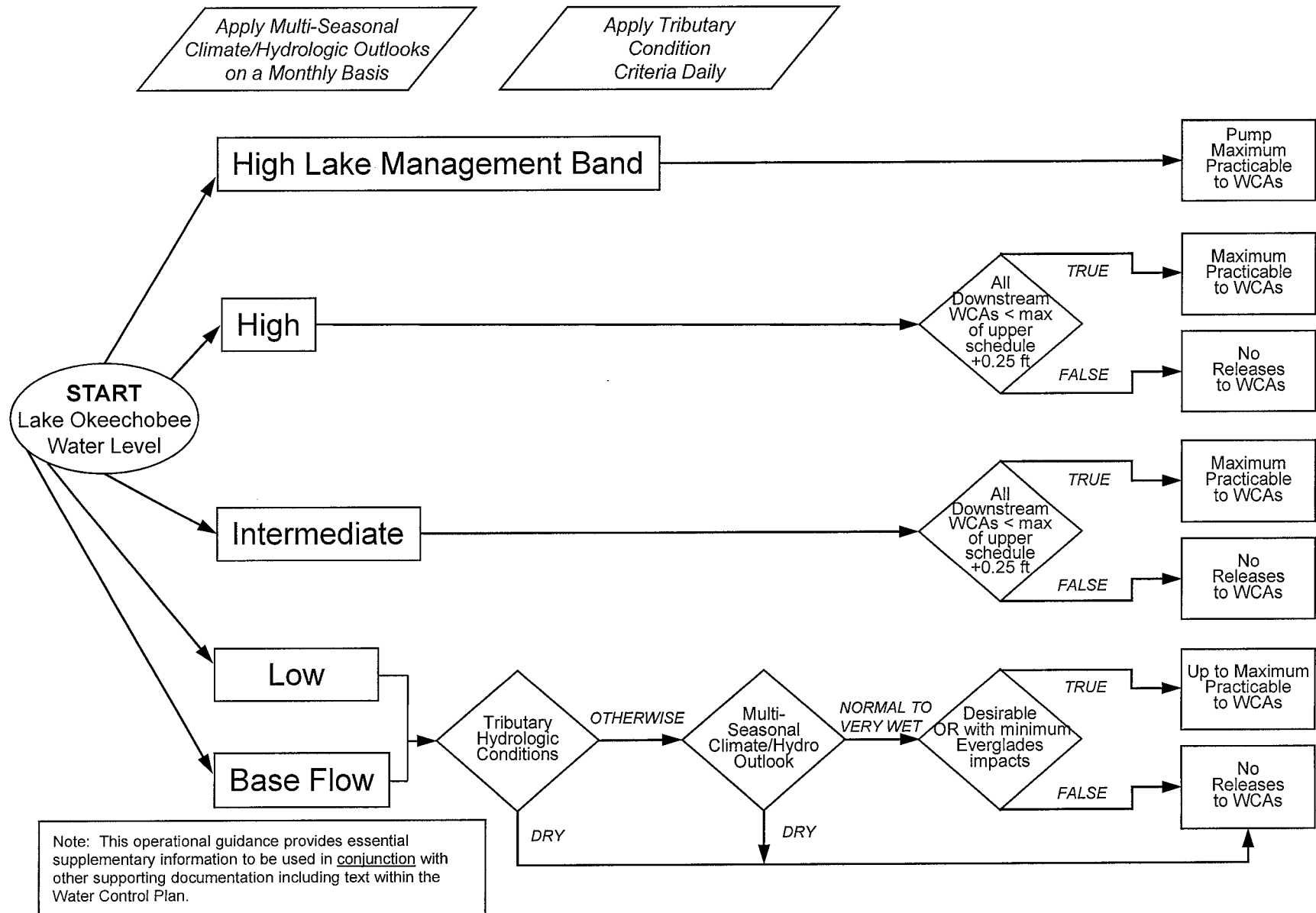
**2008 LORS****Part C: Establish Allowable Lake Okeechobee Releases to the Water Conservation Areas**

FIGURE 3

# 2008 LORS

## Part D: Establish Allowable Lake Okeechobee Releases to Tide (Estuaries)

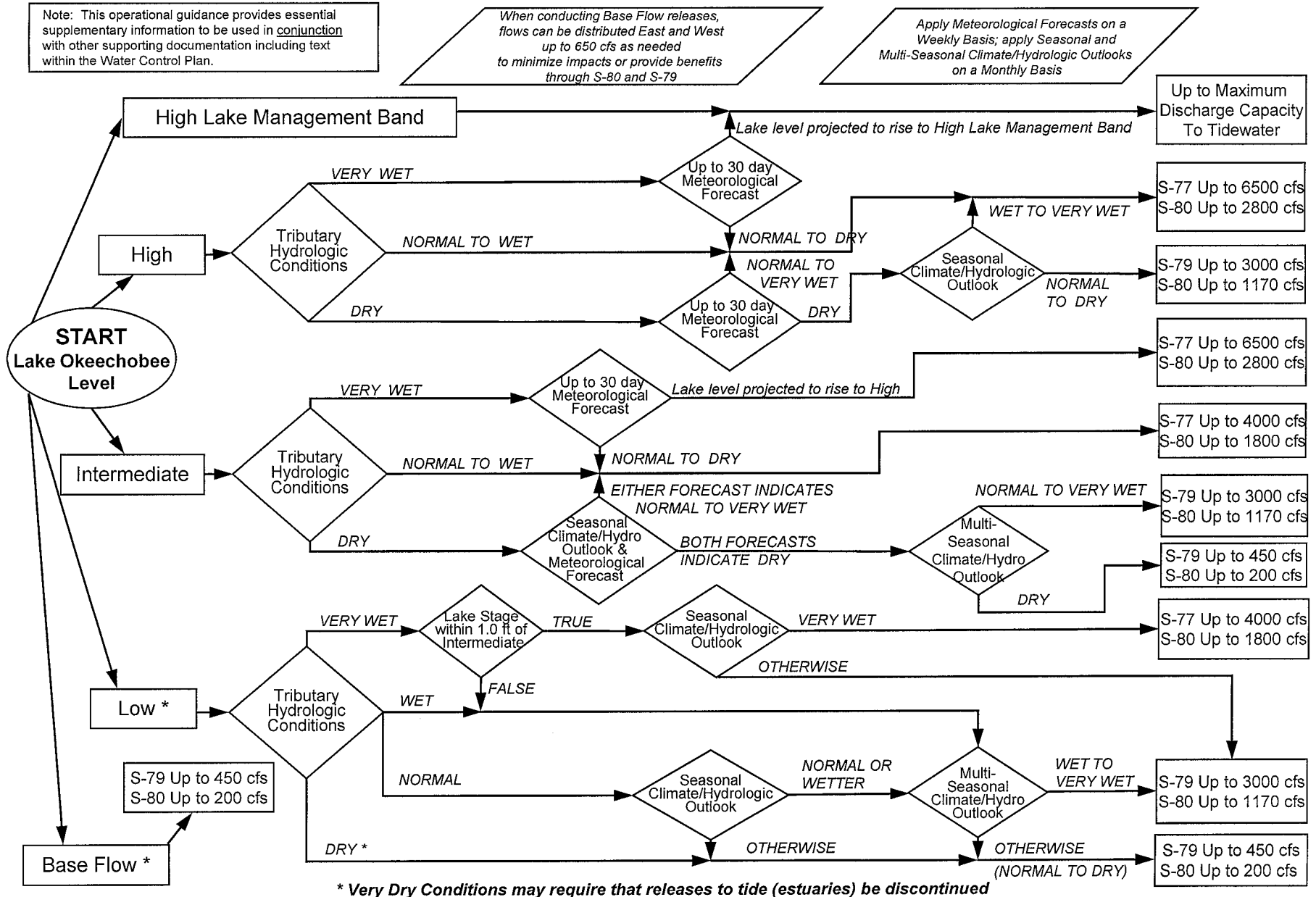


FIGURE 4

SECTION 00 33 50 WEATHER AND WATER STAGE DATA

Lake Elevation ( January 1932 thorough September 22, 2015)

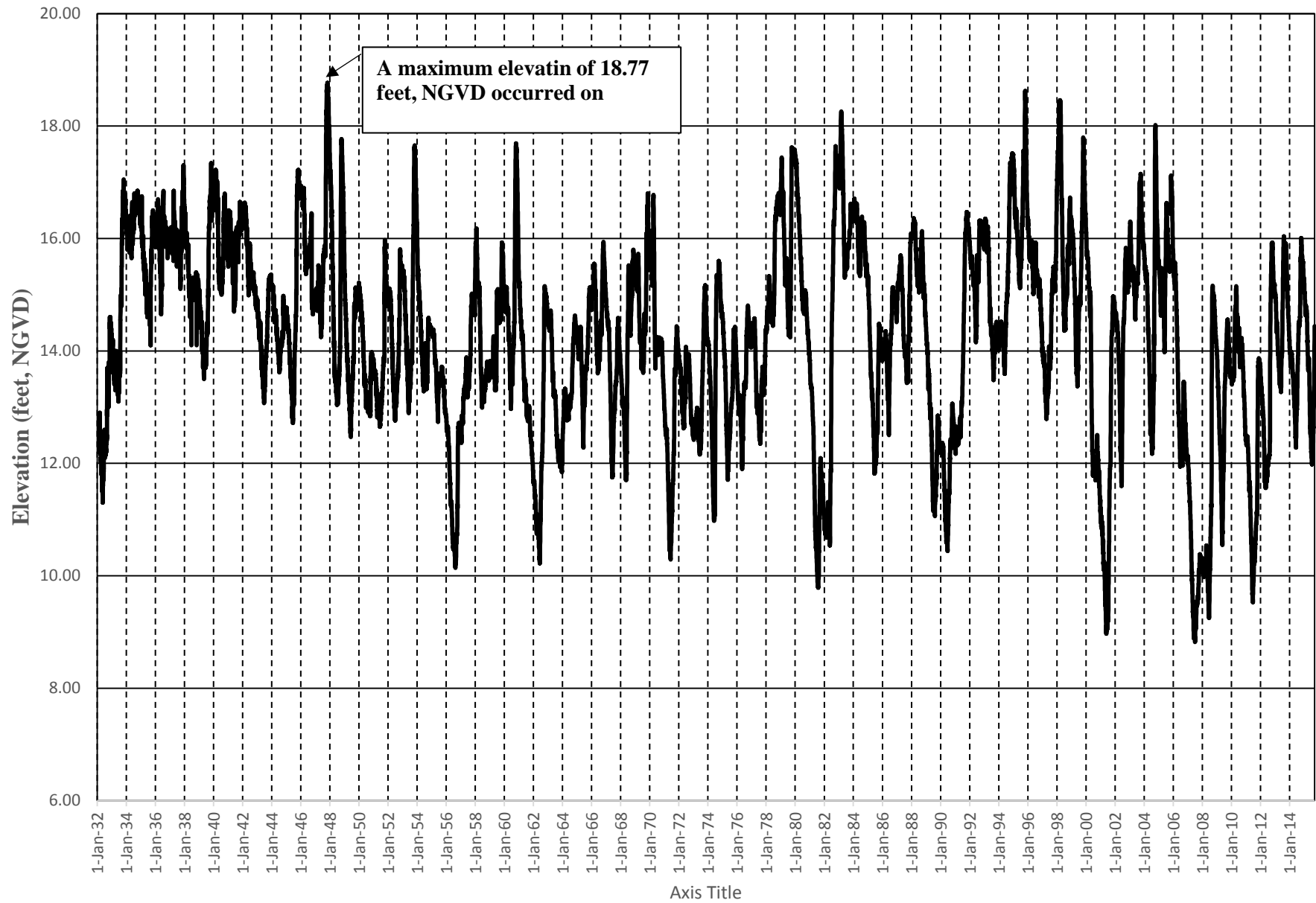


Figure 5  
SECTION 00 33 50 Page 9

# SECTION 00 33 50 WEATHER AND WATER STAGE DATA

Laked Okeechobee Exceedance Curves  
(January 1932 through September 22, 2015)

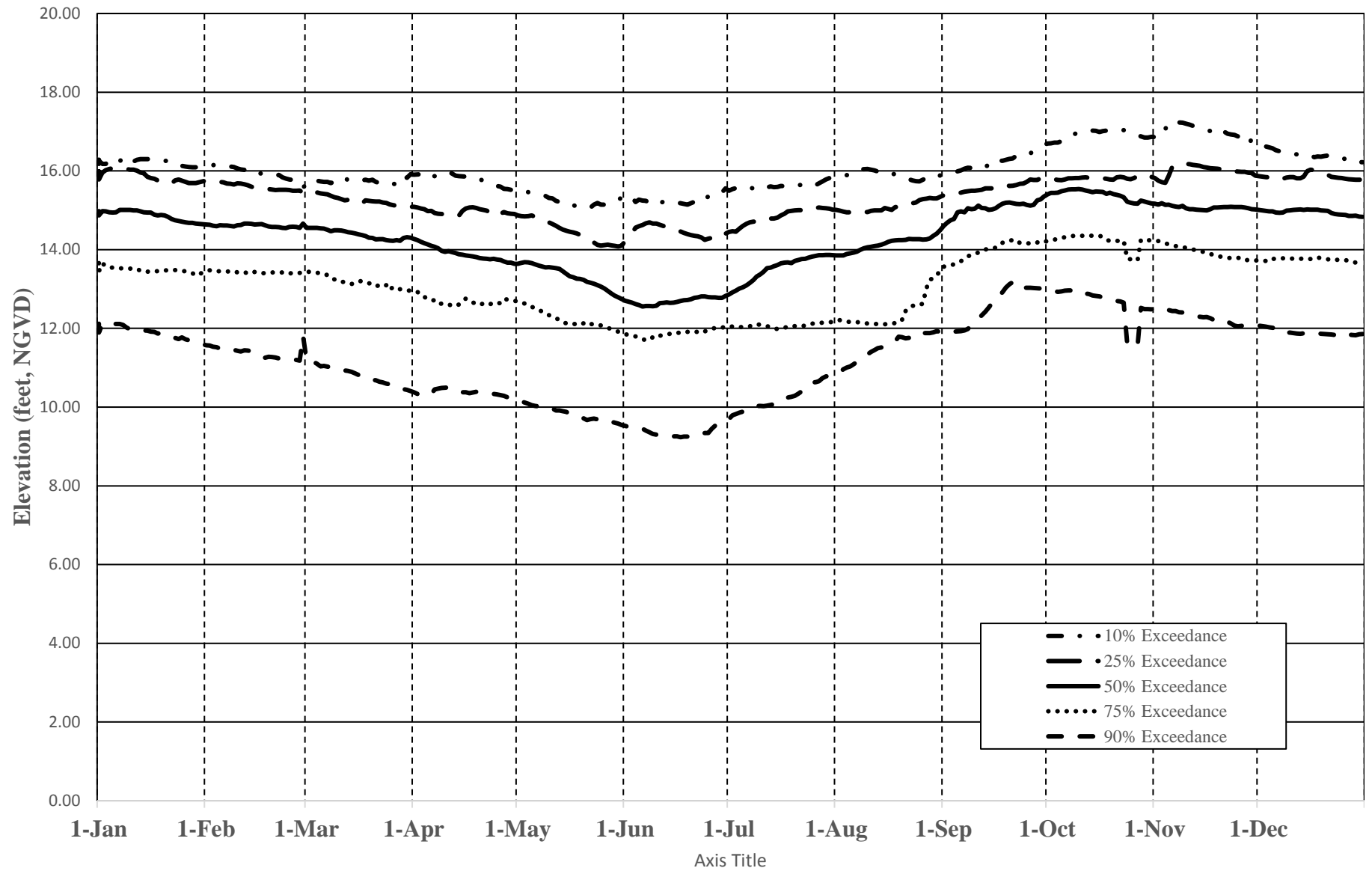


Figure 6  
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SECTION 00 33 50 WEATHER AND WATER STAGE DATA

C -40 Canal Elevation as measured at the S-72 Tailwater Stage  
( April 30,2003 through October 13, 2015)



Figure 7

SECTION 00 33 50 WEATHER AND WATER STAGE DATA

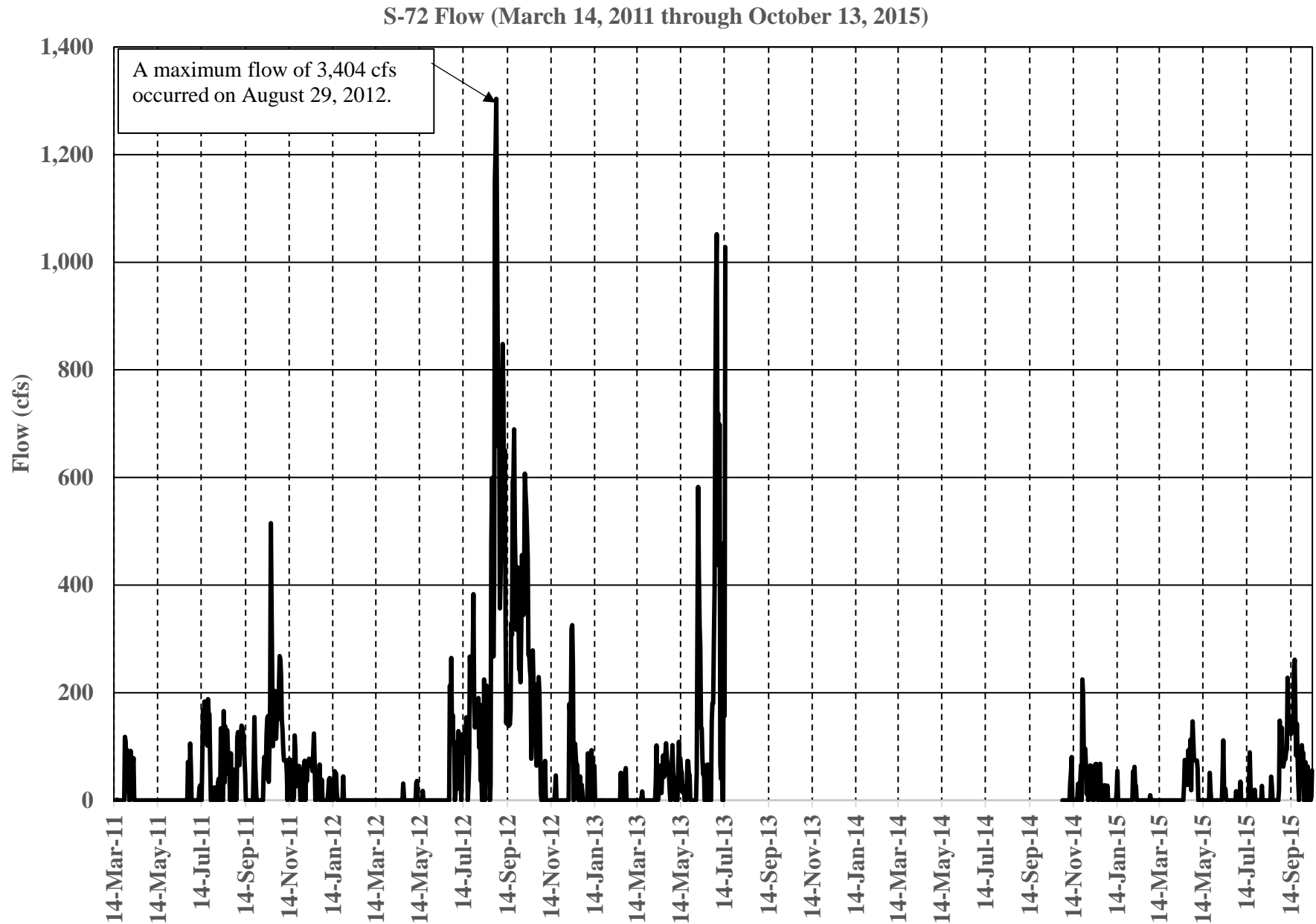


Figure 8

SECTION 00 33 50 WEATHER AND WATER STAGE DATA

L-59 Stage upstream from IP-3 (May 9, 2003 through October 13, 2015)

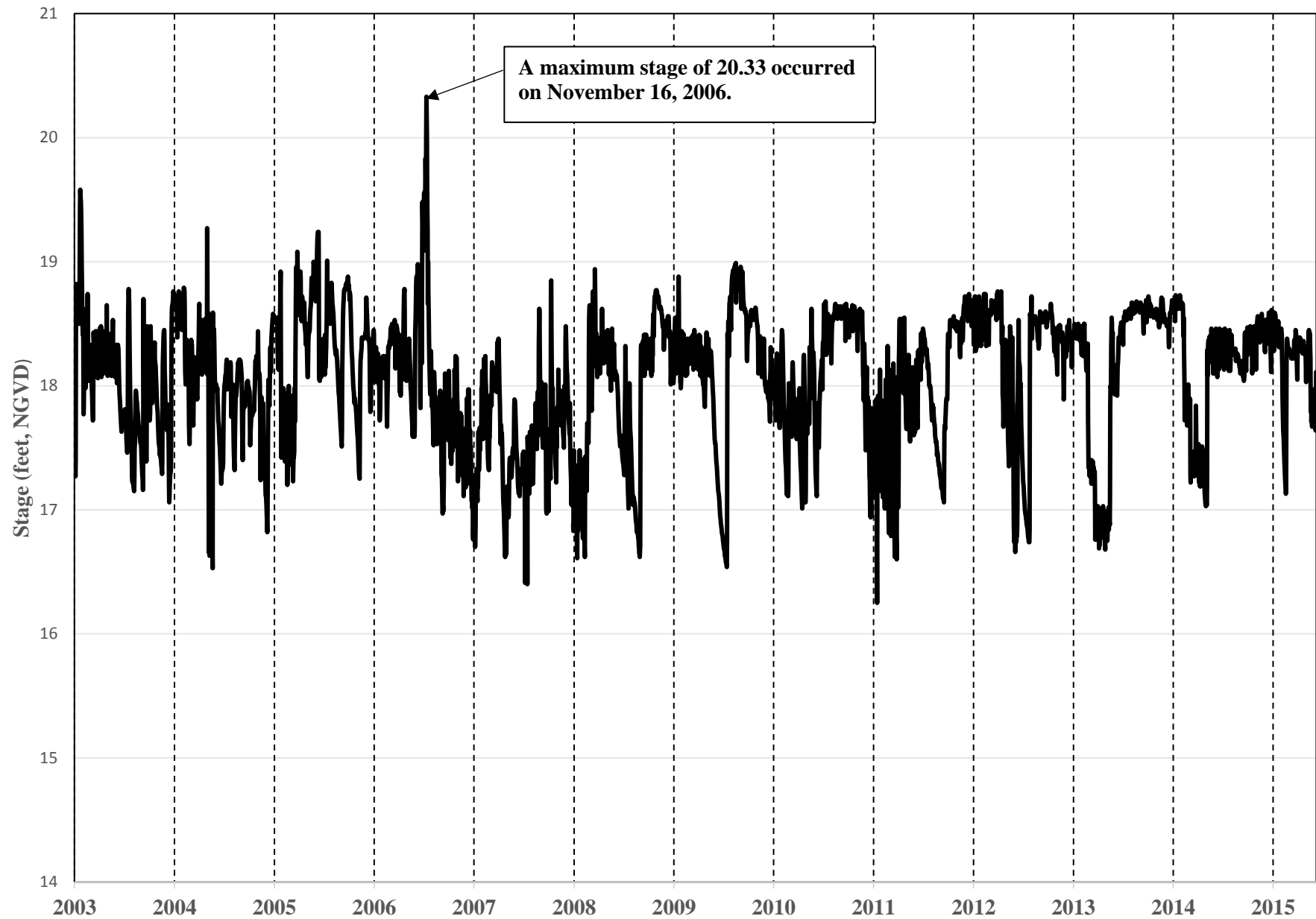


Figure 9  
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SECTION 01 11 00

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  - 1.10.1 Schedule of Monthly Anticipated Adverse Weather Delays
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- 1.11 COORDINATION
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PART 2 PRODUCTS (NOT APPLICABLE)

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## SUMMARY OF WORK

## 1.1 REFERENCES

U.S. ARMY CORPS OF ENGINEERS (USACE)

## 1.2 SUBMITTALS

SD-02 Shop Drawings

### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

### 1.3.1 Project Description

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### 1.3.2 Order of Work

The first order of work (Phase I) shall include the installation of the project access roads/ramps and turbidity barriers; followed by the temporary relocation of the Glades Electric overhead power, construction of the lakeside and landside cofferdam systems, the installation of the dewatering systems, and the excavation of the new structure. The second order of work (Phase II) will include the construction of the new water control structure; including the scour cutoff walls, apron riprap, control building, embankment drainage features, and installation of the commercial power by Glades Electric. The third order of work (Phase III) will be the reconstruction of the embankment, the removal of the cofferdam systems, and embankment reconstruction of L-59. The fourth order of work (Phase IV) will be the partial demolition and abandonment of the original (IP-3) structure (inclusive of salvaged materials); including installing the lakeside and landside cofferdam system, dewatering systems, grouting of barrels, partial removal of the existing headwalls. The fifth and final order of work will be reconstruction of the embankment over the original IP-3 structure installation. Construction features include the installation of the access roads, riprap, grassing, and the excavation of the lakeside and landside channels.

Cofferdam removal shall commence once the following criteria have been verified and accepted by the Contracting Officer:

a. Embankment restoration elevations are met according to the grades indicated in the drawings, excluding final surface treatments and areas where the cofferdam system is in direct conflict. See Section 35 41 00 EMBANKMENT CONSTRUCTION.

b. The bulkhead(s) and combination gate(s) have been installed and tested by the Contractor and accepted by the Government. See Section 35 20 16 VERTICAL LIFT SLIDE GATES, and Section 35 20 17 VERTICAL LIFT ROLLER GATES.

### 1.3.3 Location and Access

The Contractor's access to the structure will be from State Road 78 along the north bank of Canal 40 to the northwest. The Contractor shall obtain access through South Florida Water Management District (SFWMD) gate by applying for key permit at "<http://my.sfwmd.gov/kpa/index.php>". SFWMD point of contact is Ms. Amy Best at 561-682-2864. The Contractor is responsible for obtaining and complying with all requirements of State, County, and other jurisdictional agencies for permits, criteria, and use.

For access and traffic control along Canal 40, the Contractor may elect to design and construct temporary turnouts every 1,000 feet along the HHD tie back levee (L-59) crest. If so elected, a [Temporary Turnouts Design Plan](#) must be submitted by the Contractor for approval by the Government prior to commencement of work. The design of the temporary turnouts must also be prepared by, and signed and sealed by a registered professional engineer in the State of Florida.

### 1.3.4 Work Restrictions

During the construction work at each culvert site, the Contractor shall not reduce the conveyance ability of any landside toe swales. All gate operations will be performed by Government and/or South Florida Water

Management District (SFWMD) personnel. The Contractor shall provide unobstructed access to these structures for Government and or SFWMD personnel involved in project operations at all times. The Contractor shall coordinate with the adjacent landowner to provide passage through the construction site for private structures upstream of the project area. The adjacent landowner shall be escorted through the construction site.

Normal duty hours shall be defined as daylight hours Monday through Friday. Requests for additional work outside these hours to include Federal Holidays shall require written approval from the Contracting Officer seven (7) days in advance of the proposed work period. Contract duration was derived using five ten-hour work days, Monday through Friday.

#### 1.3.5 Bypass of Water Plan and Requirements

Structure 291 (Culvert IP-3) will require bypass of water for continual flood protection for the entire duration of construction activities. The Contractor shall prepare and submit a Bypass Plan for care and diversion of water to the Government for approval prior to commencement of work. The Bypass Plan shall be such that it is capable of being operated 24 hours a day, 7 days a week throughout the duration of construction.

For Structure 291 (Culvert IP-3), the Contractor shall allow the operation of a flood protection bypass system consisting of the existing IP-3 Culvert while the new structure (S-291) is under construction.

#### 1.3.6 Emergency Action Plan

In the event of anticipated high lake stages, the Contracting Officer will direct the Contractor to execute an emergency action plan (EAP). The EAP will only be executed by the Contractor when directed by the Contracting Officer in the event of an approaching hurricane, tropical storm or high lake water stage. The plan may include additional armoring, equalizing the hydraulic head across cofferdams or preventative drawdown of adjacent stormwater canals. An equitable adjustment pursuant to Clause CHANGES (FAR 52.243-4) of Section 00700 CONTRACT CLAUSES in Volume 1 will be made as full compensation for work required to execute and recover from the EAP.

#### 1.4 COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK

a. Read this paragraph in conjunction with the Clause COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (FAR 52.211-10) of Section 00700 CONTRACT CLAUSES in Volume 1.

b. Grass shall be established not later than the time stated in the Clause COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (FAR 52.211-10) of Section 00700 CONTRACT CLAUSES in Volume 1. This reflects the time stated for the establishment of grass in Section 32 92 23 SODDING.

#### 1.5 PHYSICAL DATA

Read this paragraph in conjunction with the Clause PHYSICAL DATA (FAR 52.236-4) of Section 00700 CONTRACT CLAUSES in Volume 1.

##### 1.5.1 Physical Conditions

The indications of physical conditions on the drawings and in the specifications are the result of site investigations by surveys and/or by

core borings. When the indicated physical conditions are the result of site investigations by core borings, the core boring logs and laboratory data are in Section 00 31 32 GEOTECHNICAL DATA REPORT (GDR) and the core boring locations are shown on the drawings. Also, see the report for instructions concerning availability of core borings for inspection.

#### 1.5.2 Weather and Water Stage Data

See Section 00 33 50 WEATHER AND WATER STAGE DATA. It is the Contractor's responsibility to obtain information concerning rain and wind.

#### 1.5.3 Contractor Investigation

Refer to the Clause SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK (FAR 52.236-3) of Section 00700 CONTRACT CLAUSES in Volume 1.

#### 1.5.4 Maritime Traffic

Channel traffic in the project area consists of pleasure and small recreational vessels of all types and sizes which can be accommodated by existing depths.

#### 1.5.5 Obstruction of Channel

The Contractor shall prepare a [Temporary Safety Barrier Plan](#) for Government approval for the duration of construction at each structure. Prior to construction, the USACE/South Florida Water Management District (SFWMD) will issue a notice to navigation interests of the project scope and construction schedule.

### 1.6 LAYOUT OF WORK

Read this paragraph in conjunction with the Clause LAYOUT OF WORK (FAR 52.236-17) of Section 00700 CONTRACT CLAUSES in Volume 1.

#### 1.6.1 Established Monuments

The Government has established monuments along the work site(s). Each monument is represented in the contract drawings by a Designation and in most cases, an alphanumeric Permanent Identifier (PID). Information concerning the location and elevations can be found within the Survey Notes on the plan sheets. The Survey Notes for each included field survey will cite a particular survey number, and specify the control used to conduct that survey. Additional information is included in the Survey Notes that must be duplicated if an attempt to recreate the subject survey is desired.

For navigation channels, the Government has established tidal calibration sites for projects constructed and maintained to a tidal datum. Each tidal calibration site is represented in the plan sheet drawings by Station ID, and is cited in the Survey Notes. All projects constructed and maintained to a tidal datum shall be calibrated to the Station ID specified in the plan sheet drawings. Information regarding the location and associated benchmarks of the referenced Station ID is included in the Monument Description section of these specifications.

See Section 00 31 21 CONTROL MONUMENT DESCRIPTIONS.



#### 1.6.2 Layout

From the monuments, control data and elevations established by the Government, the Contractor shall complete the layout of the work and shall be responsible for all measurements that may be required for the execution of the work to the location and limit marks prescribed in the specifications or on the contract drawings, subject to such modifications as the Contracting Officer may require to meet changed conditions or as a result of necessary modifications to the contract work.

#### 1.6.3 Survey

The Contractor shall furnish, at his own expense, such stakes, templates, platforms, equipment, tools and material, and all labor as may be required in laying out any part of the work from the monuments, control data and elevations established by the Government. It shall be the responsibility of the Contractor to maintain and preserve all stakes and other marks established by the Contracting Officer until authorized to remove them, and if such marks are destroyed by the Contractor or through his negligence, prior to their authorized removal, they may be replaced by the Contracting Officer, at his discretion, and the expense of replacement will be deducted from any amounts due or to become due the Contractor. The Contracting Officer may require that work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking of the work.

#### 1.7 DAMAGE TO WORK

The responsibility for damage to any part of the permanent work shall be as set forth in Clause PERMITS AND RESPONSIBILITIES of Section 00700 CONTRACT CLAUSES in Volume 1. However, if, in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood, earthquake, hurricane, or tornado, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, the Contractor will make the repairs as ordered by the Contracting Officer and full compensation for such repairs will be made at the applicable contract unit or lump sum prices as fixed and established in the contract. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to any part of such work, an equitable adjustment pursuant to Clause CHANGES of Section 00700 CONTRACT CLAUSES in Volume 1 will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work (including temporary construction), utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

#### 1.8 DAMAGE TO WORK -- COFFERDAM REQUIRED

a. The responsibility for damage to any part of the work to be performed under this contract shall be as set forth in Clause PERMITS AND RESPONSIBILITIES of Section 00700 CONTRACT CLAUSES in Volume 1. However, if the cofferdam(s) is constructed in accordance with plans and progress schedules approved by the Contracting Officer, but is overtopped by flood and such flood causes damage to the cofferdam or if any part of the permanent work is damaged by flood, earthquake, hurricane, or tornado, which damage is not due to the failure of the Contractor to take reasonable precaution or to exercise sound

engineering and construction practices in the conduct of the work, the Contractor will make the repairs ordered by the Contracting Officer. The Contractor shall be compensated for any such repairs in accordance with the Clause CHANGES of Section 00700 CONTRACT CLAUSES in Volume 1. The equitable adjustment shall be based on the contract unit or lump sum prices applicable to any part of the damaged work.

b. The Contractor may, subject to approval of the Contracting Officer, or the Contracting Officer may order the Contractor to, flood or breach the cofferdam during a rise prior to, and in anticipation of, natural flooding due to overtopping. Such flooding or breach will be considered the same as though the cofferdam, if constructed in accordance with plans and progress schedules approved by the Contracting Officer, had been overtopped, in which event an equitable adjustment will be made for damages to the cofferdam and/or any part of the permanent work, as provided in subparagraph a. above.

#### 1.9 LOCATION OF UNDERGROUND FACILITIES

All underground utilities within the work limits must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department and the Government. Any utilities found which are not shown on the construction drawings must be brought to the Contracting Officer's attention prior to proceeding with construction.

##### 1.9.1 Notification Prior to Excavation

Notify the Contracting Officer at least 15 days prior to starting excavation work. Contact "CALL SUNSHINE BEFORE YOU DIG" at 1-800-432-4770. Contractor is responsible for marking all utilities not marked by "CALL SUNSHINE".

#### 1.10 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (31 OCT 1989)

This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the Clause DEFAULT (FIXED-PRICE CONSTRUCTION) of Section 00700 CONTRACT CLAUSES in Volume 1. In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

a. 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.

b. 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.

##### 1.10.1 Schedule of Monthly Anticipated Adverse Weather Delays

The schedule of monthly anticipated adverse weather delays is based upon 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. See Section 00 33 50 WEATHER AND WATER STAGE DATA to obtain MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON 5-DAY WORK WEEK.

#### 1.10.2 Contractor Responsibility

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 in Section 00 33 50 WEATHER AND WATER STAGE DATA, 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 Clause DEFAULT (FIXED PRICE CONSTRUCTION) of Section 00700 CONTRACT CLAUSES in Volume 1.

#### 1.11 COORDINATION

The Government will coordinate a meeting with the Contractor, South Florida Water Management District, and adjacent landowners prior to the commencement of work. The intent of this meeting is to discuss construction activities that may impact other parties.

#### 1.12 SOUTH FLORIDA WATER MANAGEMENT DISTRICT TELEMETRY

After the Government accepts the new S-291 structure as complete but prior to the commencement of abandoning the old S-291 structure, the South Florida Water Management District will install telemetry and associated components to remotely operate the new S-291 structure. This process will take approximately 30 days. The Contractor shall commence the abandoning phase once the structure is fully operated by the South Florida Water Management District.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

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  - 1.5.6 Cofferdam Seepage Protection (Line Item 0006)
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  - 1.5.8 Excavation (Line Item 0008)
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  - 1.5.13 Lakeside Wing Walls Reinforced Concrete (Line Item 0013)
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SECTION 01 22 00

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SUMMARY

This section describes how Line Items will be measured and paid for when making progress payments. Work to be measured is described in specification sections listed for each Line Item. Measurement procedures for payment, required quantity survey or procurement documentation and payment restrictions are described in applicable specification sections. Allocate costs for work not specifically mentioned to the Line Item most closely associated with work involved. Unless there is a specific Line Item for administrative costs, such as Quality Control and Safety, allocate such costs proportionally across all Line Items.

1.2 QUALITY CONTROL SYSTEM (QCS)

1.2.1 Definition

The terms "Contract Line Item Number (CLIN)" and "Line Item" are interchangeable herein (e.g.: CLIN 0001 is Line Item 0001). The term "CLIN" is a contracting term used in the Quality Control System (QCS) payment data base.

1.2.2 Instructions

See Section 01 45 04 CONTRACTOR QUALITY CONTROL for instructions on linking a CLIN to a schedule of values of pay activities and construction schedule, and in-depth payment procedure.

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. Transmit submittal items in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later:

SD-01 Preconstruction Submittals

Schedule of Values; G, RO

Provide a breakdown of lump sum items into proposed pay activities as part of the initial project schedule. Schedule of Values will become basis for CLIN and Pay Activity data in the QCS payment data base.

Utility Invoices

Submit invoices from the utility company indicating payment for services covered in Line Item 0033 "Electrical Utilities". Payment under this line item will not be made prior to submission of valid invoices to the Government. The Contractor will be reimbursed for costs indicated on these invoices only.

#### 1.4 PAYMENT PROCEDURES

Payment items for the work in this contract on which the contract payments will be made are listed in the LINE ITEMS AND PRICING SCHEDULE and described below. The price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided. All costs for items of work, which are not specifically mentioned to be included in a particular payment item, shall be included in the listed item most closely associated with the work involved.

##### 1.4.1 Lump Sum

Progress payments for lump sum CLINs will be made in accordance with the Payments Under Fixed-Price Construction Contracts clause of Section 00700 CONTRACT CLAUSES in Volume 1. Submit a list of pay activities, (Schedule of Values) to breakdown bid for each lump sum CLIN. The Schedule of Values shall be submitted for Government approval with the baseline schedule submittal (see Section 01 32 01 PROJECT SCHEDULE. An unbalanced Schedule of Values and Pay Activity Schedule will be returned for revision. If this contract contains either the Continuing Contracts clause or the Continuing Contracts (Alternate) clause, the Contractor should take into account the amount reserved for contract payments when preparing the construction schedule.

##### 1.4.2 Unit Price

Each Unit Price CLIN may be a single pay activity item or may be broken down into pay activities with smaller quantities equal to CLIN total. Contract unit price multiplied by agreed quantity is full compensation.

#### 1.5 LINE ITEMS

Line items will be paid in accordance with the paragraph PAYMENT PROCEDURES above and as required below. The following line items are included in Section 00010A LINE ITEMS AND PRICING SCHEDULE in Volume 1:

##### 1.5.1 Access (Line Item 0001)

Lump sum payment will be made for costs associated with or incidental to clearing and grubbing; silt fence; cattle fence; and the construction, maintenance and removal of site access as indicated on the drawings. See Section 35 41 00 EMBANKMENT CONSTRUCTION.

##### 1.5.2 Turbidity Monitoring (Line Item 0002)

Payment will be made for costs associated with or incidental to obtaining, analyzing, and reporting the results of monitoring for turbidity. See Section 01 57 25 TURBIDITY AND DISPOSAL MONITORING.

1.5.3 Cofferdam Steel Pile (Line Item 0003)

Lump sum payment will be made for costs associated with or incidental to construction, maintenance and removal of pile cofferdams, including cutting and abandoning in place.

1.5.4 Earthen Cofferdam and Plugs (Line Item 0004)

Lump Sum payment will be made for costs associated with or incidental to placement, maintenance and removal of earthen cofferdams and plugs.

1.5.5 Cofferdam Armoring (Line Item 0005)

Unit price payment will be made for costs associated with or incidental to placement, maintenance and removal of import riprap, bedding stone, and geotextile. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.6 Cofferdam Seepage Protection (Line Item 0006)

Unit price payment will be made for costs associated with or incidental to placement, maintenance and removal of seepage protection, including Bedding Stone and geotextile. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.7 Dewatering (Line Item 0007)

Lump sum payment will be made for costs associated with or incidental to installation, operation, maintenance and removal of dewatering equipment and drainage facilities. This includes permitting and preparation of the Dewatering Work Plan.

1.5.8 Excavation (Line Item 0008)

Lump sum payment will be made for costs associated with or incidental to excavation, transportation, and disposal of all materials not otherwise defined; excavation, hauling and stockpiling of topsoil; providing and maintaining access to the work site(s) and disposal area(s); noise control; erosion control; and debris removal.

1.5.9 Demolition (Line Item 0009)

Lump sum payment will be made for costs associated with or incidental to demolition, hauling, offsite disposal, and stockpiling of existing structures and features, including existing riprap and existing pavement, necessary to complete work. Demolition shall also include cost of decommissioning existing monitoring wells/piezometers.

1.5.10 Sheetpile Scour Cutoff Walls (Line Item 0010)

Lump sum payment will be made for costs associated with or incidental to construction and completion of the sheetpile scour cutoff walls under the headwalls and the wingwalls on both sides of each culvert.

1.5.11 Mud Mat (Line Item 0011)

Lump sum payment will be made for costs associated with or incidental to placement and completion of the unreinforced concrete mud mat required for the entire culvert structure foundation as shown on the drawings.



1.5.12 Lakeside Headwall Reinforced Concrete (Line Item 0012)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.13 Lakeside Wing Walls Reinforced Concrete (Line Item 0013)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.14 Landside Headwall Reinforced Concrete (Line Item 0014)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.15 Landside Wing Walls Reinforced Concrete (Line Item 0015)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.16 Culvert Structure Reinforced Concrete (Line Item 0016)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.17 Lakeside Headwall Embedded Metals (Line Item 0017)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of embedded metals required for bulkhead slots, sills and armors as shown on the drawings.

1.5.18 Landside Headwall Embedded Metals (Line Item 0018)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of embedded metals required for bulkhead slots, sills and armors as shown on the drawings.

1.5.19 Miscellaneous Metals (Line Item 0019)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of miscellaneous metals not paid for under the line item "Embedded Metals" above.

1.5.20 Combination Slide/Flap Gate with Actuator (Line Item 0020)

Unit price payment will be made for costs associated with or incidental to furnishing and installation of combination slide/flap gates with actuators. Measurement will be by the number of gates installed. Unit of measure is each.

1.5.21 Manatee Screen/Debris Barrier (Line Item 0021)

Unit price payment will be made for costs associated with or incidental to furnishing and installation of manatee screen/debris barriers. Measurement will be by the number of screen/barriers installed. Unit of measure is each.

1.5.22 Embankment Fill (Line Item 0022)

Lump sum payment will be made for costs associated with or incidental to borrow, transportation, and placement of embankment or other fill to the lines and grades shown on the drawings; noise control; erosion control; and debris removal. Payment under this line item includes compaction and placement of subgrades for roads, foundations and revetment, embankment and placement of topsoil. Payment under this line item does not include Soil-Bentonite Core, Chimney Drain, Drainage Blanket, or Filter Collar.

1.5.23 Soil-Bentonite Core (Line Item 0023)

Lump sum payment will be made for costs associated with or incidental to borrow, transportation, mixing, placement and testing of Soil-Bentonite Fill to the lines and grades shown on the drawings; providing and maintaining access to the work site(s) and borrow area(s); noise control; and debris removal.

1.5.24 Chimney Drain, Drainage Blanket, and Filter Collar (Line Item 0024)

Lump sum payment will be made for costs associated with or incidental to borrow, transportation, placement and testing of all components of the Chimney Drain, Drainage Blanket, Filter Collar and internal drainage system, including Filter Soil, Filter Gravel and drain pipe to the lines and grades shown on the drawings; providing and maintaining access to the work site(s) and borrow area(s); noise control; and debris removal.

1.5.25 Limerock Surface (Line Item 0025)

Unit price payment will be made for costs associated with or incidental to processing, transportation, and placement of aggregate surface coarse (limerock) to the lines and grades shown on the drawings. Compaction and placement of the subgrade will not be paid for under this line item. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.26 Restoration Riprap (Line Item 0026)

Unit price payment will be made for costs associated with or incidental to processing, transportation, and placement of permanent geotextile, bedding stone and import riprap on the restored embankment slope and the restored channel to the lines and grades shown on the drawings. Compaction and placement of the subgrade will not be paid for under this line item. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.27 Intake and Outlet Channel (Line Item 0027)

Lump sum payment will be made for costs associated with or incidental to excavation, transportation, and disposal of materials; excavation, hauling and stockpiling of topsoil; providing and maintaining access to the work site(s) and disposal area(s); installation of the bulkheads, associated grading; noise control; and, debris removal.

1.5.28 Site Signage (Line Item 0028)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of site signage as shown in the drawings, including all necessary assemblies and appurtenances.

1.5.29 Control Building (Line Item 0029)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of the control building.

1.5.30 Electrical and Telecommunications Work and Equipment (Line Item 0030)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of electrical and telecommunication equipment including antenna and solar panel pole.

1.5.31 Sodding (Line Item 0031)

Unit price payment will be made for costs associated with or incidental to placement and establishment of sod. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.32 Temporary Safety Barrier (Line Item 0032)

Lump sum payment will be made for costs associated with or incidental to furnishing, installation, maintenance and removal of a temporary safety barrier.

1.5.33 Electrical Utilities (Line Item 0033)

Payment will include full compensation for the charges paid to the utility company by the Contractor for furnishing all materials, equipment, and labor required to install electrical utility services in accordance with detailed work as shown in the drawings. Payment will be made for actual cost incurred for utility relocation and installation. Actual cost incurred will be based on utility invoices indicated in paragraph SUBMITTALS above.

1.5.34 Dual Leaf Gates (Line Item 0034)

Unit price payment will be made for costs associated with or incidental to installation of the manually operated double leaf gate systems including gate hardware and accessories. Measurement will be by the number of gates installed. Unit of measure is each.

1.5.35 Abandonment Grouting (Line Item 0035)

Unit price payment will be made for costs associated with or incidental to fully grouting culverts to be abandoned. Measurement will be made by the pumped volume of grout required to fill the culverts. Unit of measure is cubic yard.

1.5.36 Contracting Officer's Field Office (Line Item 0036)

Unit price payment will be made for costs associated with or incidental to providing, maintaining, and final disposition of the Contracting Officer's field office including all costs for rent and provision of all services indicated in Section 01 52 10 CONTRACTING OFFICER'S FIELD OFFICE. Costs for such provision and maintenance of the Contractor's own field office and other facilities will not be paid for under this line item. Measurement will be the amount of time that the Contracting Officer's field office is available to the Government within the duration of the contract. Unit of measure is by month.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PAYMENT PROCEDURES

Upon receiving initial Resident Management System import file, go to "Pay Activities" and establish a link between bid breakdown schedule of values of "Pay Activities" to contract CLINs using "Schedule Activities" data entry page.

3.1.1 Requesting Progress Payment

For progress payments, ensure "Activity Schedule", "Feature Schedule", submittal register, and punchlists are all up to date. Use "Progress Payments" to "request Activity Earnings" for both "Activity Earnings" data entry page and "Other Earning". Provide hard copies of supporting invoices and quantity measurements to support all requested earnings. Ensure that sum of payment activities do not exceed contract award CLIN funding amounts, or "unbalanced" CLINs error will prevent processing the payment.

3.1.2 Options and Modification CLINS

When additional work is added by modification, existing CLINs funding amounts must be updated, or new CLINs for modification will be created. If contract has option CLINs not yet awarded, option CLINs will appear as zero dollar CLINs until option is awarded by modification. No payment may be requested for Options or Modification CLINs until contract modification has been funded and signed.

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SECTION 01 30 00

ADMINISTRATIVE PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

Manage project and coordinate activities of own employees, subcontractors, suppliers and offsite fabricators. Contractor shall use computers, E-mail, and Internet resources for administrative work. Notify Contracting Officer of important meetings, schedule events and activities. Furnish labor and materials and equipment required to plan and execute project management functions and coordination. Coordinate activities and manage resources to construct project conforming to contract, on time and within budget. Related Sections are 01 32 01 PROJECT SCHEDULE, and 01 45 04 CONTRACTOR QUALITY CONTROL.

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. Transmit submittal items in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later:

SD-01 Preconstruction Submittals

List of Subcontractors

Documentation of compliance with Clauses SUBCONTRACTS (LABOR STANDARDS) and LIMITATIONS ON SUBCONTRACTING of Section 00700 CONTRACT CLAUSES in Volume 1, and, if included, paragraph LIMITATIONS ON SUBSTITUTIONS FOR CERTAIN POSITIONS AND/OR SUBCONTRACTORS of Section 00800 SPECIAL REQUIREMENTS in Volume 1. As part of the initial project schedule, submit a list of proposed subcontractors with company name, person to contact, street address, mail address, phone number, type of specialty and estimated subcontract quote.

SD-07 Certificates

Signature Authority

Furnish a power of attorney or a notarized letter of authority from Contractor identifying local representatives authorized to sign contract documents.

Drug-Free Work Place Record

Documentation of compliance with Clause DRUG-FREE WORKPLACE of Section 00700 CONTRACT CLAUSES in Volume 1 (see subparagraphs (b) (1) through (b) (7)).

### 1.3 PROJECT COORDINATION

#### 1.3.1 Resident Management System (RMS)

Contractor shall use Corps of Engineers' Resident Management System, referred to as Quality Control System (QCS), for construction information management. See Section 01 45 04 CONTRACTOR QUALITY CONTROL.

#### 1.3.2 Access by Others

Maintain access to power poles and other items owned or operated by utility companies. Coordinate with utility companies as required for line marking, hookups, and relocations as needed to perform work. Incoming electrical utilities become the responsibility of Contractor at transformers. Coordinate emergency incident response with local law enforcement and fire rescue authorities. Notify Contracting Officer in writing of coordination problems encountered affecting work.

#### 1.3.3 Inspections by Others

During construction period, inspection or maintenance work will be performed by others within the construction limits. The Contractor will be responsible for neatly mowing all grass and vegetation (not to include established trees or other protected vegetation designated as wetland areas) within the construction limits for the duration of the contract. Areas not accessible to mowers shall be edged or trimmed neatly. Mowing or trimming shall be performed every three weeks or when vegetation exceeds twelve inches in height.

### 1.4 PROJECT MEETINGS

Contracting Officer requires following types of project meetings:

- Preconstruction Conference
- Partnering Meeting
- Partnering Regroup Meetings
- Coordination Meeting
- Preparatory and Initial Phase meeting for each feature of work
- Project Progress Meetings

Project meetings are described in detail in subparts below.

### 1.5 PRECONSTRUCTION CONFERENCE

Contracting Officer will conduct a Preconstruction Conference for this project in accordance with Clause PRECONSTRUCTION CONFERENCE of Section 00700 CONTRACT CLAUSES in Volume 1. Preconstruction Conference will be 30 calendar days after Notice of Award (NOA) or 15 calendar days after Notice to Proceed (NTP), whichever is later. (Refer to subparagraph "Preconstruction Conference Submittals" below.) Contracting Officer will notify Contractor of time, place, and agenda. Contractor shall notify key subcontractors and suppliers to attend. Contracting Officer will discuss contract "ground rules" and general issues including:

- Lines of Contracting Officer authority
- Lines of Contractor authority
- 00700 Contract Clauses
- 00800 Special Contract Requirements

- Contract Administration
- Progress Payment
- Correspondence Procedures
- Project Schedule
- Submittal Register
- Labor requirements
- General Site Safety

#### 1.5.1 Preconstruction Conference Minutes

Contracting Officer will take detailed minutes of Preconstruction Conference discussions and may use an audio or video tape. Copies of typed minutes will be provided to the Contractor to review for accuracy, sign and return. Signed minutes become part of the contract file. Audio or video tapes if used will be made available for Contractor to review or copy at Area Office.

#### 1.5.2 Preconstruction Conference Submittals

The timing of submission of submittals and completion of the Preconstruction Conference is intended to allow the Contractor and the Government adequate time to prepare for commencement of work. However, should the Contractor fail to submit required items and receive acceptance and/or approval within the times stated, the Contractor will not be permitted to commence work until these requirements have been satisfied. Any delays attributable to the Contractor's failure to comply with these pre-work requirements shall be at the Contractor's expense and may be cause for remedial action by the Contracting Officer. Submittals required by this Section are described in paragraph SUBMITTALS above.

##### 1.5.2.1 Other Division 01 Submittals

The Contracting Officer reviews submitted draft plans to prepare Coordination Meeting agenda and understand Contractor procedures. Submit the following, as indicated in their respective sections, 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later:

- Project Schedule - See Section 01 32 01 PROJECT SCHEDULE
- Accident Prevention Plan - See Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS
- Quality Control Plan - See Section 01 45 04 CONTRACTOR QUALITY CONTROL
- Temporary Facilities Plan - See Section 01 50 02 TEMPORARY CONSTRUCTION FACILITIES
- Environmental Protection Plan - See Section 01 57 20 ENVIRONMENTAL PROTECTION

##### 1.5.2.2 Divisions 02 through 48 Submittals

In addition to the above, bring submittal items for materials, workmanship, plans or events required early in project schedule which are ready for transmittal to Contracting Officer. Prepare transmittal of submittal items in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

#### 1.6 PARTNERING

Contracting Officer wants to have a bilateral project partnership with Contractor that draws on strengths of both organizations to identify and achieve common goals. Typical partnering goals include:



- Effective and efficient contract performance
- Project completion on time and within budget
- Construction completed according to plans and specifications
- Development of cooperative management teams
- Project success with customer (stakeholders) satisfaction
- Improved Project communication

#### 1.6.1 Initial Partnering Meeting

Contractor, key subcontractors and suppliers shall attend a one-day project "Partnering Meeting". The Partnering Meeting is a project team building workshop facilitated by qualified persons. Contracting Officer attendees and invited persons may include:

Administrative Contracting Officer Representative (Area Engineer)  
Construction Quality Assurance Representatives  
Jacksonville District - Construction Branch persons  
Jacksonville District - Engineering Division Designers  
Jacksonville District - Operations Division (operations oversight)

Goal of initial Partnering Meeting is to build trust, identify common goals, and understand individual project members' expectations and organizational values. Usual results include better communication between contract parties, shortened project learning curve and a cohesive two party contract partnership. Participants usually sign a voluntary partnering agreement generally describing mutual obligation to cooperate to achieve project goals and maintain effective communication. Contracting Officer will pay costs for workshop site rental and facilitator fees.

#### 1.6.2 Partnering Regroups

After initial Partnering Meeting participation will be voluntary in accordance with a signed Partnering Agreement. After initial Partnering Workshop, partnering sessions will be hosted by both parties on an alternating basis with the hosting party being responsible for all costs associated with their meeting. At no time will these costs be used to change the contract price. Partnering Agreements include provisions for Contracting Officer and Contractor to request "Partnering Regroups" when needed. A "Partnering Regroup" is usually a short (4 hours - 1 day) informal partnering session where senior level Contractor and Contracting Officer project members and other interested parties review project issues of concern. Issues of conflict are reviewed, attempt to affirm common project goals and understand concerns of other partner.

#### 1.7 NOTICE TO PROCEED

Notice to proceed (NTP) will be issued 15 calendar days after award or after all required bonds are in place, whichever is later. If the Contractor has failed to submit and receive acceptance and/or approval of specified plans, including, but not limited to, Accident Prevention Plan - Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, Quality Control Plan - Section 01 45 04 CONTRACTOR QUALITY CONTROL, and Environmental Protection Plan - Section 01 57 20 ENVIRONMENTAL PROTECTION, or has not yet received the Contracting Officer's conditional approval to work under an interim plan, the Contractor shall not proceed with the work and shall consider the work to be suspended in accordance with the Suspension Of Work clause of the contract. While the Contractor is working under a conditionally accepted interim plan, funds may be retained from progress payments in

accordance with the Payments Under Fixed-Price Construction Contracts clause of this contract until such time as the Contractor submits an acceptable plan. If the Contractor does not submit an acceptable plan within a reasonable time, as determined by the Contracting Officer, the Contracting Officer may order the Contractor to suspend work. Any suspension order issued for the Contractor's failure to submit an acceptable plan will not constitute unreasonable delay under the Suspension Of Work clause and the Contractor will not be entitled to an equitable adjustment of either performance period or contract price.

#### 1.8 COORDINATION MEETING

Coordination Meeting is scheduled, convened and conducted by Contracting Officer after a Preconstruction Conference and prior to starting physical construction. Draft plans submitted after NOA (i.e., Quality Control Plan, Environmental Protection Plan and Accident Prevention Program) will have been reviewed. Coordination Meeting is primarily for on-site Contractor Quality Control staff, including subcontractor and supplier employees performing quality control, to meet and discuss the project in detail with Contracting Officer's Quality Assurance Representatives. Purposes of Coordination Meeting are:

- Achieve mutual understanding with Contractor of required Quality Control
- Jointly review submitted draft plans; resolve issues of concern
- Discuss project plans and specifications, schedule, documentation
- Establish a good working relationship between the Contractors Quality Control Staff and Quality Assurance Representatives

#### 1.9 PROGRESS MEETINGS

Schedule, convene and preside over progress meetings as required. As project activities increase ("ramp up"), a minimum of one progress meeting per week is typical of a project of this scope. Convene additional meetings as required, or when requested by Contracting Officer. Notify persons needed to be present to discuss agenda issues. Contracting Officer may direct attendance by key Contractor suppliers, or fabricators as needed. A sample meeting agenda is provided in paragraph GENERAL MEETING REQUIREMENTS below. The Contractor shall take minutes of the meetings and distribute copies of the minutes within three working days after the meetings.

##### 1.9.1 Progress Meeting Participants

Typical participants include:

- Contracting Officer or Contracting Officer's Representative
- Contractor's Site Superintendent
- Contractor's Quality Control Manager
- Contractor's Safety Coordinator
- Subcontractors, as appropriate to the agenda
- Suppliers, as appropriate to the agenda
- Others as appropriate to the agenda

#### 1.10 CONTRACTOR PERFORMANCE EVALUATIONS

Contractors are given an opportunity to provide and/or enter performance evaluation comments directly into the Contractor Performance Assessment Reporting System (CPARS). The system is a web-enabled application that

supports the completion, distribution, and retrieval of contract performance evaluations. Provide to the responsible area office the name and email address of the contractor user that will be accessing CPARS.

#### 1.10.1 Training

Contractor online training is available at the following web site: <https://www.cpars.gov/allapps/cpartrng/onlinetrn.htm>. Training will give the student an understanding of the Contractor Representative and Contractor Corporate Senior Management levels of access, the policies and regulations governing CPARS, and the electronic workflow with particular attention to the Contractor comment function.

### PART 2 PRODUCTS (NOT APPLICABLE)

### PART 3 EXECUTION

#### 3.1 GENERAL MEETING REQUIREMENTS

See Section 01 45 04 **CONTRACTOR QUALITY CONTROL** for Preparatory and Initial Phase meeting checklists. Contractor is responsible for phase and progress meetings to include:

- Meeting notification to participants
- Prepare agenda for meetings
- Use phase checklists for Preparatory and Initial Phase meetings
- Physical arrangements for meetings
- Preside at meetings
- Record minutes recording proceedings and decisions
- Copy and send minutes to:
  - Meeting participants
  - Project parties affected by decisions
  - Contracting Officer (No later than 3 working days)

#### 3.2 PROGRESS MEETING AGENDA

Modify agenda as needed for on-going work.

- Review minutes from previous progress meetings
- Review QCS Contractor Action Item Report
- Review work progress since previous meeting
- Review current definable features of work:
  - Identify phases of current features of work
  - Identify pending phase changes
  - Identify features for discussion in next scheduled meeting
- Discuss problem prevention:
  - Field observations
  - Deficiencies and tracking
  - Procedures working well
  - Problems, conflicts
  - Methods to improve
- Review construction schedule:
  - Identify delays
  - Discuss proposed corrective actions to regain schedule
- Submittals and Requests for Information (design interpretation):
  - Review submittal register
  - Identify submittals to expedite as required
- Review off-site activities:
  - Fabrications

- Material and equipment delivery schedule

Review Testing:

- Type, Schedule
- Received Results

Review changes to construction schedule:

- Planned progress during succeeding work period
- Coordination of various schedules
- Effect of changes on construction and completion date

Review site safety

Discuss maintaining contract quality for materials and workmanship

Discuss pending modifications, changes and substitutions

Discuss other business, as appropriate

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SECTION 01 32 01

PROJECT SCHEDULE

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.

AACE INTERNATIONAL (AACE)

AACE 29R-03 (2011) Forensic Schedule Analysis

AACE 52R-06 (2006) Time Impact Analysis - As Applied  
in Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (1995) Administration -- 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Project Scheduler Qualifications; G, RO  
Preliminary Project Schedule; G, RO  
Initial Project Schedule; G, RO  
Periodic Schedule Update; G, RO

1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating and production of reports. The authorized representative must have a minimum of 2-years experience scheduling construction projects similar in size and nature to this project with scheduling software that meets the requirements of this specification. Representative must have a comprehensive knowledge of CPM scheduling principles and application.

PART 2 PRODUCTS

2.1 SOFTWARE

The scheduling software utilized to produce and update the schedules required herein must be capable of meeting all requirements of this

specification.

#### 2.1.1 Government Default Software

The Government intends to use Primavera P6.

#### 2.1.2 Contractor Software

Scheduling software used by the contractor must be commercially available from the software vendor for purchase with vendor software support agreements available. The software routine used to create the required sdf file must be created and supported by the software manufacturer.

##### 2.1.2.1 Primavera

If Primavera P6 is selected for use, provide the "xer" export file in a version of P6 importable by the Government system.

##### 2.1.2.2 Other Than Primavera

If the contractor chooses software other than Primavera P6, that is compliant with this specification, provide for the Government's use two licenses, two computers, and training for two Government employees in the use of the software. These computers will be stand-alone and not connected to Government network. Computers and licenses will be returned at project completion.

### PART 3 EXECUTION

#### 3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to FAR Clause 52.236-15, SCHEDULE FOR CONSTRUCTION CONTRACTS. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of **construction** is the responsibility of the Contractor. Contractor management personnel must actively participate in its development. **Subcontractors and suppliers** working on the project must also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

#### 3.2 BASIS FOR PAYMENT AND COST LOADING

The schedule is the basis for determining contract earnings during each update period and therefore the amount of each progress payment. The aggregate value of all activities coded to a contract CLIN must equal the value of the CLIN.

##### 3.2.1 Activity Cost Loading

Activity cost loading must be reasonable and without front-end loading. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.



### 3.2.2 Withholdings / Payment Rejection

Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial or periodic schedule updates and subsequent rejection of payment requests until compliance is met.

In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount from each payment period until such revisions to the project schedule have been made.

### 3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

#### 3.3.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

#### 3.3.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have Original Durations (OD) greater than 20 work days or 30 calendar days.

#### 3.3.3 Procurement Activities

Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

#### 3.3.4 Mandatory Tasks

Include the following activities/tasks in the initial project schedule and all updates.

- a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).
- b. Submission, review and acceptance of features require design completion
- c. Submission of mechanical/electrical/information systems layout drawings.
- d. Long procurement activities
- e. Submission and approval of O & M manuals.
- f. Submission and approval of as-built drawings.
- g. Submission and approval of DD1354 data and installed equipment lists.

- h. Submission and approval of testing and air balance (TAB).
- i. Submission of TAB specialist design review report.
- j. Submission and approval of fire protection specialist.
- k. Submission and approval of Building Commissioning Plan, test data, and reports: Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with the contract commissioning requirements. All tasks associated with all building testing and commissioning will be completed prior to submission of building commissioning report and subsequent contract completion.
- l. Air and water balancing.
- m. Building commissioning - Functional Performance Testing.
- n. Controls testing plan submission.
- o. Controls testing.
- p. Performance Verification testing.
- q. Other systems testing, if required.
- r. Contractor's pre-final inspection.
- s. Correction of punch list from Contractor's pre-final inspection.
- t. Government's pre-final inspection.
- u. Correction of punch list from Government's pre-final inspection.
- v. Final inspection.

### 3.3.5 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: [approvals](#), environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

### 3.3.6 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in [ER 1-1-11](#). This exact structure is mandatory. All Activity Codes shall be developed and assigned to activities as detailed herein. A template SDEF compatible schedule backup file is available on the QCS web site: <http://rms.usace.army.mil>.

The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per day

Field	Activity Code	Length	Description
2	RESP	4	Responsible party
3	AREA	4	Area of work
4	MODF	6	Modification Number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of work
7	CATW	1	Category of work
8	FOW	20	Feature of work*
*Some systems require that FEATURE OF WORK values be placed in several activity code fields. The notation shown is for Primavera P6. Refer to the specific software guidelines with respect to the FEATURE OF WORK field requirements.			

#### 3.3.6.1 Workers Per Day (WRKP)

Assign Workers per Day for all field construction or direct work activities, if directed by the Contracting Officer. Workers per day shall be the average number of workers expected each day to perform a task for the duration of that activity.

#### 3.3.6.2 Responsible Party Coding (RESP)

Assign responsibility code for all activities to the Prime Contractor, Subcontractor(s) or Government agency(ies) responsible for performing the activity.

- a. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Property/Equipment (GFP) and Notice to Proceed (NTP) for phasing requirements.
- b. Activities cannot have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE).

#### 3.3.6.3 Area of Work Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities cannot have more than one Work Area Code.

Not all activities are required to be Work Area coded. A lack of Work Area coding indicates the activity is not resource or space constrained.

#### 3.3.6.4 Modification Number (MODF)

Assign a Modification Number Code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer. Key all Code values to the Government's modification numbering system. An activity can have only one Modification Number Code.

#### 3.3.6.5 Bid Item Coding (BIDI)

Assign a Bid Item Code to all activities using the Contract Line Item Schedule (CLIN) to which the activity belongs, even when an activity is not cost loaded. An activity can have only one BIDI Code.

#### 3.3.6.6 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are [procurement phase](#) and [construction phase](#). Each activity can have only one Phase of Work code.

- a. Code proposed fast track design and construction phases proposed to allow filtering and organizing the schedule by fast track design and construction packages.
- b. If the contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.

#### 3.3.6.7 Category of Work Coding (CATW)

Assign a Category of Work Code to all activities. Category of Work Codes include, but are not limited to [construction submittal](#), procurement, fabrication, weather sensitive installation, non-weather sensitive installation, start-up, and testing activities. Each activity can have no more than one Category of Work Code.

#### 3.3.6.8 Feature of Work Coding (FOW)

Assign a Feature of Work Code to appropriate activities based on the Definable Feature of Work to which the activity belongs based on the approved QC plan.

Definable Feature of Work is defined in Section [01 45 04](#) CONTRACTOR QUALITY CONTROL. An activity can have only one Feature of Work Code.

#### 3.3.7 Contract Milestones and Constraints

Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited.

Mandatory constraints that ignore or effect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for

approval on a case by case basis.

#### 3.3.7.1 Project Start Date Milestone and Constraint

The first activity in the project schedule must be a start milestone titled "NTP Acknowledged," which must have a "Start On" constraint date equal to the date that the NTP is acknowledged.

#### 3.3.7.2 End Project Finish Milestone and Constraint

The last activity in the schedule shall be a finish milestone titled "End Project."

The project schedule must be constrained to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path. The Government is under no obligation to accelerate Government activities to support a Contractor's early completion.

#### 3.3.7.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

##### 3.3.7.3.1 Start Phase

Use a start milestone as the first activity for a project phase. The start milestone shall be called "Start Phase X" where "X" refers to the phase of work.

##### 3.3.7.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

#### 3.3.8 Calendars

Schedule activities on a Calendar to which the activity logically belongs. Develop calendars to accommodate any contract defined work period such as a 7-day calendar for Government Acceptance activities, concrete cure times, etc. Develop the default Calendar to match the physical work plan with non-work periods identified including weekends and holidays. Develop sSeasonal Calendar(s) and assign to seasonally affected activities as applicable.

If an activity is weather sensitive it should be assigned to a calendar showing non-work days on a monthly basis, with the non-work days selected at random across the weeks of the calendar, using the anticipated days provided in the contract clause TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. The assignment of the non-work days should be over a seven-day week since weather records are compiled on seven-day weeks, which will cause some of the weather related non-work days to fall on weekends.

#### 3.3.9 Open Ended Logic

Only two open ended activities are allowed: the first activity "NTP

Acknowledged" must have no predecessor logic, and the last activity -"End Project" must have no successor logic.

Predecessor open ended logic may be allowed in a time impact analyses upon the Contracting Officer's approval.

#### 3.3.10 Default Progress Data Disallowed

Actual Start and Finish dates must not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of any activity must be independent functions. Disable program features that calculate one of these parameters from the other. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process must match those dates provided in the Contractor Quality Control Reports. Failure to document the AS and AF dates in the Daily Quality Control report will result in disapproval of the Contractor's schedule.

#### 3.3.11 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Address out of sequence progress or logic changes in the Narrative Report and in the periodic schedule update meetings.

#### 3.3.12 Added and Deleted Activities

Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and cannot be changed without Contracting Officer approval.

#### 3.3.13 Original Durations

Activity Original Durations (OD) must be reasonable to perform the work item. OD changes are prohibited unless justification is provided and approved by the Contracting Officer.

#### 3.3.14 Leads, Lags, and Start to Finish Relationships

Lags must be reasonable as determined by the Government and not used in place of realistic original durations, must not be in place to artificially absorb float, or to replace proper schedule logic.

- a. Leads (negative lags) are prohibited.
- b. Start to Finish (SF) relationships are prohibited.

#### 3.3.15 Retained Logic

Schedule calculations must retain the logic between predecessors and successors ("retained logic" mode) even when the successor activity(s) starts and the predecessor activity(s) has not finished (out-of-sequence progress). Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") are not be allowed.

### 3.3.16 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management.

### 3.3.17 Remaining Duration

Update the remaining duration for each activity based on the number of estimated work days it will take to complete the activity. Remaining duration may not mathematically correlate with percentage found under paragraph entitled Percent Complete.

### 3.3.18 Cost Loading of Closeout Activities

Cost load the "Correction of punch list from Government pre-final inspection" activity(ies) not less than 1 percent of the present contract value. Activity(ies) may be declared 100 percent complete upon the Government's verification of completion and correction of all punch list work identified during Government pre-final inspection(s).

#### 3.3.18.1 As-Built Drawings

If there is no separate contract line item (CLIN) for as-built drawings, cost load the "Submission and approval of as-built drawings" activity not less than \$35,000 or 1 percent of the present contract value, which ever is greater, up to \$200,000. Activity will be declared 100 percent complete upon the Government's approval.

#### 3.3.18.2 O & M Manuals

Cost load the "Submission and approval of O & M manuals" activity not less than \$20,000. Activity will be declared 100 percent complete upon the Government's approval of all O & M manuals.

### 3.3.19 Anticipated Adverse Weather

Paragraph applicable to contracts with clause entitled TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER. Reflect the number of anticipated adverse weather delays allocated to a weather sensitive activity in the activity's calendar.

### 3.3.20 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates all scope of the required contract work will be completed before the contractually required completion date.

- a. No IPS indicating an Early Completion will be accepted without being fully resource-loaded (including crew sizes and manhours) and the Government agreeing that the schedule is reasonable and achievable.
- b. The Government is under no obligation to accelerate work items it is responsible for to ensure that the early completion is met nor is it responsible to modify incremental funding (if applicable) for the project to meet the contractor's accelerated work.

### 3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD/DVD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, then the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

#### 3.4.1 Preliminary Project Schedule Submission

Within 15 calendar days after the NTP is acknowledged submit the [Preliminary Project Schedule](#) defining the planned operations detailed for the first 90 calendar days for approval. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. The Preliminary Project Schedule may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, planned submissions of all early design packages, permitting activities, design review conference activities, and other non-construction activities intended to occur within the first 90 calendar days. Government acceptance of the associated design package(s) and all other specified Program and Plan approvals must occur prior to any planned construction activities. Activity code any activities that are summary in nature after the first 90 calendar days with Bid Item (CLIN) code (BIDI), Responsibility Code (RESP) and Feature of Work code (FOW).

#### 3.4.2 Initial Project Schedule Submission

Submit the [Initial Project Schedule](#) for approval within 42 calendar days after notice to proceed is issued. The schedule must demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. No payment will be made for work items not fully detailed in the Project Schedule.

#### 3.4.3 Periodic Schedule Updates

Update the Project Schedule on a regular basis, monthly at a minimum. Provide a draft Periodic Schedule Update for review at the schedule update meetings as prescribed in the paragraph PERIODIC SCHEDULE UPDATE MEETINGS. These updates will enable the Government to assess Contractor's progress.

- a. Update information including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete is subject to the approval of the Government at the meeting.
- b. AS and AF dates must match the date(s) reported on the Contractor's Quality Control Report for an activity start or finish.



### 3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

#### 3.5.1 Data CD/DVDs

Provide two sets of data CD/DVDs containing the current project schedule and all previously submitted schedules in the format of the scheduling software (e.g. .xer). Also include on the data CD/DVDs the Narrative Report and all required Schedule Reports. Label each CD/DVD indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file name. Each schedule must have a unique file name and use project specific settings.

#### 3.5.2 Narrative Report

Provide a Narrative Report with each schedule submission. The Narrative Report is expected to communicate to the Government the thorough analysis of the schedule output and the plans to compensate for any problems, either current or potential, which are revealed through that analysis. Include the following information as minimum in the Narrative Report:

- a. Identify and discuss the work scheduled to start in the next update period.
- b. A description of activities along the two most critical paths where the total float is less than or equal to 20 work days.
- c. 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.
- d. Identify and explain why activities based on their calculated late dates should have either started or finished during the update period but did not.
- e. Identify and discuss all schedule changes by activity ID and activity name including what specifically was changed and why the change was needed. This should include at a minimum new and deleted activities, logic changes, duration changes, calendar changes, lag changes, resource changes, and actual start and finish date changes.
- f. Identify and discuss out-of-sequence work.

#### 3.5.3 Schedule Reports

The format, filtering, organizing and sorting for each schedule report must be as directed by the Contracting Officer. Typically, reports 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 Date, Actual Finish Date, and Percent Complete. Provide the reports electronically in .pdf format. Provide one hard copy of each report. The following lists typical reports that will be requested:

##### 3.5.3.1 Activity Report

List of all activities sorted according to activity number.

#### 3.5.3.2 Logic Report

List of detailed predecessor and successor activities for every activity in ascending order by activity number.

#### 3.5.3.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

#### 3.5.3.4 Earnings Report by CLIN

A compilation of the Total Earnings on the project from the NTP to the data date. This report must reflect the earnings of activities based on the agreements made in the schedule update meeting defined herein. Provided a complete schedule update has been furnished, this report serves as the basis of determining progress payments. Group activities by CLIN number and sort by activity number. This report must also provide a total CLIN percent earned value, CLIN percent complete, and project percent complete. The printed report must contain the following for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Earnings to Date, Earnings this period, Total Quantity, Quantity to Date, and Percent Complete (based on cost).

#### 3.5.3.5 Schedule Log

Provide a Scheduling/Leveling Report generated from the current project schedule being submitted.

#### 3.5.4 Network Diagram

The Network Diagram is required for the Preliminary, Initial and Periodic Updates. 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:

##### 3.5.4.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

##### 3.5.4.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

##### 3.5.4.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

##### 3.5.4.4 Banding

Organize activities using the WBS or as otherwise directed to assist in the

understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area and/or responsibility.

#### 3.5.4.5 Cash Flow / Schedule Variance Control (SVC) Diagram

With each schedule submission, provide a SVC diagram showing 1) Cash Flow S-Curves indicating planned project cost based on projected early and late activity finish dates, and 2) Earned Value to-date.

### 3.6 PERIODIC SCHEDULE UPDATE

#### 3.6.1 Periodic Schedule Update Meetings

Conduct periodic schedule update meetings for the purpose of reviewing the proposed Periodic Schedule Update, Narrative Report, Schedule Reports, and progress payment. Conduct meetings at least monthly within five days of the proposed schedule data date. Provide a computer with the scheduling software loaded and a projector which allows all meeting participants to view the proposed schedule during the meeting. The Contractor's authorized scheduler must organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Government. The meeting is a working interactive exchange which allows the Government and Contractor the opportunity to review the updated schedule on a real time and interactive basis. The meeting will last no longer than 8 hours. Provide a draft of the proposed narrative report and schedule data file to the Government a minimum of two workdays in advance of the meeting. The Contractor's Project Manager and scheduler must attend the meeting with the authorized representative of the Contracting Officer. Superintendents, foremen and major subcontractors must attend the meeting as required to discuss the project schedule and work. Following the periodic schedule update meeting, make corrections to the draft submission. Include only those changes approved by the Government in the submission and invoice for payment.

#### 3.6.2 Update Submission Following Progress Meeting

Submit the complete [Periodic Schedule Update](#) of the Project Schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 work days after the periodic schedule update meeting.

### 3.7 WEEKLY PROGRESS MEETINGS

Conduct a weekly meeting with the Government (or as otherwise mutually agreed to) between the meetings described in paragraph entitled PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. Use the current approved schedule update for the purposes of this meeting and for the production and review of reports. At the weekly progress meeting, address the status of RFIs, RFPs and Submittals.

### 3.8 REQUESTS FOR TIME EXTENSIONS

Provide a justification of delay to the Contracting Officer in accordance with the contract provisions and clauses for approval within 10 days of a delay occurring. Also prepare a time impact analysis for each Government request for proposal (RFP) to justify time extensions.

### 3.8.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact to the work. As part of the description, identify all schedule activities impacted. Show that the event that caused the delay/impact was the responsibility of the Government. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date or interim completion date(s). Multiple impacts must be evaluated chronologically; each with its own justification of delay. With multiple impacts consider any concurrency of delay. A time extension and the schedule fragnet becomes part of the project schedule and all future schedule updates upon approval by the Contracting Officer.

### 3.8.2 Time Impact Analysis (Prospective Analysis)

Prepare a time impact analysis for approval by the Contracting Officer based on industry standard [AACE 52R-06](#). Utilize a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If Contracting Officer determines the time frame between the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes will be incorporated into the schedule being used to justify the time impact.

### 3.8.3 Forensic Schedule Analysis (Retrospective Analysis)

If the project has been subject to multiple delays and time impact analysis has not been used to successfully analyze the time extensions, the Contractor shall prepare an analysis for approval by the Contracting Officer based on industry standard [AACE 29R-03](#).

### 3.8.4 Fragmentary Network (Fragnet)

Prepare a proposed fragnet for time impact analysis. The proposed fragnet must consist of a sequence of new activities that are proposed to be added to the project schedule to demonstrate the influence of the delay or impact to the project's contractual dates. Clearly show how the proposed fragnet is to be tied into the project schedule including all predecessors and successors to the fragnet activities. The proposed fragnet must be approved by the Contracting Officer prior to incorporation into the project schedule.

### 3.8.5 Time Extension

The Contracting Officer must approve the Justification of Delay including the time impact analysis before a time extension will be granted. No time extension will be granted unless the delay consumes all available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

### 3.8.6 Impact to Early Completion Schedule

No extended overhead will be paid for delay prior to the original Contract Completion Date for an Early Completion IPS unless the Contractor actually performed work in accordance with that Early Completion Schedule. The Contractor must show that an early completion was achievable had it not been for the impact..

### 3.9 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

#### 3.9.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

#### 3.9.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and/or may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

#### 3.9.3 Recovery Schedule

Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

### 3.10 OWNERSHIP OF FLOAT

Except for the provision given in the paragraph IMPACT TO EARLY COMPLETION SCHEDULE, float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor including activity and/or project float. Activity float is the number of work days that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the contract completion date milestone.

### 3.11 TRANSFER OF SCHEDULE DATA INTO RMS/QCS

Import the schedule data into the Quality Control System (QCS) and export the QCS data to the Government. This data is considered to be additional supporting data in a form and detail required by the Contracting Officer

pursuant to FAR 52.232-5 - Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 - Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and matching electronic export from QCS of the application for progress payment.

### 3.12 PRIMAVERA P6 MANDATORY REQUIREMENTS

If Primavera P6 is being used, request a backup file template (.xer) from the Government, if one is available, prior to building the schedule. The following settings are mandatory and required in all schedule submissions to the Government:

- a. Activity Codes must be Project Level, not Global or EPS level.
- b. Calendars must be Project Level, not Global or Resource level.
- c. Activity Duration Types must be set to "Fixed Duration & Units".
- d. Percent Complete Types must be set to "Physical".
- e. Time Period Admin Preferences must remain the default "8.0 hr/day, 40 hr/week, 172 hr/month, 2000 hr/year". Set Calendar Work Hours/Day to 8.0 Hour days.
- f. Set Schedule Option for defining Critical Activities to "Longest Path".
- g. Set Schedule Option for defining progressed activities to "Retained Logic".
- h. Set up cost loading using a single lump sum resource. The Price/Unit must be \$1/hr, Default Units/Time must be "8h/d", and settings "Auto Compute Actuals" and "Calculate costs from units" selected.
- i. Activity ID's must not exceed 10 characters.
- j. Activity Names must have the most defining and detailed description within the first 30 characters.

-- End of Section --

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

This section describes submittal procedures in Jacksonville District contracts using Quality Control System submittal procedures in accordance with Section 01 45 04 **CONTRACTOR QUALITY CONTROL**. It covers submittal item identification, number of copies, review periods, quality control review, QC/QA reviewer coding, and transmittal tracking procedures using Quality Control System (QCS)/Resident Management System (RMS) shared data base. Contractor shall use QCS software to identify, track and transmit submittal items.

1.2 DEFINITIONS

1.2.1 Submittal

Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.2.2 Transmittal

This is a routine contract correspondence action using a transmittal form (ENG Form 4025) to send submittal items to the Government. The QCS "Transmittal Log" module uses data base entry to create a hard copy of ENG Form 4025.

1.2.3 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by SD numbers and titles as follows.

**SD-01 Preconstruction Submittals**

Submittals which are required prior to start of construction (work) or the start of the next major phase of the construction on a multi-phase contract, includes schedules, tabular list of data, or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work. Preconstruction submittals shall be submitted no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later.

**SD-02 Shop Drawings**

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

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

product or system into the project.

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

#### SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.

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

#### SD-04 Samples

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

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

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

#### SD-05 Design Data

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

#### SD-06 Test Reports

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

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

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

Investigation reports.

Daily checklists.

Final acceptance test and operational test procedure.

#### SD-07 Certificates

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

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

Confined space entry permits.

#### SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

#### SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

Factory test reports.

#### SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

#### SD-11 Closeout Submittals

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

#### 1.2.4 Approving Authority

Office authorized to approve submittal.

#### 1.2.5 Work

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

#### 1.2.6 Contractor Reviewer

Contractor employee performing quality control review on submittal items.

#### 1.2.7 Primary Reviewer

Initial Government reviewer is usually among construction field personnel who perform quality assurance review on submittal items.

#### 1.2.8 Secondary Reviewer

Secondary Government reviewer is usually an in-house designer or Architect/Engineer (A/E) firm hired to perform "engineering during construction". This is a submittal reviewer for design critical "G" submittal items. Secondary Reviewers may also be specialized district staffs such as safety or environmental specialists, users, or operations and maintenance reviewers. Secondary Reviewers are advisors to Approving Authority.

#### 1.2.9 Reviewer Codes

Two and three letter codes used to identify Government primary and secondary reviewer on submittal register are as follows:

- PO -- Construction Project Office
- RO -- Construction Resident Office
- AO -- Construction Area Office
- DO -- Jacksonville District Office
- AE -- Architect Engineer Contractor providing engineering during construction

#### 1.2.10 Review and Action Codes

Reviewer code letters A,B,C,E,F,G and X are used by Contractor QC Staff and Government Primary and Secondary Reviewers to indicate approval, acceptance or rejection of a submittal item.

#### 1.2.11 Review Comments to Contractor

ENG Form 4025, Section III is generated in Resident Management System, and contains consolidated remarks for Primary and Secondary Reviewers. When RMS exports to QCS, "Review Comments to Contractor" will electronically update. A hard copy of ENG Form 4025, Part III is attached to a submittal item when returned.

### 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 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later:

#### SD-01 Preconstruction Submittals

##### Export File; G, RO

As part of the initial project schedule, review and correct the "Submittal Register". Provide the corrected "Submittal Register" as part of first QCS export file to the Government.

### 1.4 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

#### 1.4.1 Government Approved

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

#### 1.4.2 Information Only

All submittals not requiring Government approval will be for information only. "Information Only" submittal items shall be reviewed, coded and approved by the Contractor. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

#### 1.5 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

#### 1.6 DISAPPROVED SUBMITTALS

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. Any transmittals that are designed code action "C" or "E" shall be corrected and returned by the Contractor within 10 days. 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.

#### 1.7 WITHHOLDING OF PAYMENT

No payment for materials incorporated in the work will be made if required approvals have not been obtained until it is determined by the Contracting Officer that materials meet contract requirements.

#### 1.8 GENERAL

The Contractor shall make submittals as required by the specifications using the QCS software "Transmittal Log". The Contracting Officer may request 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. Prior to transmittal, all items shall be checked and approval coded by the Contractor's Quality Control (CQC) System Manager, and each item shall be stamped, signed, and dated by the CQC System Manager 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.

#### 1.9 SUBMITTAL REGISTER

At the end of this section is a submittal register showing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Submittal Register using QCS/RMS is a shared electronic database constantly updated by both Government and Contractor. The Government will provide initial RMS export file to populate the QCS submittal register in electronic format. This list may not be all inclusive, and additional submittals may be required. Examine contract drawings and specifications, verify QCS data, and add required submittal items. The Contractor's initial update to the submittal register shall be made prior to submission of the initial project schedule. The Contractor can print or e-mail QCS/RMS generated current Submittal Register ENG Form 4288, and Transmittal Log as QCS reports. Submittal and Transmittal status are updated with each RMS/QCS data file exchange.

#### 1.10 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. QCS requires the Contractor to schedule and transmit submittal items from one Section together. Certifications to be submitted with drawings shall be scheduled. Schedule submittals with sufficient time to obtain a Government response prior to delivery of applicable equipment and materials, and commencement of applicable work. The Contractor assumes risk for applicable deliveries and work performed prior to receipt of a Government response to a submittal which requires no resubmission as indicated in the clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION of Section 00700 CONTRACT CLAUSES of Volume 1. Unless otherwise indicated in specific paragraphs governing each submittal, allow QC/QA review periods from date of receipt by Approval Authority in the schedule as follows:

Information Only - Contractor QC Review - 10 Calendar Days  
"G" - Government QA Review - 30 Calendar Days

The Government has the number of calendar days indicated above from the date a transmitted "G" submittal item is received to review, code and return comments. The Contractor shall resubmit disapproved submittal items (codes C, D, E, G or X) within 10 calendar days after return. No delay damages or time extensions will be allowed for time lost caused by late submittals.

##### 1.10.1 Avoiding Delays

Notify the Contracting Officer immediately when procurement or construction delays due to submittal review are possible.

#### 1.11 TRANSMITTAL FORM (ENG FORM 4025)

These forms are included in the QCS software. Use the QCS transmittal log to generate "ENG Form 4025 - Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance" to transmit submittal items to the Government. EN Form 4025R has three sections as follows:

Section I - "Request for Approval of the Following Items" is initiated by the Contractor.

Section II - "Approval Action" combined with a review code in column "For CE Use Code" indicates submittal item acceptance or rejection by Approving Authority.

Section III - Government Review Remarks.

This form shall be properly completed using QCS software to fill out all the heading blank spaces and identify each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph or sheet number of the contract drawings pertinent to the data submitted for each item.

##### 1.11.1 Approving Authority Review Codes

The Contractor shall use QCS to act as Approving Authority to code FIO submittals. The Government will use RMS to prepare reviewer comments and code "G" submittal items. These comments and coding will update QCS when the .RFX file update is imported by the Contractor from the QCS SFTP repository. The action codes are as follows ("Resubmit" in parentheses means the Contractor is required to resubmit):

- A -- Approved as submitted (Complete)
- B -- Approved, except as noted on drawings (Complete)
- C -- Approved, except as noted on drawings (Resubmit)
- D -- Returned by correspondence (Complete)
- E -- Disapproved (See Attached and Resubmit)
- F -- Receipt Acknowledged (Completed)
- G -- Other (Specify Action in Detail; Resubmittal may be required)
- X -- Receipt Acknowledged, does not comply (Resubmit)

#### 1.12 SUBMITTAL PROCEDURES

Submittals shall be made as follows:

##### 1.12.1 Reviewing, Certifying, Approving Authority

The Contractor shall perform QC review of all submittal items, and certify for compliance or note submittal item is a variation. Approving authorities are as follows:

"G" - Government will approve "G" submittal items.  
Information Only - Contractor shall approve "Information Only" submittal items.

The Government reserves the right to perform quality assurance on an "Information Only" submittal even after it has been approved by the Contractor's Approving Authority. See paragraph INFORMATION ONLY

SUBMITTALS below.

#### 1.12.2 Procedures

The Contractor shall furnish submittals required by contract and transmit them to the Contracting Officer using ENG Form 4025 as contract transmittal form. Transmit all submittals to the address provided by the Resident Engineer prior to the Preconstruction Conference. The address may also be provided by contacting the area office indicated in Page 00010-2 of the Standard Form 1442.

#### 1.12.3 Number of Copies or Samples

Transmit five (5) hard copies and one (1) soft copy of "G" submittal items and three (3) hard copies and one (1) soft copy of "Information Only" submittals to Contracting Officer. Each transmittal of a set of hard copy submittal items shall have a coded and signed hard copy of a QCS generated ENG Form 4025 attached. Soft copy submittal items shall be transmitted on CD-ROM in PDF format unless otherwise approved by the Contracting Officer. Only one transmittal shall be transmitted per CD-ROM. The Contractor shall attach a signed copy of ENG Form 4025 on each CD-ROM disk case, mark the contract and transmittal numbers on each CD-ROM disk, and include a PDF of the signed ENG Form 4025 on each CD-ROM.

#### 1.12.4 Identifying Submittal Items and Transmittals

QCS creates a unique number using section number and generated number (01 30 00-X) for each submittal item. Also, QCS creates a unique number for each transmittal using section number and a number assigned by the Contractor (01 33 00-XXXXX). The Contractor assigned numbers are not consecutive and may be an activity number from the procurement schedule. Attach a QCS generated ENG Form 4025 to each set and copy of submittal items. Identify each sample submittal item with project title, contract number, section/submittal item number, name, address and phone number of Contractor's point of contact.

#### 1.12.5 Submittal Format

##### 1.12.5.1 Format for Shop Drawings

Paper copies of shop drawings shall be ANSI standard sizes A, B, C or E (8.5"x11", 11"x17", 17"x22" or 34"x44" respectively). Each drawing shall have a right side margin information block similar to contract drawings with project title, contract number, contractor/supplier names, section/submittal item number, drawing title, number and date, revision date, and approval box. Units shall be the same as those in contract drawings. Dimensions shall be to the scale shown or noted as "Not to Scale" (NTS).

##### 1.12.5.2 Format for Construction Drawings

Construction drawings are large sized shop drawings for complex structures and systems, layout of site temporary construction (dewatering), mapping access, and land use descriptions. When required, prepare construction drawings on ANSI standard sizes C (17"x22") or E (34"x44") as directed by the Contracting Officer. The layout of construction drawings shall be as indicated in subparagraph "Format for Shop Drawings" above.



#### 1.12.5.3 Format for Computer Aided Design (CAD) Drawings

CAD drawings may be transmitted on CD-ROM if approved by the Contracting Officer. The Contractor shall transmit the same number of CD-ROM disks as the number of hard copies required. Attach a copy of ENG Form 4025 on each CD-ROM disk case, and mark the contract and transmittal numbers on each CD-ROM disk. One paper copy of drawings shall be included with each set of CD-ROM disks transmitted.

#### 1.12.5.4 Administrative Submittal Items Format

When an administrative submittal becomes part of the contract or project record, use 8.5"x11" pages for text and 11"x17" sheets for drawings. Use a table of contents with tabs for large submittal items. Use loose leaf binder or binder fastener to allow for disassembly, and addition of documents.

#### 1.12.5.5 Operation and Maintenance Data

See Section 01 78 23 OPERATION AND MAINTENANCE DATA.

#### 1.12.6 Deviations

Deviations are also known as "variations" from the contract requirements. Variations require Government approval, and will be considered when beneficial to the Government. An "Information Only" submittal item becomes a "G" submittal item requiring Government review and approval when a variation is proposed. When QCS variation block is checked, explain why the variation should be accepted in place of the specified item in "Remarks to Government". The "Remarks to Government" will populate the ENG Form 4025R "REMARKS" block. The variation will become a modification to contract requirements if it is approved by the Contracting Officer. Approved variations may require adjustments to contract price for increased (basic change document) or decreased (Government's credit) costs, and construction time. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

#### 1.12.7 Considering Variations

Discuss proposed variations with the Contracting Officer prior to submission. Ensure function and quality requirements are met. Submit proposed variation as a Value Engineering Change Proposal (VECP) if it is likely to result in lower cost. See the clause VALUE ENGINEERING - CONSTRUCTION of Section 00700 CONTRACT CLAUSES of Volume 1.

#### 1.12.8 Proposing Variations

Use QCS Transmittal Log to identify submittal items as variations. In "Remarks to Government", describe what the proposed variation is, how it differs from the contract, and why it is desirable and beneficial to the Government. Include estimate of cost savings if lower cost is a benefit.

#### 1.12.9 Warranty Variations

Use the QCS transmittal log "Remarks to Government" to warrant that the variation submitted for approval will be compatible with other work if incorporated.

#### 1.12.10 Electronic Correspondence

All correspondence and contract related documents shall be submitted in searchable Adobe Portable File format (PDF) with the only exceptions being those stated at the end of this paragraph. Any documents that require signature shall be submitted in PDF format with signature. Minimum scan quality shall be 150 dpi. The Contracting Officer will discuss electronic correspondence procedures at Preconstruction and Coordination Meetings. These procedures may include sending files by e-mail, submitting on electronic media such as compact disks, through the SAD Repliweb internet site, or other methods approved by the Contracting Officer. The Contractor shall be responsible for the cost of the electronic media. Examples of correspondence and contract related documents that must be submitted in PDF format include, but are not limited to, Contractor serial letters, notifications to Contracting Officer, requests for equitable adjustment, change requests, claims, Contract Modifications (SF 30), QC Reports, RFIs, pay requests, meeting minutes, insurance certificates, schedules, shop drawings, submittals and ENG 4025 transmittal forms and supporting data. QC Reports will include all required attachments including QC Test Reports. Both a hard copy and a PDF file of the signed QC Report including required attachments shall be submitted daily. In addition, one month after the end of each month all QC Reports for the month shall be combined into one PDF and submitted. Submit copies of correspondence to other businesses, entities, or agencies such as "Notices to Mariners", permit required reports, and other contract related documents in PDF format. Include signatures if applicable for final versions of scanned contracts. All correspondence and contract related documents shall also be submitted in hard copy form, in the quantities and with the requirements listed in these documents, unless the Contractor obtains a waiver from the Contracting Officer. E-mail correspondence and payroll documentation do not have to be provided in PDF format.

#### 1.13 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."

#### 1.14 GOVERNMENT 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. Three (3) copies of the submittal will be retained by the Contracting Officer and two (2) copies of the submittal will be returned to the Contractor.

#### 1.15 INFORMATION ONLY SUBMITTALS

Normally submittals for information only are approved by the Contractor's approving authority. The Government will notify the Contractor if the submittal has received an "F" action code, and the submittal will not be returned. Approval of the Contracting Officer is not required on information only submittals. Submittal items found not to comply with contract requirements will be given an "X" action code, returned to the Contractor, and shall require resubmittal by the Contractor as a "G" submittal item. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the

Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.16 REQUEST FOR INFORMATION (RFI)

Requests for Information are not submittal items. They are time sensitive Quality Control related correspondence. See Section 01 45 04 CONTRACTOR QUALITY CONTROL.

1.17 SUBMITTAL REGISTER

The Submittal Register is appended after the end of this section.

1.18 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following (see next page):

CONTRACTOR	
(Firm Name)	
_____	Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets(s).	
SIGNATURE: _____	
TITLE: _____	
DATE: _____	

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

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TITLE AND LOCATION HHD Rehab., Structure Repl. S-291 Recon.						CONTRACTOR											
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		01 11 00	SD-02 Shop Drawings														
			Bypass of Water Plan	1.3.5	G DO												
			Traffic Plan		G RO												
			Temporary Safety Barrier Plan	1.5.5	G RO												
			Temporary Turnouts Design Plan	1.3.3	G RO												
		01 22 00	SD-01 Preconstruction Submittals														
			Schedule of Values		G RO												
			Utility Invoices														
		01 30 00	SD-01 Preconstruction Submittals														
			List of Subcontractors														
			SD-07 Certificates														
			Signature Authority														
			Drug-Free Work Place Record														
		01 32 01	SD-01 Preconstruction Submittals														
			Project Scheduler Qualifications	1.3	G RO												
			Preliminary Project Schedule	3.4.1	G RO												
			Initial Project Schedule	3.4.2	G RO												
			Periodic Schedule Update	3.6.2	G RO												
		01 33 00	SD-01 Preconstruction Submittals														
			Export File		G RO												
		01 35 25	SD-01 Preconstruction Submittals														
			Dive Operations Plan		G RO												
			SD-07 Certificates														
			Dive Personnel Qualifications		G RO												
		01 35 26	SD-01 Preconstruction Submittals														
			Accident Prevention Plan (APP)	1.6	G DO												

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		01 35 26	Activity Hazard Analysis (AHA)	1.7	G DO												
			Crane Critical Lift Plan	1.6.1	G DO												
			SD-06 Test Reports														
			Notifications and Reports	1.11													
			Accident Reports	1.11.1													
			Crane Reports	1.11.2													
			SD-07 Certificates														
			Confined Space Entry Permit	1.8													
			Hot work permit	1.8													
			License Certificates	1.13													
			Crane Operators	1.5.2.3	G DO												
			Third Party Certification of	1.11.4													
			Barge-Mounted Mobile Cranes														
			Certificate of Compliance	1.11.3													
		01 45 04	SD-01 Preconstruction Submittals														
			Contractor Quality Control (CQC)	3.2	G RO												
			Plan														
			Initial Work Schedule		G RO												
			SD-07 Certificates														
			Laboratory Qualifications	3.7.2	G RO												
			Letter of Authority	3.2.2													
		01 50 02	SD-01 Preconstruction Submittals														
			Mobilization/Demobilization Plan		G AO												
			Security Plan	3.8	G AO												
			Maintenance of Traffic Plan		G DO												
			SD-02 Shop Drawings														

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		01 50 02	Contractor's Temporary Facilities	3.7	G AO												
			Temporary Electric Drawings		G AO												
		01 52 10	SD-02 Shop Drawings														
			Contracting Officer's Field Office	2.1													
		01 57 20	SD-01 Preconstruction Submittals														
			Environmental Protection Plan		G DO												
			SD-07 Certificates														
			Bird Monitoring Qualifications		G DO												
			Eastern Indigo Snake Observer		G DO												
			SD-11 Closeout Submittals														
			Logs/Final Summary Report														
			Eastern Indigo Snake Monitoring														
			Report														
			Project Environmental Summary														
			Sheet														
			Logs/Summary of Bird Nesting														
			Monitoring														
			Comprehensive Final Report														
		01 57 25	SD-03 Product Data														
			Calibration Standard														
			SD-06 Test Reports														
			Turbidity Monitoring														
		01 57 50	SD-02 Shop Drawings														
			Drilling Program Plan		G DO												
		01 78 02	SD-02 Shop Drawings														
			As-Builts		G RO												

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		01 78 02	SD-03 Product Data														
			As-Built Record of Equipment and Materials	1.3.3	G RO												
			Warranty Management Plan	1.4.1	G RO												
			Warranty Tags	1.4.5	G RO												
			Final Cleaning	1.7	G RO												
		02 22 13	SD-01 Preconstruction Submittals														
			Vibration Control Specialist		G DO												
			Vibration Control Specialist Alternate		G DO												
			Vibration Monitoring Technician(s)		G DO												
			Structural Inspection/Evaluation Engineer		G DO												
			Pre-Construction Structural Survey		G DO												
			Vibration Control Plan		G DO												
			SD-06 Test Reports														
			Vibration Monitoring Report														
			Daily Instrument Logs														
			Post-Construction Structural Survey		G DO												
		02 41 00	SD-02 Shop Drawings														
			Demolition Plan	1.2.1	G RO												
		03 11 13	SD-02 Shop Drawings														
			Formwork	3.1.1	G DO												



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		03 11 13	SD-03 Product Data														
			Design	1.2													
			Form Materials	2.1													
			Form Releasing Agents	2.1.5													
			SD-06 Test Reports														
			Inspection	3.5													
			Formwork Not Supporting Weight of Concrete	3.4.1	G DO												
		03 15 00	SD-02 Shop Drawings														
			Waterstops	2.4	G DO												
			SD-03 Product Data														
			Preformed Expansion Joint Filler	2.2													
			Sealant	2.3													
			Waterstops	2.4													
			SD-04 Samples														
			Lubricant for Preformed Compression Seals	2.3.2													
			Field-Molded Type	2.3.3													
			Non-metallic Materials	2.4.1													
			Waterstops	2.4													
			Splicing Waterstops	2.5.2	G DO												
			SD-07 Certificates														
			Preformed Expansion Joint Filler	2.2													
			Sealant	2.3													
			Waterstops	2.4													
		03 20 00	SD-02 Shop Drawings														

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		03 20 00	Reinforcement	3.1	G DO												
			SD-03 Product Data														
			Welding	1.3.1													
			Butt-Splices	3.1.4.2	G DO												
			Material	2.8	G DO												
			SD-06 Test Reports														
			Material	2.8	G DO												
			Tests, Inspections, and Verifications	2.8	G DO												
			SD-07 Certificates														
			Reinforcing Steel	2.3													
			Qualification of Steel Bar	1.3.2													
			Butt-Splicers														
		03 31 01	SD-03 Product Data														
			On-Site Batch Plant		G RO												
			Concrete Mixture Proportions	1.2	G RO												
			Testing Technicians	1.4													
			Conveying Equipment	2.2.2	G RO												
			Concrete Construction Inspector (CCI)	1.4													
			Construction Joint Treatment	3.1.4	G RO												
			Curing and Protection		G RO												
			Hot Weather Placing	3.2.5	G RO												
			Cold Weather Placing	3.2.4	G RO												
			Thermal Analysis		G RO												
			SD-06 Test Reports														

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		03 31 01	Quality of Aggregates		G RO												
			Tests and Inspections	3.4	G RO												
			Mixer Uniformity	3.4.2.7	G RO												
			SD-07 Certificates														
			Batch Plant/Ready Mix Plant		G RO												
			Cementitious Materials	2.1.1													
			Aggregates		G RO												
			Impervious-Sheet Curing														
			Materials														
			Air-Entraining Admixture	2.1.3.1													
			Membrane-Forming Curing														
			Compound														
			Epoxy Resin	2.1.7													
			Latex Bonding Compound	2.1.6													
			Nonshrink Grout	2.1.5													
		03 35 00	SD-03 Product Data														
			Latex Bonding Compound	2.1	G DO												
			Epoxy Resin	2.2	G DO												
		03 39 00	SD-06 Test Reports														
			Testing and Inspection for CQC	3.2	G RO												
		05 50 14	SD-02 Shop Drawings														
			Quality Control Plan		G DO												
			Detail Drawings	1.3.2	G DO												
			Control Dimensions		G DO												
			SD-03 Product Data														
			Welding of Structural Steel	2.2.2.1	G DO												

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		05 50 14	Welding of Stainless Steel	2.2.2.4	G DO												
			Welding of Aluminum		G DO												
			Structural Steel Welding Repairs	2.3.4	G DO												
			Materials Orders	2.1.1													
			Materials List	2.1.2													
			Shipping Bill	2.1.3													
			Tubular Welding Schedule		G DO												
			SD-06 Test Reports														
			Tests, Inspections, and Verifications	2.3													
			Fabrication Quality Control Reports														
			SD-07 Certificates														
			Qualification Of Structural Steel Fabricator		G DO												
			Qualification of Welders and Welding Operators	1.3.1													
			Application Qualification for Steel Studs	2.2.2.3	G DO												
			Application Qualification for Stainless Steel Studs	2.2.2.5	G DO												
			Welding of Aluminum		G DO												
			Inspector Qualifications	1.4.1	G DO												
			NDT Equipment Calibration Records		G DO												
			SD-08 Manufacturer's Instructions														

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		05 50 14	Welding Procedure Specifications (WPS)		G DO												
			NDT Written Practice		G DO												
		05 50 15	SD-02 Shop Drawings														
			Quality Control Plan		G DO												
			Miscellaneous Metals & Standard Metal Articles	2.1	G DO												
			Shop Fabricated Metal Items	2.2	G DO												
			Control Dimensions		G DO												
			SD-03 Product Data														
			Miscellaneous Metals & Standard Metal Articles	2.1	G DO												
			Shop Fabricated Metal Items	2.2	G DO												
			SD-06 Test Reports														
			Miscellaneous Metals & Standard Metal Articles	2.1	G DO												
			Shop Fabricated Metal Items	2.2	G DO												
			SD-07 Certificates														
			NDT Equipment Calibration Records		G DO												
			Welder Qualification Records		G DO												
			Inspector Qualifications		G DO												
			SD-08 Manufacturer's Instructions														
			Welding Procedure Specifications		G DO												
			NDT Written Practice		G DO												
		08 11 13	SD-02 Shop Drawings														

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		08 11 13	Doors		G RO												
			Frames	2.2	G RO												
			Frames	2.2	G RO												
			Accessories														
			Weatherstripping	2.3													
			SD-03 Product Data														
			Doors		G RO												
			Frames	2.2	G RO												
			Accessories														
			Weatherstripping	2.3													
		08 71 00	SD-02 Shop Drawings														
			Hardware schedule	1.3	G RO												
			Keying system	2.3.5													
			SD-03 Product Data														
			Hardware items	2.3	G RO												
			SD-07 Certificates														
			Certificates														
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-10 Operation and Maintenance														
			Data														
			Hardware Schedule	1.3	G RO												
		08 91 00	SD-02 Shop Drawings														
			Wall louvers	1.4													
			SD-03 Product Data														
			Metal Wall Louvers	2.2													

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		08 91 00	SD-06 Test Reports														
			Test Data		G DO												
			SD-07 Certificates														
			Certification		G DO												
		13 34 23	SD-02 Shop Drawings														
			Shop and Erection Drawings		G DO												
			SD-03 Product Data														
			Manufacturer's Catalog Data														
			SD-07 Certificates														
			Qualifications	1.3.3													
			Design Certification														
			Plant Certification														
		13 51 00	SD-02 Shop Drawings														
			Survey Marker Placement and		G DO												
			Settlement Monitoring Plan														
			SD-03 Product Data														
			Instrumentation Pre-Installation		G RO												
			Form														
			Survey Markers		G DO												
			SD-06 Test Reports														
			Instrumentation Installation Form		G RO												
			Settlement Monitoring Readings		G DO												
			Thermistor Data		G DO												
			SD-10 Operation and Maintenance														
			Data														

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		13 51 00	Operation and Maintenance		G DO												
			Manuals for all equipment (five copies each)														
			Manufacturer's Warranty														
			SD-11 Closeout Submittals														
			As-Built Drawings		G DO												
			As-Built Drawings for Settlement		G DO												
			Monitoring Survey Markers														
		25 31 01	SD-02 Shop Drawings														
			Layout and Shop Drawings		G DO												
			SD-03 Product Data														
			Catalog Data		G DO												
			Spare Equipment and Parts Data														
			SD-07 Certificates														
			Manufacturer's Representative		G DO												
			Qualifications														
			SD-10 Operation and Maintenance														
			Data														
			Operating Manuals		G DO												
		26 20 00	SD-02 Shop Drawings														
			Panelboards	2.11	G DO												
			Wireways	2.20	G DO												
			Marking Strips	3.1.7.1	G DO												
			SD-03 Product Data														
			Receptacles	2.10	G DO												
			Circuit breakers	2.11.3	G DO												



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		26 20 00	Switches	2.8	G DO												
			Motor controllers	2.15	G DO												
			Meter base only	2.21	G DO												
			Surge protective devices	2.22	G DO												
			SD-06 Test Reports														
			Grounding system test	3.5.4	G DO												
			Ground-fault receptacle test	3.5.3	G DO												
			SD-10 Operation and Maintenance														
			Data														
			Electrical Systems	1.5.1	G DO												
		26 29 10	SD-02 Shop Drawings														
			Controller, Terminal Leads,														
			Terminal Blocks														
			Motor Nameplates, Equipment														
			and Door Nameplates														
			Controller		G DO												
			Limit Switch		G DO												
			Electric Motor Actuator		G DO												
			Control Stations		G DO												
			Enclosing Case		G DO												
			SD-03 Product Data														
			Electric Motor Actuator		G DO												
			Actuator Motor		G DO												
			Limit Switch		G DO												
			Overload Relays		G DO												
			Controller														

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		26 29 10	Control Stations		G DO												
			Wiring		G DO												
			Spare Parts List														
			Protective Coating List														
			SD-09 Manufacturer's Field														
			Reports														
			Tests	2.18													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance Data		G DO												
		26 31 00	SD-02 Shop Drawings														
			Schematic Diagrams		G DO												
			Interconnection Diagrams		G DO												
			Installation Drawings		G DO												
			SD-03 Product Data														
			Roof Mounting Structure for	2.4	G DO												
			Modules (Racking)														
			Photovoltaic Modules	2.1	G DO												
			SD-05 Design Data														
			System Operation	1.6.3	G DO												
			SD-06 Test Reports														
			Field Test Plan		G DO												
			Field Test Reports		G DO												
			SD-07 Certificates														
			Installer	1.6.4	G DO												
			Materials	1.6.5	G DO												

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		26 31 00	Warranty	1.8	G DO												
			SD-08 Manufacturer's Instructions														
			Installation Instructions		G DO												
			SD-10 Operation and Maintenance														
			Data														
			Electrical Systems	1.6.6.1	G DO												
		26 41 01	SD-02 Shop Drawings														
			Detail Drawings	1.3	G DO												
			SD-07 Certificates														
			Materials	2.2													
		26 51 00	SD-03 Product Data														
			Luminaires	2.1	G DO												
			Lamps		G DO												
			SD-10 Operation and Maintenance														
			Data														
			Operational Service		G DO												
		26 56 00	SD-02 Shop Drawings														
			Luminaire Drawings		G DO												
			Poles	1.4.1.2	G DO												
			SD-03 Product Data														
			Luminaires	1.4.1.1	G DO												
			Luminaires	2.2	G DO												
			Lamps		G DO												
			Photocell switch	2.3	G DO												
			Concrete poles	2.4.1	G DO												
			Aluminum poles	2.4.2	G DO												

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		26 56 00	Steel poles	2.4.3	G DO												
			Brackets	2.5													
			Anchorage system		G DO												
			SD-05 Design Data														
			Design Data for Luminaires	1.4.2	G DO												
			SD-06 Test Reports														
			Operating Test	3.2													
			SD-08 Manufacturer's Instructions														
			Poles	1.4.1.2													
			Foundation Requirements														
			Mounting Details														
			SD-10 Operation and Maintenance														
			Data														
			Operational Service		G DO												
		31 05 19	SD-03 Product Data														
			Thread	2.1.2	G RO												
			Manufacturing Quality Assurance	2.2	G RO												
			Sampling and Testing														
			SD-04 Samples														
			Quality Control Samples and	3.1	G RO												
			Tests														
			SD-07 Certificates														
			Geotextile	2.1.1	G RO												
		31 23 24	SD-01 Preconstruction Submittals														
			Work Plan														
			SD-05 Design Data														

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		31 23 24	CLSM Grout Mix Design		G DO												
			SD-07 Certificates														
			Receipts														
		31 41 16	SD-02 Shop Drawings														
			Metal Sheet Piling	2.1	G DO												
			SD-03 Product Data														
			Driving	3.2.2.2	G DO												
			Pile Driving Equipment	3.2.1	G DO												
			Pulling and Redriving	3.2.5	G DO												
			SD-06 Test Reports														
			Materials Tests	2.3.1	G RO												
			SD-11 Closeout Submittals														
			Pile Driving Record	3.4													
		31 62 13	SD-02 Shop Drawings														
			Installation	3.2	G DO												
			Pile Driving	3.2.2	G DO												
			Wave Equation Analysis	3.1.1	G DO												
			Wave Equation Analysis	3.4.2	G DO												
			Professional Engineer		G DO												
			SD-03 Product Data														
			Pile Driving Equipment	3.3	G DO												
			Epoxy Bonding Compound for	2.3.9	G DO												
			Pile Build-Ups														
			SD-05 Design Data														
			Calculations		G DO												
			SD-06 Test Reports														

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		31 62 13	Pile Dynamic Test Reports		G DO												
			Field Tests and Inspections		G DO												
			Aggregates		G DO												
			Silica Fume		G DO												
			Compressive Strength		G DO												
			Test piles		G DO												
			Load tests		G DO												
			Dynamic Pile Analysis		G DO												
			SD-07 Certificates														
			Aggregates		G RO												
			Admixtures	2.1.1	G RO												
			Silica fume manufacturer's representative		G RO												
			Prestressing steel		G RO												
			Cement		G RO												
			Fly ash and pozzolan		G RO												
			Slag		G RO												
			Epoxy coating		G RO												
			Supporting Data		G RO												
			SD-11 Closeout Submittals														
			Pile records		G DO												
		32 11 23	SD-03 Product Data														
			Offsite Plant, Equipment, and Tools	1.5	G RO												
			Waybills and delivery tickets;	1.6	G RO												
			Aggregate Sources	3.1.2	G DO												

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		32 11 23	SD-06 Test Reports														
			Sampling and Testing	1.3	G RO												
			Field Density Tests	1.3.2	G RO												
		32 92 23	SD-03 Product Data														
			Delivery														
			Finished Grade and Topsoil														
			Topsoil														
			Quantity Check		G RO												
			Sod Establishment Period		G RO												
			Maintenance Record														
			SD-06 Test Reports														
			Equipment Calibration														
			Soil Test														
			SD-07 Certificates														
			Sod														
			Topsoil														
			Fertilizer														
		33 29 00	SD-02 Shop Drawings														
			Well Closure Plan		G DO												
			SD-06 Test Reports														
			Post Construction Well Closure		G DO												
			Report														
			Water Level Summary Report		G DO												
		33 46 13	SD-07 Certificates														
			Materials	2.1	G RO												
		33 71 02	SD-02 Shop Drawings														

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		33 71 02	Precast underground structures	1.4.1	G DO												
			SD-03 Product Data														
			Precast concrete structures	2.9.2.1	G DO												
			Sealing Material	2.9.2.4													
			Handhole frames and covers	2.9.3	G DO												
			Composite/fiberglass handholes	2.9.4	G DO												
			Cable supports	2.10	G DO												
			Pulling-In Irons	3.5.3	G DO												
			SD-06 Test Reports														
			Field Acceptance Checks and Tests	3.14.1	G												
			Cable Installation Plan and Procedure	3.3													
		35 20 16	SD-02 Shop Drawings														
			Detail Drawings	2.3.1	G DO												
			SD-03 Product Data														
			Materials	2.1													
			Materials	2.1													
			Welding	2.3.2.1	G DO												
			Gate Lifting Stem		G DO												
			SD-05 Design Data														
			Gate Component Design		G DO												
			SD-06 Test Reports														
			Tests, Inspections, and Verifications	2.4	G DO												



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		35 20 16	Acceptance Trial Operation and Test Procedures		G DO												
			Acceptance Trial Operation and Test	3.2													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Data														
			Operation and Maintenance Instructions Manual		G DO												
		35 20 17	SD-02 Shop Drawings														
			Detail Drawings	2.3.1	G DO												
			SD-03 Product Data														
			Materials	2.1													
			Materials	2.1													
			Welding	2.3.2.1	G DO												
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			Acceptance Trial Operation and Test	3.2	G DO												
		35 20 18	SD-02 Shop Drawings														
			Detail Drawings	2.3.1	G DO												
			Acceptance Trial Operation and Test Procedures		G DO												
			SD-03 Product Data														
			Materials	2.1													

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		35 20 18	Welding	2.3.2.1	G DO												
			SD-05 Design Data														
			Gate Component Design		G DO												
			SD-06 Test Reports														
			Tests, Inspections, and	2.4													
			Verifications														
			Acceptance Trial Operation and	3.2													
			Test														
			SD-10 Operation and Maintenance														
			Data														
			Operation And Maintenance Data														
			Operation And Maintenance		G DO												
			Instruction Manuals														
		35 31 19	SD-02 Shop Drawings														
			Stone Source		G DO												
			Construction Methods		G DO												
			SD-05 Design Data														
			Survey		G DO												
			SD-06 Test Reports														
			Bulk Specific Gravity		G DO												
			Gradation Test		G DO												
			Evaluation Testing of Stone		G DO												
			Report														
			SD-07 Certificates														
			Weight Scale Certification		G RO												
		35 41 00	SD-02 Shop Drawings														

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		35 41 00	Dewatering Work Plan	3.6	G DO												
			Dewatering Work Plan	3.6.5	G DO												
			Shoring, Sheeting, and Bracing		G DO												
			Excavation	3.7	G DO												
			Plan of Operations		G DO												
			Embankment and Backfill	1.3.1	G DO												
			Materials														
			Survey of Restored Embankment		G DO												
			SD-06 Test Reports														
			Foundation Inspection Checklist		G RO												
			Nuclear Density		G RO												
			Measurement of Fill Material		G RO												
			Testing														
			SD-07 Certificates														
			Testing		G RO												
		35 42 00	SD-03 Product Data														
			Equipment and Plans		G DO												
			SD-06 Test Reports														
			Soil-Bentonite Fill Mix Design and		G DO												
			Laboratory Test Results														
			Calibration Curves		G RO												
			Soil Classification Test		G DO												
			Field Density		G RO												
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			Nuclear Density		G RO												
			SD-07 Certificates														

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CONTRACTOR

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SECTION 01 35 25

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SECTION 01 35 25

OWNER SAFETY REQUIREMENTS - DIVING

PART 1 GENERAL

1.1 SUMMARY

Section covers job specific underwater diving requirements and dive safety.

1.1.1 Related Section

Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

1.2 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. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 Safety and Health Requirements Manual

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

29 CFR 1910.1030 Bloodborne pathogens

1.3 SAFETY AND HEALTH REQUIREMENTS MANUAL

EM 385-1-1 is available at the web site indicated in paragraph REGULATORY REQUIREMENTS of Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. One copy will be provided to Contractor at a Preconstruction Conference (refer to Section 01 30 00 ADMINISTRATIVE PROCEDURES.

1.4 DEFINITIONS

Use definitions found in EM 385-1-1 in transmitted dive plan submittal items.

Dive Supervisor - A person with specialized training or experience in Dive safety.

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 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later:

## SD-01 Preconstruction Submittals

### Dive Operations Plan; G, RO

Refer to paragraphs DIVE PLAN, DIVING OPERATIONS, and DIVE OPERATIONS below.

## SD-07 Certificates

### Dive Personnel Qualifications; G, RO

Qualifications, and training certificates of dive personnel. "Annual" diver physicals shall conform to the requirements of EM 385-1-1. Contractor shall submit only a statement from a licensed physician that states the diver is "Fit To Dive". Submitted physician statement shall contain at a minimum the diver name, examination date, physician's name, physician's signature, physicians' medical license number, and physicians telephone number. The signing physician shall be an MD or an OD. Submitted statement shall NOT contain divers Personal Health Information (PHI) or Personal Identification Information (PII).

First Aid (FA), Cardiopulmonary Resuscitation (CPR) & Emergency Oxygen System (EO2) training shall be in accordance with the EM 385-1-1, Section 03.A.05 and all applicable OSHA regulations. FA, CPR & EO2 training are required to be Hands-on training. Online training will "NOT" be accepted. Proof of Hands-on training shall be provided within this submittal.

Blood-Bourne Pathogen (BBP) Program and "Annual" Training shall comply with the EM 385-1-1 and OSHA 29 CFR 1910.1030, as well as all other applicable regulations. Proof of BBP Program and "Annual" Training shall be provided within this submittal.

## 1.6 DIVE PLAN

Dive plan shall address all requirements of Section DIVING OPERATIONS of EM 385-1-1. See paragraph DIVE OPERATIONS below. An approved Dive Plan and Safe Practices Manual is required on all projects with work on, or over water; see paragraph DIVING OPERATIONS below.

### 1.6.1 Dive Plan Reviewer

Dive Plans shall be submitted by Contractor to Contracting Officer in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Dive Operations Plans are "District Office (DO)" secondary reviewed by Jacksonville District Diving Coordinator or an Alternate. The names and contract information of the Diving Coordinator and Alternate(s) will be provided at the Preconstruction Conference. When a transmittal with a Dive Plan submittal item is delivered to Resident Engineer, send a copy directly to:

#### Delivery Address:

U.S. Army Corps of Engineers - Jacksonville District  
ATTN: CESAJ-CD-Q (Diving Coordinator)  
701 San Marco Blvd  
Jacksonville, FL 32207-8175

Mailing Address is PO Box 4970

U.S. Army Corps of Engineers - Jacksonville District  
ATTN: CESAJ-CD-Q (Diving Coordinator)  
PO Box 4970  
Jacksonville, FL 32232-0019

## 1.7 MEETINGS

### 1.7.1 Phase Meetings

Each Dive shall be treated as a "definable feature of work" in accordance with accepted Quality Control Plan. Perform a Preparatory and Initial Phase meeting for all Dives.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION

### 3.1 EMERGENCY MEDICAL TREATMENT

Arrange with local authorities for emergency dive medical response, treatment and evacuation to medical facility and nearest hyperbaric chamber. Provide map with route directions to nearest hospital and hyperbaric chamber in dive plan Emergency Management Plan required by [EM 385-1-1](#).

### 3.2 DIVING OPERATIONS

Submit a Dive Operations Plan when work is performed on or over water. No matter if a dive is actually planned or only required as a contingency (i.e., most dredging projects) submit a Diving Operations Plan for Contracting Officer's approval. Dive Operations Plan shall cover all requirements in Section DIVING OPERATIONS of [EM 385-1-1](#). Dive Operations Plan consists of a "Safe Practices Manual" describing Contractor's diving program and a "Dive Plan" describing site specific information of proposed dive or contingency dive. Safe Practices Manual, Dive Plan and revisions shall have cover sheets signed and dated by Contractor. When diving is subcontracted, cover sheets shall also be signed and dated by diving contractor's principal or authorized representative.

#### 3.2.1 Dive Operations Execution

Execute dives in accordance with approved Dive Operations Plan submittal; Section DIVING OPERATIONS of [EM 385-1-1](#). Contractor shall submit completed daily dive logs at the end of each dive day. Daily dive logs shall be faxed to District Dive Coordinator 904-232-1590 or his authorized representative. Contractor shall use COE form ENG 4615 and ENG 4616 to record daily diving activities.

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GOVERNMENTAL SAFETY REQUIREMENTS

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/ASSE)

ANSI/ASSE A10.32	(2004) Fall Protection
ANSI/ASSE A10.34	(2001; R 2005) Protection of the Public on or Adjacent to Construction Sites
ANSI/ASSE Z359.1	(2007) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

AMERICAN NATIONAL STANDARDS INSTITUTE/AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ANSI/ASME)

ANSI/ASME B30.22	(2010) Articulating Boom Cranes
ANSI/ASME B30.3	(2009) Tower Cranes
ANSI/ASME B30.5	(2007) Mobile and Locomotive Cranes
ANSI/ASME B30.8	(2010) Floating Cranes and Floating Derricks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2013) Standard for Portable Fire Extinguishers
NFPA 241	(2013) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 51B	(2009; TIA 09-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2015) National Electrical Code
NFPA 70E	(2015) Standard for Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	Safety and Health Requirements Manual
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1919	Gear Certification
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926 Subpart AA	Construction Work in Confined Spaces
29 CFR 1926.1400	Cranes & Derricks in Construction
29 CFR 1926.500	Fall Protection
29 CFR 1926.1427	Operator Qualification and Certification, Cranes and Derricks in Construction
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

1.2 DEFINITIONS

- a. Competent/Qualified Person for Fall Protection. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.
- b. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- c. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even though provided by a physician or registered personnel.
- d. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers and crane walkers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).
- e. Qualified Person for Fall Protection. A person with a recognized degree or professional certificate, and with extensive knowledge, training and experience in the field of fall protection; who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

- f. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
  - (1) Death, regardless of the time between the injury and death, or the length of the illness;
  - (2) Days away from work (any time lost after day of injury/illness onset);
  - (3) Restricted work;
  - (4) Transfer to another job;
  - (5) Medical treatment beyond first aid;
  - (6) Loss of consciousness; or
  - (7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.
- g. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.
- h. Load Handling Equipment (LHE) Accident. A LHE accident occurs when any one or more of the six elements in the operation 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/or collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered an accident even though no material damage or injury occurs. A component failure is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components.

### 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later.

#### SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, DO

\*Activity Hazard Analysis (AHA); G, DO

\*Crane Critical Lift Plan; G, DO

\*Note: Only for activities required to start work. Remaining AHA's shall be submitted in accordance with paragraph ACTIVITY HAZARD ANALYSIS (AHA) below. Remaining Crane Critical Lift Plans shall be submitted in accordance with paragraph ACCIDENT PREVENTION PLAN (APP) below.

## SD-06 Test Reports

### Notifications and Reports

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

### Accident Reports

### Crane Reports

## SD-07 Certificates

### Confined Space Entry Permit

### Hot work permit

### License Certificates

Proof of qualification for Crane Operators; G, DO

### Third Party Certification of Barge-Mounted Mobile Cranes

### Certificate of Compliance (Crane)

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

## 1.4 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, comply with the most recent edition of USACE EM 385-1-1, and all Federal, State, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern. The most recent USACE EM 385-1-1 can be viewed at <http://www.publications.usace.army.mil/USACEPublications/EngineerManuals.aspx>.

## 1.5 SITE QUALIFICATIONS, DUTIES AND MEETINGS

### 1.5.1 Safety Personnel Training

a. The 30-hour OSHA Construction Course will not substitute nor qualify any personnel in meeting the competent or qualified person training or work requirements. On-line 30-hour OSHA Construction Course will not be accepted to meet training requirements.

b. Additional training, experience, hands-on and practical knowledge are required to meet the competent and qualified person requirements in various work activities, fall protection, scaffolding, excavation, trenching, confined space, hazardous communications/hazardous materials, LOCKOUT/TAGOUT (LOTO), respiratory protection, hearing protection, steel erection, spills, lead abatement, asbestos, blasting, critical lifts, and additional work activities listed in the EM 385-1-1. Verification of training will be required and submitted with the Accident Prevention Plan.

## 1.5.2 Personnel Qualifications

### 1.5.2.1 Site Safety and Health Officer (SSHO)

The contractor shall provide a Safety oversight team that includes a minimum of one (1) Qualified Person at each project site to function as the Safety and Health Officer (SSHO). The SSHO shall be at the work site at all times, unless specified differently in the contract, to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor, and their training, experience, and qualifications shall be as required by EM 385-1-1 paragraph 01.A.17 and all associated sub-paragraphs.

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

The Competent/Qualified Person may be the SSHO provided the person meets all the requirements for both SSHO and Competent/Qualified Person.

#### 1.5.2.1.1 Contractor Quality Control (QC) Person:

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

### 1.5.2.2 Qualified Person for Confined Space Entry

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

### 1.5.2.3 Crane Operators

Meet the crane operators requirements in USACE EM 385-1-1, Section 16, and 29 CFR 1926.1427. In addition, for lifting devices (not including those exempted by EM 385-1-1) rated 2,000 pounds or more, mobile cranes with Original Manufacturer (OEM) rated capacity of 50,000 pounds or greater, designate crane operators qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Provide proof of current qualifications. Conduct a review of all licenses, training, certifications and the medical certifications required by EM 385-1-1, Paragraph 16.B.05, every 30 days. Document and maintain a record of each review. Make this review a part of the APP.

## 1.5.3 Personnel Duties

### 1.5.3.1 Site Safety and Health Officer (SSHO)

The SSHO shall:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified

hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily quality control report.

- b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
- c. Maintain applicable safety reference material on the job site.
- d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- e. Implement and enforce accepted APPS and AHAs.
- f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. Post a list of unresolved safety and health deficiencies on the safety bulletin board.
- g. Ensure sub-contractor compliance with safety and health requirements.
- h. Maintain a list of hazardous chemicals on site and their material safety data sheets.
- i. Review all licenses, training, certifications and medical evaluations will be conducted every 30 days. These inspections are to be documented and maintained for record. This requirement shall be part of the Accident Prevention Plan submittal.
- j. Report any mishaps involving crane operations to the Government Designated Authority (GDA) and USACE Safety Office immediately. All crane operations mishap information must be completed, reviewed and forwarded to the USACE Safety Officer within 4 hours of the incident.
- k. Ensure smoking or tobacco use on USACE worksite is in designated areas only.
- l. Perform a daily safety meeting for all activities of the day prior to beginning work, and record meeting on the daily QC report.
- m. Above ground storage tank (AST) shall be coordinated with the local fire department. Any permit or paperwork required shall be documented and provided to the GDA.
- n. Lightning protection/detection devices are required on all LHE, cranes and crane work.
- o. Perform Project Site Safety Trend Analysis: The Site Safety Health Officer (SSHO), Project Manager (PM) and Supervisor(s) shall review and analyze all records, deficiencies and documentation pertaining to the safety and health program. This review will be conducted on a monthly basis and will focus on hazard and injury analysis, and recognition of developing trends. Trend analysis will identify recurring accidents and near-miss incidents resulting in or potentially involving injury, illness, or property damage. The analysis will also recognize repeatedly identified hazards or violations needing corrective actions to establish what plan component(s) is (are) failing that allows the hazard(s) to exist. The SSHO will provide information and recommendations for corrective measures to all contract management



personnel for the trends identified in the project template. Employees will be made aware of the developing trends and hazard exposures as they are recognized. Employees will be solicited and contacted to encourage their inputs in mitigating and reversing any identified trends. Trends of accidents or hazard recurrences will be a focal point for pro-active corrective actions and employee training. Employee training records will be reviewed quarterly to ensure an adequate and effective training program is being accomplished and maintained. Follow-up with employees will be accomplished periodically to establish training retention, effective implementation or additional information needed to update the recognized trends. Meetings shall be documented, including the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Documentation shall be maintained and copies furnished to the GDA on request.

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

#### 1.5.4 Meetings

##### 1.5.4.1 Preconstruction Conference

- a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).
- b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- c. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

##### 1.5.4.2 Safety Meetings

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

#### 1.6 ACCIDENT PREVENTION PLAN (APP)

Use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident

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

Submit the APP to the Contracting Officer no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later. Work cannot proceed without an accepted APP.

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

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

All certifications and/or training certificates will be reviewed by SAJ-SO to include third party training certificates. All third party training will be reviewed and verified. Training certifications for the third party trainer shall be provided. These documents shall be submitted in the Accident Prevention Plan (APP) and the AHA prior to work activity commencing.

Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site. Continuously reviewed and amended the APP, as necessary, throughout the life of the contract. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. The activities shall be detailed and outlined in the APP and AHAs. Qualified person credentials on each safety office activity shall be submitted the Safety Office for review.

#### 1.6.1 EM 385-1-1 Contents

a. Confined Space Entry Plan. Develop a confined and/or enclosed space entry plan in accordance with USACE EM 385-1-1, OSHA standards 29 CFR 1910, 29 CFR 1915, 29 CFR 1926, 29 CFR 1926 Subpart AA, and OSHA Directive CPL 2.100, and any other federal, state and local regulatory

requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by Contractor personnel and the coordination with emergency responders. Identify and provide a listing and map of all confined space(s) located on site. If there is no confined space work, include a statement that no confined space work exists and none will be created.

b. **Crane Critical Lift Plan.** Prepare and sign load handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. Submit 30 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.H. and the following:

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

(2) For barge mounted mobile cranes, barge stability calculations identifying barge list and trim based on anticipated loading; and load charts based on calculated list and trim. The amount of list and trim shall be within the crane manufacturer's requirements. Submit a job specific Naval Architecture Survey for review by the Safety Office.

(3) For installation of Articulated Concrete Block Mattress (ACBM), the Contractor shall submit a detailed lift plan outlining all equipment (including crane, spreader bar, rigging, etc.), layout and procedures that will be used. The plan shall also include documentation showing that the proposed equipment and procedures are in accordance with the manufacturer's recommendations and procedures. The plan shall include all personnel and subcontractors that will be involved in the ACBM installation, their qualifications, and the Contractor's designated safety officer. The lift plan, and all lift operations, shall be in accordance with the requirements outlined in EM 385-1-1, Section 16. The Contractor is responsible for all safety associated with the installation of ACBM.

#### 1.7 **ACTIVITY HAZARD ANALYSIS (AHA)**

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1, Section 1. Submit the AHA for review at least 30 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

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

Develop the activity hazard analyses using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHA for each activity shall be prepared by personnel qualified for that activity. The AHAs will be developed by

the Contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

#### 1.8 DISPLAY OF SAFETY INFORMATION

Within one calendar day after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, shall be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, section 01.A.07. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.

#### 1.9 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.

#### 1.10 EMERGENCY MEDICAL TREATMENT

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

#### 1.11 NOTIFICATIONS and REPORTS

##### 1.11.1 Accident Reports

Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, property damage accidents resulting in at least \$5,000 in damages, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the applicable USACE Accident Report Form 3394, and provide the report to the Contracting Officer within 5 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms. Any mishap involving crane operations will be reported to the GDA and SAJ-SO office immediately. All crane operation mishaps information shall be completed, reviewed and forwarded to SAJ-SO within four (4) hours of the incident. The incident shall be documented in the Contractor's Significant Incident Report (CSIR). Provide to the SO a crane and/or rigging incident/accident notification form within 24 hours of the incident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the Contracting Officer. All "near misses" shall be reported to SAJ-SO and investigated. A preliminary action notification (PAN) shall be forwarded to SAJ-SO. Report non-recordable incidents (accidents) within four (4) hours of the incident.

##### 1.11.2 Crane Reports

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

### 1.11.3 Certificate of Compliance

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

### 1.11.4 Third Party Certification of Barge-Mounted Mobile Cranes

Certify barge-mounted mobile cranes in accordance with 29 CFR 1919 by an OSHA accredited person.

### 1.12 HOT WORK

Submit permits required by state and local laws and regulations prior to performing "Hot Work". The Contractor shall provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall have current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on hot work permits.

### 1.13 RADIATION SAFETY REQUIREMENTS

License Certificates for radiation materials and equipment shall be submitted to the Contracting Officer and Radiation Safety Office (RSO) for all specialized and licensed material and equipment that could cause fatal harm to construction personnel or to the construction project.

### 1.14 FACILITY OCCUPANCY CLOSURE

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

### 1.15 SEVERE STORM PLAN

The Contractor shall submit, as part of the Accident Prevent Plan, a Severe Storm Plan, which fulfills all the requirements of Paragraph 19.A.03, USACE EM 385-1-1.

### 1.16 CONFINED SPACE ENTRY REQUIREMENTS.

Contractors entering and working in confined spaces while performing general industry work are required to follow the requirements of OSHA 29 CFR 1926 and comply with the requirements in Section 34 of EM 385-1-1, OSHA 29 CFR 1910, OSHA 29 CFR 1910.146, and OSHA 29 CFR 1926 Subpart AA.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 CONSTRUCTION AND OTHER WORK

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

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be worn by each person.

Mandatory PPE includes:

- a. Hard Hat
- b. Appropriate Safety Boots
- c. Reflective Vests

3.1.1 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-isocyanates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval.

3.1.2 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e. 29 CFR Part 1910.1000). If 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. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Apply for utility outages at least 10 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination

meeting with the Contracting Officer and the Public Utilities representative to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

### 3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

The Contractor is required to review, ensure that each employee is familiar with, and comply with all areas of the LOTO program referenced in EM 385-1-1, Section 12. Additionally, the Contractor must meet all OSHA requirements of 29 CFR 1910.147. The complete Accident Prevention Plan must include electrical, mechanical and mechanized equipment to include all construction heavy equipment, power tools, batteries, etc. The Contractor's LOTO program shall be submitted with the Accident Prevention Plan.

### 3.4 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

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

#### 3.4.1 Training

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

#### 3.4.2 Fall Protection Equipment and Systems

Enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, Paragraphs 21.O. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ANSI/ASSE A10.32.

##### 3.4.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI/ASSE Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and

specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 6 feet. The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

#### 3.4.3 Fall Protection for Roofing Work

Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed 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, protect personnel from falling by use of personal fall arrest systems, guardrails, or safety nets.
- (2) For work greater than 6 feet from an edge, erect and install warning lines in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

##### b. Steep-Sloped Roofs: Work on steep-sloped roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

#### 3.4.4 Horizontal Lifelines

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

#### 3.4.5 Guardrails and Safety Nets

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

#### 3.4.6 Rescue and Evacuation Procedures

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

### 3.5 SCAFFOLDING

Provide employees 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 scaffold platforms greater than 20 feet maximum in height by use of a scaffold stair system. Do not use



vertical ladders commonly provided by scaffold system manufacturers for accessing scaffold platforms greater than 20 feet maximum in height. The use of an adequate gate is required. 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. Give special care 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. Place work platforms 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.

### 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.
- d. All heavy equipment operators to include excavators, front-end loaders, dump trucks, and compactors shall be evaluated by a competent/qualified person prior to starting work. The SSHO will maintain all records of this training. The training plan/outline will include hazards identified in the owner's manual.

#### 3.6.2 Load Handling Equipment (LHE)

- a. Equip cranes and derricks as specified in EM 385-1-1, section 16 and in accordance with 29 CFR 1926.1427.
- b. Notify the Contracting Officer 30 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. Prior to all cranes entering a USACE project for the first time, the crane information along with a standard lift plan or critical lift plan shall be submitted to GDA for approval. Crane information shall include the crane capacity, copy of the current inspection, the credential for the qualified person that performed the inspection and the credential for the qualified operator.
- c. Comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person

(as defined in ANSI/ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.

- d. Comply with ANSI/ASME B30.5 for mobile and locomotive cranes, ANSI/ASME B30.22 for articulating boom cranes, ANSI/ASME B30.3 for construction tower cranes, and ANSI/ASME B30.8 for floating cranes and floating derricks.
  - e. Under no circumstance shall a Contractor make a lift at or above 90 percent of the cranes rated capacity in any configuration.
  - f. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and follow the requirements of USACE EM 385-1-1 Section 11 and ANSI/ASME B30.5 or ANSI/ASME B30.22 as applicable.
  - g. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane. No other item shall be lifted with the crane while the work platform is in use (lifting a worker).
  - h. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.
  - i. All employees must keep clear of loads about to be lifted and of suspended loads.
  - j. Use cribbing when performing lifts on outriggers.
  - k. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
  - l. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.
  - m. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.
  - n. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.
  - o. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).
  - p. Lightning Protection/Devices are required on all Load Handling Equipment, Cranes, Crane Work.
- 3.6.3 Equipment and Mechanized Equipment
- a. Proof of qualifications for operator 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.  
Incorporate such additional safety precautions or requirements into the  
AHAs.

#### 3.6.4 USE OF EXPLOSIVES

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

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

#### 3.7 EXCAVATIONS

Soil classification must be performed by a competent/qualified person in accordance with 29 CFR 1926 and EM 385-1-1.

##### 3.7.1 Utility Locations

All underground utilities in the work area must be positively identified by a third party, independent, private utility locating company in addition to any station locating service and coordinated with the station utility department.

##### 3.7.2 Utility Location Verification

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

##### 3.7.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

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

#### 3.8 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 will 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 boots, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

### 3.8.2 Portable Extension Cords, Generators and Tools

Size portable extension cords in accordance with manufacturer ratings for the tool to be powered and protected from damage. Immediately remove from service all damaged extension cords. Portable extension cords shall meet the requirements of EM 385-1-1, NFPA 70E, and OSHA electrical standards. All portable generators shall be in compliance with National Electrical Code (NFPA 70) Article 250-34. All portable energized power tools shall be connected to Ground Fault Interrupter GFI receptacles or Ground Fault Circuit Interrupter (GFCI). At the disposal site, portable equipment, floodlights, and work lights shall be grounded to comply with EM 385-1-1, Section 11.D.01.f. The protective ground shall be maintained during relocation unless circuits are de-energized.

### 3.9 WORK IN CONFINED SPACES

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

- a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 34 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space

shall be reviewed with each employee during review of the AHA.

- b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its action level.
- c. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

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SECTION 01 45 04

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 QUALITY CONTROL SYSTEM (QCS)

Contractor shall use Government-furnished "Quality Control System (QCS)" software. There is no separate payment for using QCS. Include all costs in pricing work. Download Quality Control System software, user manual, and updates from web site <http://rms.usace.army.mil>. Software and hardware requirements and download instructions are indicated in the QCS Manual on this web site. Upon download, provide "QCS Site ID" number to Contracting Officer (Area Office RMS Administrator). QCS is used to share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

QCS/RMS data file imports and exports are how all payments, schedule changes, transmittal tracking, submittal review, quality control reporting, requests for information (RFI), punch list items, and warranty management are processed.

1.1.1 QCS Forms and Signatures

QCS generates electronic forms and reports. For ease and speed of communications, both Government and Contractor will, exchange these documents in electronic format. Provide signed and dated paper copies of transmittals, pay requests and other contract records when directed. Signed paper documents will govern, when there is a conflict with electronic version.

1.1.2 QCS Software

QCS is Windows-based application that can be run stand-alone or be networked. At Notice Of Award, download QCS software from website. See download tutorial at <http://rms.usace.army.mil>. Download QCS updates when notified. Download "power user" default user name is "SYSDBA" and password is "masterkey".

1.1.3 Help Support

Contractor should contact following help phone numbers for assistance.

Step 1 - Call your Area Office RMS Administrator:

Area Office RMS Administrators:

North Florida - 904-232-3818



Gulf Coast - 813-831-4894  
South Florida - 561-472-3533  
San Juan - 787-707-6165 x3008

Step 2 - Call RMS Help Desk 760-247-0217

#### 1.1.1.4 Contract Database

Prior to pre-construction conference, Contracting Officer will provide Contractor with the RMS contract ID. The Contractor shall then download the initial RMS export file from the QCS SFTP repository. This will appear as "full export" file for Contractor to "add" and create a QCS contract file. Contracting Officer will provide "QA Data" export updates to Contractor on a regular basis. In order to correctly link QCS data and schedule Contractor must first build "Features" and "Subcontractor" and then use these to link Pay Activities. Prior to submission of the initial project schedule, fill in data for Administrations; Prime Contractor, Subcontractors, Pay Activities, Activity Schedule, Features Schedule, and export it to Contracting Officer.

##### 1.1.1.4.1 Schedule Standard Data Exchange

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. A template SDEF compatible schedule backup file (sdef.prx) is available on the QCS website:  
<http://rms.usace.army.mil>. The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per Day
2	RESP	4	Responsible Party (e.g. GC, subcontractor, USACE)
3	AREA	4	Area of Work
4	MODF	6	Modification or REA number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of Work
7	CATW	1	Category of Work
8	FOW1	10	Feature of Work (used up to 10 characters in length)
9	FOW2	10	Feature of Work (used up to 20 characters in length)
10	FOW3	10	Feature of Work (used up to 30 characters in length)

#### 1.1.1.5 Database Maintenance

Establish, maintain, and update contract data for duration of contract. Update QCS database each workday. Ensure sufficient resources are available to maintain QCS database, and to provide regular database updates. QCS shall be an integral part of the Contractor's management of quality control. At least monthly, generate and submit an export file to Government with schedule update and progress payment request. Submit data updates to the Government (e.g., daily reports, submittals, RFI's, schedule updates, payment requests, etc.) using the Government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, e-mail or CD-ROM may be used instead of the QCS SFTP repository (see Paragraph DATA SUBMISSION VIA CD-ROM). The QCS database typically includes current data on the following items:

#### 1.1.5.1 Administration

a. Contractor Information. Contain within the database the Contractor's name, address, telephone numbers, management staff, and other required items.

b. Subcontractor Information. Contain within the database 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. Assign each subcontractor/trade a unique Responsibility Code, provided in QCS.

c. Correspondence. Identify all Contractor correspondence to the Government with a serial number. Prefix correspondence initiated by the Contractor's site office with "S". Prefix letters initiated by the Contractor's home (main) office with "H". Letters must be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

d. Equipment. Contain within the Contractor's QCS database a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

e. 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.

f. Request for Information (RFI). Exchange all Requests For Information (RFI) using the Built-in RFI generator and tracker in QCS.

#### 1.1.5.2 Finances

a. Pay Activity Data. Include within the QCS database a list of pay activities that the Contractor must develop in conjunction with the construction schedule. The sum of all pay activities must be equal to the total contract amount, including modifications. Group pay activities Contract Line Item Number (CLIN); the sum of the activities must equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

b. Payment Requests. Prepare all progress payment requests using QCS. Complete the payment request worksheet, prompt payment certification, and payment invoice in QCS. Update the work completed under the contract, measured as percent or as specific quantities, at least monthly. After the update, generate a payment request report using QCS. Submit the payment request, prompt payment certification, and payment invoice with supporting data using the Government's SFTP repository built into QCS export function. If permitted by the Contracting Officer, e-mail or a CD-ROM may be used. A signed paper copy of the approved payment request is also required, which will govern in the event of discrepancy with the electronic version.

#### 1.1.5.3 Quality Control

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. Maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. Within seven calendar days of Government acceptance, submit a QCS update reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

a. 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 must be the Contractor's official report. Summarize data from any supplemental reports by the Contractor and consolidate onto the QCS-generated Daily CQC Report. Electronically submit reports to the Government within 24 hours after the date covered by the report. Also provide the Government a signed, printed copy of the daily CQC report.

b. Deficiency Tracking. Use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. 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. Regularly update the correction status of both QC and QA punch list items.

c. QC Requirements. Develop and maintain a complete list of QC testing and required structural and life safety special inspections required by the International Code Council (ICC), transferred and installed property, and user training requirements in QCS. Update all data on these QC requirements as work progresses, and promptly provide this information to the Government via QCS.

d. Three-Phase Control Meetings. Maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

e. Labor and Equipment Hours. Log labor and equipment exposure hours on a daily basis. This data will be rolled up into a monthly exposure report.

f. Accident/Safety Reporting. 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. Regularly update the correction status of the safety comments. In addition, 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 300.

g. Features of Work. 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.

h. Hazard Analysis. Use QCS to develop a hazard analysis for each feature of work included in the CQC Plan. Address any hazards, or potential hazards, that may be associated with the work.

i. Warranty. The Government will issue warranty items whenever warranty deficiencies are observed. The Government's warranty comments will be included in its export file to the Contractor during the warranty period. Update the scheduled correction date, actual correction date, and correction status under Contractor remarks. Response times shall comply with warranty requirements outlined in the approved warranty management plan.

j. Three-Phase Inspection Checklists. Use QCS to create and maintain all three-phase inspection checklists.

k. Subcontractors. Use QCS to track subcontractors. Record subcontractors working on site on each daily QC report.

#### 1.1.5.4 Submittal Management

The Government will provide the initial submittal register in electronic format. Thereafter, 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. Use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update must be produced using QCS. QCS and RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

#### 1.1.5.5 Schedule

Develop a construction schedule consisting of pay activities, in accordance with Section 01 32 01 PROJECT SCHEDULE. Input and maintain this schedule in the QCS database. Include with each pay request the updated schedule.

#### 1.1.5.6 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 from RMS.

#### 1.1.6 Implementation

Contractor use of QCS as described in the preceding paragraphs is mandatory. 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.

#### 1.1.7 Data Submission Via CD-ROM

The Government-preferred method for Contractor's submission of QCS data is by using the Government's SFTP repository built into QCS export function. Other data should be submitted using E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of CD-ROM for data transfer. Export data onto CDs using the QCS built-in export function. If used, submit CD-ROMs in accordance with the following:

##### 1.1.7.1 File Medium

Submit in English required data on CD-ROM conforming to industry standards used in the United States.

#### 1.1.7.2 CD-ROM Labels

Affix a permanent exterior label to each CD-ROM submitted. Indicate on the label 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.

#### 1.1.7.3 File Names

The files will be automatically named by the QCS software. The naming convention established by the QCS software must not be altered.

#### 1.1.8 Monthly Coordination Meeting

Update the QCS database each workday and export to the QCS SFTP repository. At least monthly, 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, meet with the Government representative to review the planned progress payment data submission for errors and omissions.

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.

### 1.2 DEFINITIONS

#### 1.2.1 Contractor's Representative (Site Superintendent or Project Manager)

Highest level manager located onsite and responsible for site construction and related activities, including quality, safety, environmental protection and production.

#### 1.2.2 Definable Features of Work

Construction task separate and distinct from other tasks and having separate control requirements. A definable feature of work may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. An example for Concrete would be: formwork, placement, finish, curing.

#### 1.2.3 Quality Control System Manager

A person assigned duties to manage Contractor's Quality Control (CQC) system. CQC System Manager shall have written delegated authority sufficient to stop non-conforming work.

#### 1.2.4 Quality Control Staff

Persons assigned CQC functions and performing quality control activities. CQC Staff members may be employees of Contractor, subcontractors, testing laboratories, product representatives; however, CQC Staff are working under direction of CQC System Manager.

#### 1.2.5 Safety Officer

Person assigned responsibility for site safety management. The Safety Officer shall have no other duties. See Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

#### 1.2.6 Qualified Scheduler

Person assigned responsibility for the preparation of the schedule, all required schedule updates, and preparation of all required schedule reports.

### 1.3 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.

#### ASTM INTERNATIONAL (ASTM)

ASTM C1077 (2013) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

ASTM D3740 (2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM E329 (2011c) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

#### U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (1995) Administration -- Progress, Schedules, and Network Analysis Systems

ER 1110-1-261 (1999) Quality Assurance of Laboratory Testing Procedures

ER 1180-1-6 (1995) Construction Quality Management

Corps of Engineers publications Internet location site is:  
<http://www.publications.usace.army.mil/>.

### 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. Submittals shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later.

#### SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan; G, RO

Contractor's plan describing proposed Quality Control System including organization and procedures to plan and execute quality control activities.

Initial Work Schedule; G, RO

Contractor's work schedule (shifts, days, hours) shall be submitted to the Contracting Officer for approval. The Contracting Officer shall be notified 48 hours prior to any temporary changes in this schedule. Permanent changes to Initial Work Schedule shall be resubmitted.

SD-07 Certificates

Laboratory Qualifications; G, RO

Submit laboratory qualifications as specified in subparagraph "Testing Laboratories" below.

Letter of Authority

Letter to CQC System Manager signed by an authorized Contractor official which describes responsibilities and delegates sufficient authorities to perform functions of the CQC System Manager, including authority to stop work not in compliance with contract.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 GENERAL

Contractor is responsible to plan and execute quality control in accordance with ER 1180-1-6. Establish and maintain an effective quality control system in compliance with the Clause INSPECTION OF CONSTRUCTION of Section 00700 CONTRACT CLAUSES in Volume 1. Quality control system consists of plans, procedures, and organization necessary to produce a quality end product that complies with contract. Quality control system shall cover all construction operations, both onsite and offsite activities, and be keyed to definable features of work, construction sequence and schedule. Project Manager/Superintendent is responsible for quality of work and is subject to removal by Contracting Officer for non-compliance with contract quality requirements. Project Manager/Superintendent shall be onsite at all times, except as otherwise approved by the Contracting Officer.

3.2 CONTRACTOR QUALITY CONTROL (CQC) PLAN

Upon receiving Notice of Award, prepare a CQC Plan specific to project organization, site, and features of work. Describe proposed procedures to implement requirements of Clause INSPECTION OF CONSTRUCTION of Section 00700 CONTRACT CLAUSES in Volume 1. After a Preconstruction Conference, Contracting Officer will schedule a Coordination Meeting (see paragraph COORDINATION MEETING below). Contractor's CQC Plan will be discussed in detail by onsite personnel from Contractor and Contracting Officer. Contracting Officer may accept an "interim CQC Plan" under a "conditional acceptance" for first 30 days of operation when CQC Plan first applicable

definable features of work are acceptable. Contractor shall furnish, not later than 30 calendar days after commencement of work, an acceptable overall CQC Plan.

### 3.2.1 General

No later than 20 calendar days after award or 5 calendar days after Notice to proceed, whichever is later, submit a written CQC Plan for review and acceptance by Contracting Officer. CQC Plan submittal will be reviewed by Contracting Officer and discussed in detail at the Coordination Meeting. See paragraph COORDINATION MEETING below. Fully describe proposed procedures to implement requirements of Clause INSPECTION OF CONSTRUCTION of Section 00700 CONTRACT CLAUSES in Volume 1. CQC Plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. Contracting Officer may accept an "interim CQC Plan" under a "conditional acceptance" for first 30 calendar days of operation when construction quality control planning for first definable features of work are acceptable. Contractor shall furnish, not later than 30 calendar days after commencement of work, an acceptable overall CQC Plan.

#### 3.2.1.1 CQC Plan Resubmittal

No construction will be allowed to start until an "interim CQC Plan" is "conditionally accepted". When an "interim CQC Plan" is "conditionally accepted", revise and resubmit overall project CQC Plan for Contracting Officer's acceptance. When Contractor is working under an "interim CQC Plan", until Contractor submits an acceptable final CQC Plan, Contracting Officer will retain funds from progress payments in accordance with Clause PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section 00700 CONTRACT CLAUSES in Volume 1. When no acceptable CQC Plan is resubmitted within a reasonable time, as determined by Contracting Officer, Contracting Officer may order Contractor to stop work until such time as a CQC Plan is accepted. Such a directed stop work order shall not be considered a suspension of work under Clause SUSPENSION OF WORK of Section 00700 CONTRACT CLAUSES in Volume 1. No pay or construction period adjustments will be allowed as a result of a directed stop work order based on Contractor inability to plan quality control in a manner acceptable to Contracting Officer.

#### 3.2.1.2 Failure

Failure to comply with above requirements within time prescribed will be considered a condition endangering contract performance and may be considered grounds for termination of contract in accordance with Clause DEFAULT (FIXED-PRICE CONSTRUCTION) of Section 00700 CONTRACT CLAUSES in Volume 1.

### 3.2.2 Content of CQC Plan

CQC Plan shall cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. Describe Quality Control Organization: Include an Organization Chart with lines of authority and reporting. CQC Staff shall include a CQC System Manager who shall perform his duties. For CQC matters, CQC System Manager shall directly report to Contractor other than Project Manager/Site Superintendent.



b. Definable Features of Work: Although each section of specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. A definable feature of work list will be agreed upon during the Coordination Meeting.

c. CQC Staff Qualifications: Names, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function. If included, see paragraph LIMITATIONS ON SUBSTITUTIONS FOR CERTAIN POSITIONS AND/OR SUBCONTRACTORS of Section 00800 SPECIAL REQUIREMENTS in Volume 1.

d. Letter of Authority: Copy of Letter of Authority to CQC System Manager. CQC System Manager shall issue letters of direction to other quality control staff describing duties, authorities, and responsibilities.

e. Submittal Control: Procedures for scheduling, reviewing, certifying, and managing submittals, including submittal items from subcontractors, offsite fabricators, suppliers, and purchasing agents. Procedures shall be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

f. Testing: Control, verification, and acceptance testing procedures. Provide a list of specific tests. Provide information including test type or testing standard, specification paragraph requiring test, feature of work being tested, test frequency, and identify who (i.e., Contractor, subcontractor, Testing Laboratory) is responsible for each test (Laboratory facilities must be approved by the Contracting Officer).

g. Three-Phase Control: Procedures to implement three-phase quality control system. Procedures to plan and document preparatory, initial, and follow-up control phases.

h. Deficiency Tracking: Procedures for tracking construction deficiencies from identification through acceptable corrective action. Establish procedures that verify deficiencies have been corrected and document correction.

i. Reports and Forms: Reporting procedures, including proposed reporting formats and sample forms.

j. Table of Contents: Pages of the QC plan shall be numbered, including appendices. Table of contents shall be provided. Sections of the plan and all appendices shall be indexed in the table of contents.

### 3.2.3 Acceptance of Plan

"Conditional acceptance" of a Contractor's "interim CQC Plan" is required prior to start of construction. Within a specified period after commencement of work, Contractor's overall CQC Plan requires Contracting Officer's acceptance or work is subject to a stop work directive. Contracting Officer's acceptance is conditional and is contingent on satisfactory performance during the construction. Contracting Officer reserves the right to require Contractor to make changes in his CQC Plan and construction operations, including removal of personnel, in order to obtain required contract quality.

### 3.2.4 Notification of Changes

Submit to the Contracting Officer in writing a minimum of 30 calendar days prior to CQC Plan procedure changes. Proposed changes are subject to Contracting Officer acceptance.

### 3.3 COORDINATION MEETING

Refer to Section 01 30 00 ADMINISTRATIVE PROCEDURES. Contracting Officer will schedule a Coordination Meeting where Contractor, CQC Staff, and Contracting Officer will develop a mutual understanding of Contractor's CQC Plan with Contracting Officer's Quality Assurance. CQC Plan will be discussed in detail, including forms for recording CQC operations, control activities, testing, administration of the system for both onsite and offsite work. Contractor's quality control both onsite and offsite, safety and environmental protection and supervision by Quality Control personnel will be discussed. Meeting minutes will be prepared by Contracting Officer and signed by both parties. Minutes will become part of contract files. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in CQC system or procedures requiring corrective action.

### 3.4 QUALITY CONTROL ORGANIZATION

#### 3.4.1 General

CQC Organization shall have a CQC System Manager, and sufficient number of additional qualified personnel to ensure contract quality control for workmanship and materials, including safety and environmental protection compliance. Designate a Safety Officer who shall serve as a member of CQC Staff. Personnel identified in other contract sections as requiring specialized skills to assure work is performed properly shall also be included as part of CQC Organization. Contractor's CQC Staff shall be present onsite during work and shall have authority and responsibility to ensure contract compliance. CQC Staff shall be subject to acceptance by Contracting Officer. Provide office space, filing systems and other resources as necessary to maintain an effective and functional CQC Organization. Complete records of letters, transmitted submittal items, shop drawings, progress schedules, changes to contract drawings, test results, and other project documentation shall be given promptly furnished to CQC Organization by Contractor. CQC Organization shall be responsible to maintain these documents and records onsite, unless otherwise approved by Contracting Officer.

#### 3.4.2 CQC System Manager

Appoint a CQC System Manager, an individual employed by Contractor, within onsite organization who shall be responsible for CQC management. CQC System Manager shall have authority to act in all CQC matters for Contractor. CQC System Manager shall be an experienced construction person with a minimum of 5 years in related work or a graduate engineer, graduate architect, or graduate of a college level construction management course of study, with a minimum of 3 years construction experience on construction similar to this contract. In the CQC Plan identify an alternate for CQC System Manager to manage CQC during CQC System Manager's absences. Designated alternate shall be a construction person with a minimum three years experience on similar projects and shall meet CQM-C Training requirement below. CQC System Manager or designated alternate shall be

onsite during construction. CQC System Manager and Alternate CQC System Manager shall be assigned no other duties.

### 3.4.3 Qualified Scheduler

Provide a Qualified Scheduler who will be responsible for the preparation of the schedule and all required updating and preparation of reports. The Qualified Scheduler shall be part of the QC staff. The resume of the Qualified Scheduler shall be provided as part of the CQC Plan for Government review and acceptance. The scheduler shall be experienced in scheduling and have previously developed, created, and maintained at least 2 electronic schedules for projects similar in nature and complexity to this project. The scheduler shall be experienced in the use of scheduling software that meets the requirements this contract and is used by the Contractor.

### 3.4.4 CQC Personnel

In addition to CQC personnel specified elsewhere in contract, Contractor shall provide as part of CQC Organization specialized personnel to assist CQC System Manager for the following areas: Individuals may be employees of Contractor, Supplier Product Representative or subcontractor employee as needed; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have necessary education and experience in accordance with experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the CQC Plan.

#### Experience Matrix

Area/Discipline	Qualifications
a. Geotechnical Engineer	Registered Engineer with ten (10) years specialized experience in construction of embankments and dewatering systems (see subparagraph "Geotechnical Engineer" below).
b. Concrete Inspector	American Concrete Institute Certified Concrete Construction Special Inspector.
c. Concrete Field Technician	American Concrete Institute Certified Concrete Field Testing Technician Grade 1.
d. Soils Field Technician	Certified materials technician with five (5) years specialized experience with field testing of soils.
e. Field Welding Inspector	American Welding Society Certified Welding Inspector.

In addition, the CQC staff shall include a qualified scheduler who will be responsible for the preparation of the schedule and all required updating and preparation of reports. The scheduler shall be experienced in scheduling and have previously developed, created, and maintained at least 2 electronic schedules for projects similar in nature and complexity to this project. The scheduler shall be experienced in the use of scheduling

software that meets the requirements of this contract.

It is the Contractor's responsibility to ensure that the CQC specialists are aware of their areas of responsibility, and are present during work on their areas of responsibility. Any specialist and activities where the specialist shall be present are indicated below at the discretion of the Government.

#### 3.4.4.1 Geotechnical Engineer

The geotechnical engineer shall be present for, a minimum and not limited to, initiation of earthen plug and steel pile cofferdam construction, settlement plates and survey markers installation, dewatering system installation, excavation inspection, soil-bentonite core and filter soil placement, embankment fill placement, and to perform periodic inspections during the phases of construction related to the discipline.

#### 3.4.5 CQM-C Training Requirement

CQC System Manager and alternate shall have completed U.S. Army Corps of Engineers (COE) course "Construction Quality Management For Contractors" within the previous 5 years. A completion certificate from any Corps District or Naval Facilities Command is acceptable. In event proposed CQC System Manager has not completed "Construction Quality Management for Contractors" (CQM-C) training, he or she shall complete this course prior to commencement of work. The Contractor will not be permitted to commence work until these training requirements have been satisfied. Any delays attributable to the Contractor's failure to comply with these pre-work requirements shall be at the Contractor's expense and may be cause for remedial action by the Contracting Officer. CQM-C is periodically offered by Jacksonville District. Information regarding course can be obtained by contacting Chief, Quality Assurance Branch at 904-232-1128.

#### 3.4.6 Organizational Changes

When CQC Staff changes are needed, revise CQC Organization Chart in CQC Plan to reflect changes and submit changes to Contracting Officer for acceptance.

### 3.5 SUBMITTALS AND DELIVERABLES

Submittals shall be prepared and transmitted as specified in Section 01 33 00 SUBMITTAL PROCEDURES. CQC Organization shall certify submittals comply with contract requirements. Items delivered to Contracting Officer shall be controlled, packaged, transported and stored in a manner to prevent damage or loss. Deliverables including quality control documentation, invoices, correspondence shall be controlled to prevent loss or delays.

### 3.6 CONTROL

Contractor Quality Control is the means by which Contractor ensures construction, including that of subcontractors and suppliers, complies with contract. Conduct Preparatory Phase and Initial Phase meetings for each definable feature of work (Refer to Section 01 30 00 ADMINISTRATIVE PROCEDURES). At least three phases of control shall be conducted by the CQC System Manager for each definable feature of the construction work as follows:

### 3.6.1 Preparatory Phase

Preparatory Phase shall be performed prior to beginning work on each definable feature of work. Notify Contracting Officer at least 48 hours in advance of beginning preparatory control phase. Ensure proposed plans, activity hazard analyses, permits and submittals, are approved and copies are onsite. Conduct a Preparatory Phase meeting headed by CQC System Manager and attended by Superintendent, other CQC personnel, and foremen responsible for supervising workmanship for definable feature of work. Document Preparatory Phase actions using "Preparatory Phase Checklist" and meeting minutes prepared by CQC System Manager. Attach checklist and minutes to Contractor's Quality Control (CQC) Report (sample CQC form is on any of the web sites indicated at the end of this Section). Preparatory Phase actions include:

- a. Review each paragraph of specifications, reference codes, and standards. Review copies of referenced codes and standards applicable to work to be accomplished. Make copies available for use by Contracting Officer personnel and Contractor CQC Staff at Preparatory Phase meeting. Maintain copies available until final acceptance of work.
- b. Review of contract drawings.
- c. Check to assure that all materials and equipment have been tested, submitted, and approved.
- d. Review provisions that have been made to provide required control inspection and testing.
- e. Examine work area to assure required preliminary work is complete and in compliance with contract.
- f. Inspect materials, equipment, and sample work to assure that they are on hand, conform to approved or information only submittal items, and are properly stored.
- g. Review of activity hazard analysis to assure safety requirements are met.
- h. Discuss procedures for controlling quality of the work including preventing repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. Check to ensure that portion of plan for work to be performed has been accepted by Contracting Officer.
- j. Discuss initial control phase.

### 3.6.2 Initial Phase

Notify Contracting Officer at least 24 hours in advance of beginning the Initial Phase. Initial Phase is workmanship oriented and shall be accomplished at the beginning of physical work on a definable feature of work. CQC Staff, testing personnel, foremen, workers shall attend an "Initial Phase Meeting" conducted by CQC System Manager. Exact location of Initial Phase actions shall be indicated for future reference and comparison with follow-up phases. Document "Initial Phase Meeting" using an Initial Phase Checklist and minutes prepared by CQC System Manager.

Sample Initial Phase Checklist is on any of the web sites indicated at the end of this Section. Attach checklist and minutes to Contractor's Quality Control (CQC) Report (sample CQC form is on any of the web sites indicated at the end of this Section). Initial Phase actions include:

a. Check preliminary work to ensure that it complies with contract. Review minutes of 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 contract 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 activity analysis with each worker.

f. Initial Phase shall be repeated for new crews working onsite, and when contract workmanship quality standards are not being met.

### 3.6.3 Follow-up Phase

Follow-up Phase consists of daily checks performed to assure quality control activities, including testing, to provide continued compliance with contract requirements, until feature of work is complete. Record inspection and check results in CQC documentation. Complete follow-up checks and inspections and correct deficiencies prior to starting features of work which may be affected by deficient work. No non-conforming work shall be concealed to build upon.

### 3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on same definable features of work when: quality of on-going work is unacceptable; there are changes in applicable CQC Staff, production supervision or work crews; work on a definable feature is resumed after a period of inactivity; or, when other problems develop. Contracting Officer may direct additional phase meetings as needed to assure contract compliance.

## 3.7 TESTS

### 3.7.1 Testing Procedure

Perform specified or required tests to verify that control measures are adequate and provide an end product conforming to contract. When requested, Contractor shall furnish Contracting Officer duplicate samples of test specimens for possible testing by Contracting Officer. Testing includes operation and acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor 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. Results of tests shall include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. For soil density tests, test results shall include dry density found by test, moisture content found by test, proctor optimum water content, proctor maximum density and proctor reference number. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer within 24 hours of receipt by the Contractor. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

### 3.7.2 Testing Laboratories

The Contractor's proposed testing labs require Contracting Officer approval. Submit [laboratory qualifications](#) including:

- a. Laboratory name, address, point of contact and phone number.
- b. Experience and background of technical personnel in resume format.
- c. Provide most recent external inspection report.

#### 3.7.2.1 Laboratory Requirements and Validations

a. Materials Testing Labs: Provide material testing laboratories validated by Corps of Engineers Materials Testing Center in accordance with [ER 1110-1-261](#). Labs used for testing soils, concrete, and steel shall meet criteria detailed in [ASTM C1077](#), [ASTM D3740](#), and [ASTM E329](#). A list of currently Corps validated material laboratories is available by accessing the Internet website "<http://www.erdc.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/9254/Article/476661/materials-testing-center.aspx>" and clicking the link "Validated Laboratories". If the Contractor proposes a material testing lab not currently validated by Corps of Engineers, Contractor shall pay costs for Corps lab inspection and validation. Cost will be deducted from contract amount due Contractor. Inspection and validation for material testing labs, required onsite inspection, and audit of quality control records costs \$5,500 per lab. Validation process requires labs to describe deficiency correction and respond within 30 days after receiving inspection report. Reinspection costs will be deducted from contract.

b. Onsite Laboratory: Onsite laboratory shall meet inspection validation requirements outlined above. Contracting Officer reserves the right to use Contractor's onsite testing lab and equipment to make quality assurance tests, check Contractor's testing procedures, techniques, and test results at no additional cost to the Contracting Officer.

c. Water Quality Labs: Water testing labs usually only require quality control record inspection to assure capability to perform contract tests in accordance with testing standards listed in Appendix A of [ER 1110-1-261](#). Contracting Officer reserves right to inspect lab, equipment and personnel qualifications in proposed water quality labs for compliance with standards specified in contract specifications. An inspection will include checking lab technician's testing procedures and techniques. Contracting Officer will pay for first inspection; reinspection costs will be deducted from contract.

### 3.7.3 Samples for Contracting Officer Testing

Costs incidental to obtaining and transporting samples and materials for Contracting Officer testing are Contractor's responsibility. Samples of materials for test verification and acceptance testing by Contracting Officer shall be delivered to lab designated by Contracting Officer. Contractor shall coordinate obtaining specific samples and delivery location with Contracting Officer. Routine soil, concrete, asphalt testing is usually done within Florida. Special construction products or components are usually sent to a Corps of Engineers lab located in Vicksburg, Mississippi or Champaign, Illinois. Jacksonville District chemical analysis, rock petrographic, metallurgy samples are usually sent to Atlanta, Georgia or Jacksonville, Florida for testing.

## 3.8 COMPLETION INSPECTIONS

### 3.8.1 Punch-Out Inspection

Near end of project, or phase of work established for beneficial occupancy, Contractor shall conduct a "Punch-Out Inspection" jointly inspecting completed work with subcontractors. Contractors shall develop a "punch list" of work which does not conform to contract. Provide punch list to Contracting Officer. Punch list shall include estimated date by which deficiencies will be corrected. Contractor shall make a second inspection to ensure deficiencies have been corrected. Once this is accomplished, notify Contracting Officer that work is ready for Contracting Officer Pre-Final Inspection.

### 3.8.2 Pre-Final Inspection

Contracting Officer will jointly perform a "Pre-Final Inspection" with Contractor to verify work is complete and ready for acceptance or occupancy. New punch list items may be developed as a result of Pre-Final Inspection. Contractor shall ensure items on this punch list have been corrected before notifying Contracting Officer to schedule a Final Inspection with Owner. Items on a Pre-Final punch list shall be corrected in a timely manner. Complete inspections and correct any deficiencies within construction period for completion of work or for a particular phase of work when contract has separate completion dates.

### 3.8.3 Final Acceptance Inspection

Contractor, Project Manager/Superintendent, CQC System Manager shall attend Final Inspection. Contracting Officer, and additional persons including, but not limited to, those from Sponsor, User, Customer, or Owner, and other agencies may also attend. Final Inspection will be scheduled by Contracting Officer based upon results of the Pre-Final Inspection. Contractor shall notify the Contracting Officer in writing when ready for Final Inspection and propose a date for the Final Inspection. Contractor



shall include a statement in the notification assuring the Contracting Officer that deficiencies will be corrected and work will be acceptable by the proposed Final Inspection date. The Contracting Officer will schedule a Final Inspection within 14 working days of Contractor's notification. Contractor's failure to correct deficiencies and have work complete for Final Inspection will be cause for Contracting Officer to deduct from Contractor for Contracting Officer's additional reinspection cost from contract payment in accordance with Clause INSPECTION OF CONSTRUCTION of Section 00 70 00 CONTRACT CLAUSES.

### 3.9 DOCUMENTATION

Contractor shall maintain records for each construction day documenting quality control activities that have been performed. Records shall include testing record, work of subcontractors and suppliers. A CQC report with supporting attachments shall be prepared daily on an acceptable form that includes the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. 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 (Refer to Section 01 32 01 PROJECT SCHEDULE).
- d. Testing and control activities performed with results and references to specifications or drawings requirements. Identify control phase (Preparatory, Initial, Follow-up). List deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications or 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 or received and conflicts in plans or specifications.
- j. Contractor's verification statement.

Describe trades working on the project; number of personnel working; weather conditions encountered; and delays encountered. Records shall cover both conforming and deficient work and shall include a statement that equipment and materials incorporated into work and workmanship comply with contract. The original records shall be furnished to Contracting Officer daily within 24 hours after the date covered by report. A CQC daily report is required for each contract day, including days on which no work is performed. On days when no work is performed, the daily report shall document weather and note possible effects on restarting work. All contract calendar days shall be accounted for. CQC System Manager or

Alternate shall sign and date reports. CQC System Manager's daily reports shall include copies of test reports, meeting minutes, safety inspections and issues, inspector notes, copies of reports prepared by other quality control personnel, minutes to Preparatory Phase meetings held, minutes to Initial Phase meetings held, Final Follow-up inspection results, and any other documentation of construction progress or issues. The daily reports shall also include a record of the Follow-up Phase checks performed on each definable feature of work each day, problems discovered, and corrective actions taken. The Contracting Officer may stipulate the narrative titles in the QC daily reports.

### 3.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of noncompliance with contract requirements. Take corrective action immediately after receipt of noncompliance notification. Any Contractor personnel notified at the work site is sufficient for the purpose of Contractor notification. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of work until satisfactory corrective action has been taken. Such stop orders shall not be made a basis of a Contractor's claim for time extension or other damages.

### 3.11 SAMPLE FORMS

Forms are available for Contractor use at the following web address:  
<http://140.194.76.129/publications/>. See paragraph QUALITY CONTROL SYSTEM (QCS) above for construction forms to be completed in the QCS program.

-- End of Section --

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SECTION 01 50 02

TEMPORARY CONSTRUCTION FACILITIES

PART 1 GENERAL

1.1 SUMMARY

In addition to Construction Facilities this Section covers:

Temporary Utilities  
Construction Aids  
Vehicular Access and Parking  
Project Identification

See Section 01 57 20 ENVIRONMENTAL PROTECTION for requirements including silt control, trailer placement, fueling restrictions, dust control, solid waste, and cleanup. Upon completion of project, clean up and restore area in accordance with Clause CLEANING UP of Section 00700 CONTRACT CLAUSES in Volume 1.

a. Construction Facilities include, but are not limited to, the following:

- (1) Contractor Offices
- (2) Information Bulletin Board
- (3) Material and Equipment Storage Area
- (4) Fueling Area
- (5) Secured Storage Area
- (6) Employee Parking Area
- (7) Debris Container (dumpster)
- (8) Construction Signage to include Project Sign; Safety Sign; and, Construction Warning Signs

b. Temporary Utilities include, but are not limited to, the following:

- (1) Water
- (2) Electric
- (3) Sewage
- (4) Communications
  - (i) Telephone
  - (ii) Internet (T-1 line with 1.5 MBS or higher speed)
- (5) Lighting

1.2 REFERENCES

The publications listed below form a part of this specification to extent referenced. The publications are referred to in text by basic designation only.

FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT)

FDOT

Standard Specifications for Road and

Bridge Construction

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2012; Errata 2012; INT 1-4 2012) National  
Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2015) National Electrical Code

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 Safety and Health Requirements Manual

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later:

SD-01 Preconstruction Submittals

Mobilization/Demobilization Plan; G, AO

Plan shall include, but not be limited to, the following:

a. Mobilization Requirements:

- (1) Methods, equipment and materials
- (2) Connection of utilities
- (3) Placement of site facilities and temporary controls
- (4) Construction of facilities

b. Demobilization Requirements (methods, equipment and materials required to clean-up and restore site at project conclusion):

- (1) Collection, recycle and disposal of solid waste
- (2) Contract-generated material
- (3) Utility disconnection
- (4) Removal of Contractor facilities
- (5) Repair and restoration of site (i.e., fences, roads, or permanent facilities)

Security Plan; G, AO

Prepare a Security Plan for Contracting Officer describing site security as follows:

- a. Day and night security
- b. Weekend and holiday security
- c. General security duties

Maintenance of Traffic Plan; G, DO

The Contractor may elect to modify the entrance at State Road 78 as necessary to accommodate access for equipment. If so, the Contractor shall submit a Maintenance of Traffic Plan for approval prior to commencement of work. The traffic plan shall be prepared, signed and sealed by a registered professional engineer in the State of Florida.

#### SD-02 Shop Drawings

##### Contractor's Temporary Facilities; G, AO

General layout sketch of temporary site facilities shall include, but not be limited to, the following:

- a. Trailer locations
- b. Parking areas
- c. Material storage
- d. Equipment lay down area
- e. Areas for gravel
- f. Fuel areas
- g. Supplemental or other staging area
- h. Temporary well, water supply
- i. Septic field or holding tanks, port-a-lets
- j. Contaminated water handling
- k. Concrete cleaning area and methods of disposal
- l. Fences -- location and dimensions, entrance and exit points, and details of installation
- m. Utilities (poles, connections and services)
- n. Hazardous materials storage

##### Temporary Electric Drawings; G, AO

Electricity supply and lighting - from transformer source sketch layout locations, fixtures, and materials, to include outdoor lighting as described in subparagraph "Electric Power" below.

#### 1.4 EXISTING UTILITIES

The Contractor is responsible for investigating the availability of utilities at the project site. Contractor shall provide potable water, sanitary sewer, electricity, communications and optional utilities the Contractor may require at the project site. Provide T-1 or equivalent connectivity capable internet services with 1.5 MBS minimum speed and wireless capabilities to the Contractor's Field Office complex.

##### 1.4.1 Water

In addition to the above, the Contractor shall provide and maintain at his own expense an adequate supply of water for his use for construction, and to install and maintain necessary supply connections and piping for same, but only at such locations and in such manner as may be approved by the Contracting Officer. The Contractor shall also provide and maintain his own temporary toilet and washing facilities. Toilet and washing facilities shall be installed and maintained in a location approved by the Contracting Officer. Refer to paragraph AVAILABILITY AND USE OF UTILITY SERVICES below.

##### 1.4.2 Electricity

In addition to the above, all electric current required by the Contractor

shall be furnished at his own expense. All temporary lines will be furnished, installed, connected, and maintained by the Contractor in a workmanlike manner satisfactory to the Contracting Officer and shall be removed by the Contractor in like manner at his expense prior to completion of the construction. Refer to paragraph AVAILABILITY AND USE OF UTILITY SERVICES below.

## PART 2 PRODUCTS

### 2.1 CONSTRUCTION PROJECT SIGNS

Refer to paragraph BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN below and the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

#### 2.1.1 Haul Road Traffic and Construction Warning Signs

1/2 inch HDO plywood, or aluminum sheet, conforming to **FDOT** Section 700 Uniform Traffic Manual Standard Signs, non-standard signage high visibility orange with black lettering. Orange fabric mesh acceptable for temporary survey crew use.

### 2.2 STORAGE CONTAINERS

Welded steel construction, locking, shipping containers or equal.

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

#### 3.1.1 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.

#### 3.1.2 Employee Parking

a. Park employee's vehicles in areas designated by Contractor, away from construction traffic, within reasonable walking distance of site. Maintain area free of ruts, mud holes and puddles. Place gravel where required by deteriorated conditions.

b. Contractor should protect unattended equipment as it may be subject to vandalism.

c. Storage trailers and storage area with Government material should be locking type with lighting.

#### 3.1.3 Onsite Information

Keep copy of contract drawings, specifications, and other contract documents at Contractor's Office onsite, available for use at all times.



#### 3.1.4 Janitorial Services

- a. Daily -- Sweep; empty wastebaskets; service toilets
- b. Weekly -- Mop floors; sanitize toilet seats
- c. Monthly -- Wash floors, windows (inside and out)
- d. Cut grass as needed to keep below 3 inches high

#### 3.2 AVAILABILITY AND USE OF UTILITY SERVICES

Install temporary facilities and utilities in accordance with **IEEE C2**, **EM 385-1-1**, **NFPA 70**. Obtain necessary construction, building, zoning, or soil erosion and sediment control approvals required by local authorities and utility companies. Equip trailer(s) with wind tie downs in accordance with local wind and building code requirements.

##### 3.2.1 Lighting

Electric light, non-glare type luminaries to provide a minimum illumination, level of 30-foot candles at desk height level. Comply with temporary lighting, wiring and Ground Fault Circuit Interrupter (GFCI) requirements found in **EM 385-1-1**.

##### 3.2.2 Heating and Cooling

Adequate equipment to maintain internal ambient air temperature of 75 degrees F in 105 degrees F and 70 degrees F in 30 degrees F. Equip trailer(s) with smoke alarms. If bottled gas is used to heat, equip trailer(s) with carbon monoxide alarms.

##### 3.2.3 Water

Non-potable well water may be used to flush toilets, dish and hand washing. Provide bulk potable water in storage tanks or bottled water for drinking.

##### 3.2.4 Fire Extinguisher

Refer to **EM 385-1-1**. Non-toxic, dry chemical, fire extinguisher meeting Underwriters Laboratories, Inc., approval for Class A, Class B, and Class C fires with a minimum rating of 2A; 10B; and 10C.

##### 3.2.5 Utility Lines

Install, connect and modify temporary lines as coordinated with owning utility. Conform requirements in accordance with **IEEE C2** and **NFPA 70** for Temporary Electric Lines. Remove temporary line at completion of project.

##### 3.2.6 Electric Power

Provide electrical service and transformers sufficient to operate heating/air conditioning units. Electrical power shall be purchased directly by Contractor.

#### 3.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

##### 3.3.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a

weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. 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.

### 3.3.2 Project and Safety Signs

The requirements for the signs, their content, and location shall be as indicated on the web site provided in paragraph CONSTRUCTION FORMS AND DETAILS below. On the Safety Performance Sign, replace the Safety Green First Aid Logo with the Safety Pays Logo indicated on the web site provided in paragraph CONSTRUCTION FORMS AND DETAILS below with the color pattern as shown. The Safety Pays Logo shall have a bottom width of 8 inches, and be placed 2 inches from the top of the sign and centered between Legend Group 1 and the right edge. 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.

### 3.4 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.

#### 3.4.1 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.

### 3.5 HAUL AND ACCESS ROADS

The Contractor shall, at its own expense, construct 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 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 and as directed by the Contracting Officer, remove and dispose of portions of any contractor constructed access and haul roads. The Contracting Officer will require removal of road segments which, in his determination, impede proper function or maintenance of the permanent project features; adversely impact local stormwater drainage; or adversely impact environmentally sensitive areas. The access and haul road portions removed shall be graded to approximately match the original ground contours.

Where haul roads traverse an environmentally sensitive area or if located on the crest of an earthen embankment, one-way haul roads are preferred. 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 feet. 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 feet 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 feet. Two-way haul roads for over-the-road haulage equipment only may be reduced to a usable width of 30 feet.

c. Vertical and horizontal curvature, and sight distance shall be designed in accordance with AASHTO design criteria. When conditions make it impractical to obtain the required design criteria, a positive means of traffic control shall be implemented. All requirements of **EM 385-1-1** concerning access and haul roads shall apply.

d. Dust abatement shall permit observation of objects on the roadway at a minimum distance of 300 feet.

e. Haul roads shall have the edges of the usable portion marked with posts at intervals of 50 feet on curves and 200 feet maximum elsewhere. Such markers shall extend 6 feet above the road surface, and for nighttime haulage, be provided with reflectors in both directions.

### 3.6 MAINTENANCE OF HAUL AND ACCESS ROADS

The Contractor shall be responsible for providing and maintaining safe and passable means of ingress and egress to the site and to all project features on the site for Contractor, Government, and third party entities. Requirements herein shall apply to haul and access roads that are both new and existing. Haul and access roads shall be repaired and re-graded as necessary. Roadway drainage shall be maintained, including maintaining roadway crown and profile and keeping drainage ditches clear. Potholes,

mud holes, ruts, and/or depressions of 6 inches deep or more shall be repaired within 24 hours of discovery. Condition of haul and access roads shall be checked at least weekly and after any severe weather event. All requirements of EM 385-1-1 concerning access and haul roads also apply, see section 04.B.

### 3.7 CONTRACTOR'S TEMPORARY FACILITIES

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas as approved by the Contracting Officer and in accordance with Section 01 57 20 ENVIRONMENTAL PROTECTION. Temporary movement or relocation of Contractor facilities shall be made when approved by the Contracting Officer.

#### 3.7.1 Contractor Field Office

Provide on-site field office of sufficient size and staff capability to manage project activities. Provide communications and computer capabilities to manage the work, including implementing QCS, facsimile, electronic mail, reproduction, to track schedule and cost. Contractor's field office should include a conference area with table and chairs to accommodate a minimum of 8 people. Provide handicap access with a 1 on 12 ramp and gravel parking spot marked with handicap parking sign. Provide minimum T-1 capable internet services (1.5 MBS or higher speed) and wireless capabilities to the field office facilities/compound to facilitate RMS, QCS, Sharepoint (file transfer) and visitor usage.

#### 3.7.2 Appearance of Trailer(s)

Trailer(s), used for both office and material storage purposes, shall be clean, neat exterior appearance and in good repair. Trailer(s) requiring exterior painting or maintenance will not be allowed on site until determined satisfactory by Contracting Officer.

#### 3.7.3 Storage Area

Provide temporary six-foot high chain link fence for storage containers, trailers or sheds containing Government property. Fence posts may be driven. Ground chain link fence against lightning. Store Contracting Officer's property, owned materials and equipment within fenced storage area. Store small size Government property, equipment, tools, materials in locked steel containers. No Government property and materials shall be stockpiled outside fence in preparation for next day's work. Park mobile equipment, tractors, wheeled lifting equipment, cranes, trucks, and like equipment, within fenced areas on weekends.

##### 3.7.3.1 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

#### 3.7.4 Waste Storage

Provide dumpsters or suitable debris containers. Prevent wind blown trash; cover as needed. Dispose of offsite when needed. Refer to Section 01 57 20 ENVIRONMENTAL PROTECTION.

#### 3.7.5 Fuel Storage and Fueling Operations

Refer to Section 01 57 20 ENVIRONMENTAL PROTECTION. Provide light when fueling at night.

#### 3.8 SECURITY PLAN

Provide site security person at all times when there are no on-site activities. Maintain 24-hour security during weekends and holidays. Site security shall include, but not be limited, to:

- a. Limit vehicular access to authorized vehicles and personnel only.
- b. Limit public access to travel along access road only. Access road shall be kept closed at all times except for passage of authorized personnel and vehicles.
- c. Maintain a list of authorized personnel and subcontractors available at site offices.
- d. Maintain a sign-in log documenting visitors, deliveries, and security incidents. Include date, name, address, company, time in and time out for each employee and visitor.
- e. Check fenced areas, equipment, trailers on a daily basis. If damage is observed or vandalism is found report to Contracting Officer.

##### 3.8.1 Visitors

No visitors will be allowed on site without knowledge of Contractor and permission of Contracting Officer. Direct visitors to report upon arrival to Contractor's Field Office for site safety and accident prevention briefing. Provide visitors appropriate protective equipment (i.e., ear plugs, safety glasses, etc.).

#### 3.9 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. Fencing shall extend from grade to a minimum of 48 in above grade and shall have a maximum mesh size of 2 inches. Fencing shall remain rigid/taut with a minimum of 200 lbs of force exerted on it from any direction with less than 4 inches of deflection. 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.

#### 3.10 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. Refer to Section 01 57 20 ENVIRONMENTAL PROTECTION for solid waste and post construction cleanup.

### 3.11 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.

### 3.12 CONSTRUCTION FORMS AND DETAILS

See the "Construction Forms & Details" module at the following web address:  
<http://www.saj.usace.army.mil/About/DivisionsOffices/Engineering/DesignBranch/SpecificationsSection.aspx>.

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SECTION 01 52 10

CONTRACTING OFFICER'S FIELD OFFICE

PART 1 GENERAL

1.1 SUMMARY

This section covers the requirements regarding the Contracting Officer's Field Office. See Section 01 50 02 TEMPORARY CONSTRUCTION FACILITIES and Section 01 57 20 ENVIRONMENTAL PROTECTION for requirements including silt control, portable office placement, fueling restrictions, dust control, solid waste, and cleanup. Upon completion of project, clean up and restore area in accordance with Clause CLEANING UP of Section 00700 CONTRACT CLAUSES in Volume 1. Services required in this section will be paid for by separate line item (See Section 01 22 00 MEASUREMENT AND PAYMENT).

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Within 10 calendar days following date of receipt of Notice to Proceed and prior to mobilization to site submit following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Contracting Officer's Field Office

Submit supplier or manufacturer scale drawings of office floor plans and site plan for Contracting Officer's Field Office with requirement indicated in paragraph CONTRACTING OFFICER'S FIELD OFFICE below.

1.3 EXISTING UTILITIES

See Section 01 50 02 TEMPORARY CONSTRUCTION FACILITIES.

1.4 TEMPORARY SERVICES

Furnish following services for Contracting Officer's Field Office:

- a. Janitorial service.
- b. Lawn service.
- c. Waste removal.
- d. Pest Control.
- e. Potable water in 12, 16 or 20 oz. bottles.
- f. Toilet Facility Supplies (e.g. toilet paper, hand soap, and paper towels).



## PART 2 PRODUCTS

### 2.1 CONTRACTING OFFICER'S FIELD OFFICE

Provide a portable office in good working condition that has, at a minimum, heat and air conditioning, running water, restroom facilities, a minimum of 1,200 square feet, and accommodates equipment to be installed by the Government. See paragraph FIELD OFFICE below. A suitable office replacement for the portable office may be accepted at the Contracting Officer's discretion.

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

Install Contracting Officer's Field Office ready for use no later than 30 calendar days after Notice to Proceed.

#### 3.1.1 Parking

Provide Contracting Officer twelve gravel parking spaces at Contracting Officer's Field Office. Place parking signs reserved for use of Contracting Officer and visitors. Contractor shall maintain these spaces clear of other vehicles. Designate one parking spot with sign for handicap use only. The Contractor shall comply with all ADA parking requirements for size and accessibility.

#### 3.1.2 Janitorial Service

See Section 01 50 02 TEMPORARY CONSTRUCTION FACILITIES. On a daily basis, restock cleaning supplies and toiletries such as, but not limited to, hand soap, hand sanitizer, paper towels and toilet paper.

### 3.2 AVAILABILITY AND USE OF UTILITY SERVICES

See Section 01 50 02 TEMPORARY CONSTRUCTION FACILITIES. Provide Contracting Officer's Field Office sufficient continuous power and electric supply to assure operation of systems, including computer, light and HVAC. Provide one 20 amp dedicated circuit to support copier/printer location and communications rack located in 6' x 6' IT/storage closet. Dedicated circuit wall termination shall be at the central location where Government equipment will be installed. The 20 amp circuit will support copier/printer and communication rack located in 6' x 6' IT/Storage closet.

### 3.3 FIELD OFFICE

Supply and maintain lockable field office separate from Contractor for use by Contracting Officer.

#### 3.3.1 Portable Office

a. An all metal exterior, sides and roof; double-insulated walls, floor, and roof; self-contained, built-in heat and air conditioning; and 110 volt wall outlets.

b. Security guard screens, screens, and blinds for all windows.

c. Toilet facility -- A separately enclosed room properly ventilated and complying with applicable sanitary codes including hot and cold

running water and operable flush type toilet.

d. Installed during site mobilization.

e. Contractor shall make the portable office handicap accessible and comply with all ADA requirements.

f. Portable office shall have four offices, two on each end, with a central meeting area in between. Individual offices shall be lockable.

g. Portable office shall have an IT closet with minimum dimensions of 6 feet by 6 feet and proper ventilation for IT equipment.

h. Portable office shall be prewired with network and phone drops in each office and the main conference area. Coordinate with the Contracting Officer the quantity and location of drops. Install network drops using Cat6, plenum cable from the office IT closet to the end user locations, to include a Cat6 24 port patch panel with wall mounting brackets, and any necessary conduit boxes, face plates and jacks for a complete cable installation. Install phone drops using standard 4-pair cabling to support POTS, plenum cable from the office IT closet to the end user/device locations. Pre-wiring shall include 2" conduit and CAT6 wire from the DMARK (utility pole) to the CSU/DSU location (inside the 6'x6' IT/Storage Closet). Pre-wiring shall also include phone, data and power at conference table. Portable office shall be located within 100 feet of utility services (communication location). If there are no such utilities within 100 feet, the Contractor shall provide the services to meet this requirement. Trailer installation shall meet all federal, state and local codes, and applicable IT standards.

i. Office trailer shall be tied down per local wind and building codes.

### 3.3.2 Office Equipment

Provide following furnishings:

8 - Office desks with five lockable drawers (60 inches by 30 inches, laminated top), swivel chair and power strip for each (desks should be designed for use with PCs).

1 - Conference Table with ten chairs.

1 - 16-unit first aid kit, wall mounted.

1 - Fire resistant, five drawer, legal size lockable filing cabinet.

6 - Five drawer, letter size lockable filing cabinets.

1 - Table to support FAX and printer.

2 shelf sets - Four shelves high by 12 inches deep by 3 feet long (attachable to wall).

6 - 3' x 6' Cork Bulletin Boards.

6 - 3' x 6' Dry Erase Boards.

7 - 13-gallon waste baskets, one for each office and bathroom, and 2 in central meeting room.

1 - Plan Table installed in a location directed by the Contracting Officer (may be built in) with a minimum working surface of 4 feet by 6 feet, and draftsman stool.

1 - Vertical filing plan rack sufficient for full size contract drawings.

1 - 48" x 48" x 3/4" piece of fire-retardant backboard to be installed in the 6' x 6' IT/storage closet.

- 1 - Wall mount rack enclosure closet, 10 U (Unit), 19" deep, locking on all sides (Example: Tripp Lite-SRW10US or equal as approved by the Contracting Officer).
- 1 - 7-cubic foot refrigerator.
- 1 - 1.5-cubic foot microwave oven.
- 1 - Large, lockable, double door metal office supply cabinet.
- 6 - Bookshelves (5 Shelf).

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  - 3.1.5.7 Protection of Wood Stork (*Mycteria americana*)
  - 3.1.5.8 Protection of Audubon's Crested Caracara (*Polyborus plancus audubonii*)
  - 3.1.5.9 Protection of Gopher Tortoise (GT) Populations (*Gopherus polyphemus*)
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  - 3.1.5.11 Protection of the West Indian (Florida) Manatee (*Trichechus manatus latirostris*)
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SECTION 01 57 20

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 SCOPE

This Section covers prevention of environmental damage as the result of construction operations under this contract and for those measures set forth in other Technical Requirements of these specifications. For the purpose of this specification, environmental damage is defined as the presence of hazardous, physical, chemical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; affect other species, biological communities, or ecosystems; or degrade the quality of the environment for aesthetic, cultural, and/or historical purposes. The control of environmental damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.

1.2 REFERENCES

1.2.1 Miscellaneous Environmental Laws And Regulations

There are numerous environmental laws and regulations. At the Federal level, the applicable laws and regulations include compliance with the Clean Water Act (CWA); Clean Air Act (CAA); Coastal Zone Management Act (CZMA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); Endangered Species Act (ESA); Fish and Wildlife Coordination Act (FWCA); Marine Protection, Research, and Sanctuaries Act (MPRSA); Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA); National Environmental Policy Act (NEPA); National Historic Preservation Act (NHPA); National Pollution Discharge Elimination System (NPDES); Research and Sanctuaries Act; Native American Graves Protection and Repatriation Act (NAGPRA); Resource Conservation and Recovery Act (RCRA); Rivers and Harbors Act (R&H); Safe Drinking Water Act (SDWA); Toxic Substance Control Act (TSCA); Wild and Scenic Rivers Act (WSRA); Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA); Marine Mammal Protection Act (MMPA); Code of Federal Regulations (CFRs); Executive Orders; and, Environmental Protection Agency (EPA) requirements. NEPA compliance measures specified in an Environmental Assessment (EA) or Environmental Impact Statements (EIS) are also applicable with regard to compliance.

1.2.2 Publication Reference(s)

The publication(s) listed below form(s) a part of this specification to the extent referenced. The publication(s) are referred to in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE EM 385-1-1

U.S. Army Corps of Engineers Safety and  
Health Requirements Manual

COE EM 1110-1-1003

(1996) NAVSTAR Global Positioning System  
Surveying

COE ER 1110-1-5

(1984) Plant Pest Quarantined Areas and  
Foreign Soil Samples

### 1.3 QUALITY CONTROL

The Contractor shall establish and maintain quality control for environmental protection of all items set forth herein. The Contractor shall record on daily quality control reports or attachments thereto, any problems in complying with laws, regulations and ordinances, and corrective action taken.

### 1.4 PERMITS AND AUTHORIZATIONS

The Contractor shall obtain all needed permits or licenses including the National Pollutant Discharge Elimination System (NPDES) permit for Construction Activities Exceeding 1 Acre. The Government will not obtain any permits for this project; see Clause PERMITS AND RESPONSIBILITIES of Section 00700 CONTRACT CLAUSES in Volume 1.

The Contractor is responsible for obtaining NPDES Stormwater Construction Generic Permit to provide coverage under the National Pollutant Discharge Elimination System (NPDES) Generic Permit for Stormwater Discharges from Construction Activities (CGP) pursuant to Rule 62-621.300(4), F.A.C. The Contractor is advised to contact FDEP's NPDES Stormwater Program at (850) 245-7522 or toll free at (866) 336-6312, or to download application information from <http://www.dep.state.fl.us/water/stormwater/npdes/construction1.htm> prior to commencement of construction.

In addition to the above, the Contractor shall comply with all requirements under the terms and conditions set out in the following permit(s) and authorization(s) obtained by the Corps of Engineers listed below.

a. Florida Department of Environmental Protection Permit Number 0234604-021, issued on May 2, 2014, and expires on May 2, 2019.

b. Environmental Surveys for Burrowing Owls and gopher tortoises may require additional permits for removal or taking of listed species from the Florida Fish and Wildlife Conservation Commission prior to commencement of construction. The Contractor is responsible for obtaining, and shall be bound to the conditions of such permits.

c. If bald eagles nest within 660 feet from a construction zone, the Contractor shall be required to obtain the applicable disturbance permits from USFWS and FFWCC.

The above permits indicate issuing agency approval of work required by this contract. Permits and environmental compliance documents are available at the following web address: <http://www.saj.usace.army.mil/About/DivisionsOffices/Planning/EnvironmentalBranch/EnvironmentalCompliance.aspx>

The Contractor shall comply with all requirements under the terms and conditions set out in all permit(s) in accordance with the Clause PERMITS AND RESPONSIBILITIES of Section 00700 CONTRACT CLAUSES in Volume 1.

## 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 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later:

### SD-01 Preconstruction Submittals

#### Environmental Protection Plan; G, DO

No later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later, the Contractor shall submit an Environmental Protection Plan for review and acceptance by the Contracting Officer. The Government will consider an interim plan for the first 30 days of operations. However, the Contractor shall furnish an acceptable final plan no later than 30 calendar days after receipt of Notice to Proceed. Acceptance of the Contractor's plan shall not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures. Acceptance of the plan is conditional and predicated on satisfactory performance during construction. The Government reserves the right to require the Contractor to make changes to the Environmental Protection Plan or operations if the Contracting Officer determines that environmental protection requirements are not being met. No physical work at the site shall begin prior to acceptance of the Contractor's plan or an interim plan covering the work to be performed. The Environmental Protection Plan shall include but not be limited to the following:

a. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

b. Methods for protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection, i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archeological, and cultural resources.

c. Procedures to be implemented to provide the required environmental protection and to comply with the applicable laws and regulations. The Contractor shall provide written assurance that immediate corrective action will be taken to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures set out in accordance with the environmental protection plan.

d. A permit or license for and the location of the solid waste disposal area.



- e. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossing, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.
- f. Environmental monitoring plans for the job site, including land, water, air, species, and noise monitoring.
- g. Traffic control plan.
- h. Methods of protecting surface and ground water during construction activities.
- i. Spill prevention. The Contractor shall specify all potentially hazardous substances to be used on the job site and intended actions to prevent accidental or intentional introduction of such materials into the air, ground, water, wetlands, or drainage areas. The plan shall specify the Contractor's provisions to be taken to meet Federal, State, and local laws and regulations regarding labeling, storage, removal, transport, and disposal of potentially hazardous substances.
- j. Spill contingency plan for hazardous, toxic, or petroleum material.
- k. Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas.
- l. Plan of borrow area(s).
- m. A statement as to the person who shall be responsible for implementation of the Environmental Protection Plan. The Contractor personnel responsible shall report directly to the Contractor's top management and shall have the authority to act for the Contractor in all environmental protection matters.
- n. Recycling and Waste Management Plan. Executive Order 12873 of 20 October 1993 requires a number of considerations in planning a project. Fallen trees should not be burned or buried. Mulching, composting, and other uses for trees should be considered. Also, recovery of metals at the job site, including aluminum cans, should be considered with proceeds to be retained by the Contractor. Non-Federal recycling and waste minimization efforts shall also be incorporated into this plan.
- o. Construction activities shall be conducted in a manner as not to impact migratory birds or induce their nesting.
- p. Steps to be taken to construct the project in such a manner as not to impact gopher tortoises.
- q. A protection and education plan for the Okeechobee Gourd.
- r. A protection and education plan to achieve protection of Bald Eagles during construction.
- s. A protection and education plan to achieve protection of

Burrowing Owls and their nests during construction.

- t. A protection and education plan for the Eastern Indigo Snake.
- u. A protection and education plan for the Everglades Snail Kite.
- v. A protection and education plan for Audubon's Crested Caracara.
- w. A protection and education plan for the Wood Stork.
- x. A protection and education plan for the Gopher Tortoise.
- y. A protection and education plan for Manatees.
- z. Nuisance Species Decontamination Plan.

#### SD-07 Certificates

##### Bird Monitoring Qualifications; G, DO

No later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later, the Contractor shall furnish to the Contracting Officer for approval, the qualifications of the bird monitor/observer. Appropriate qualifications for bird monitor/observer shall be a demonstrated ability to find and/or identify bird species, nesting behavior, eggs and nests, and habitat requirements. In addition, references shall be provided to verify non-educational experience. The Contractor shall consult with and coordinate all monitoring plans and activities with Stacie Auvinshine at 904-232-3694.

##### Eastern Indigo Snake Observer; G, DO

No later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later, the Contractor shall furnish to the Contracting Officer for approval, the qualifications of the eastern indigo snake observer.

#### SD-11 Closeout Submittals

##### Logs/Final Summary Report

Contractor shall submit as specified, logs and final summary report of sightings and incidents with endangered species.

##### Eastern Indigo Snake Monitoring Report

Contractor shall submit an Eastern indigo snake monitoring report to the appropriate U.S. Fish and Wildlife (FWS) Field Office within 60 days of the conclusion of clearing phases. The report shall be submitted whether or not Eastern indigo snakes are observed. The report shall contain any sightings of Eastern indigo snakes, summaries of any relocated snakes if relocation was approved for the project (e.g., locations of where and when they were found and relocated), and other obligations required by the State that may or may not be stipulated in the permit.

### Project Environmental Summary Sheet

Contractor shall submit within 30 days following completion of the project, a written report of the absence or occurrence of environmental incidents. In addition, for construction activities whose anticipated duration is more than one calendar year, the Contractor shall complete a sheet each May 31st (plus/minus 14 days).

### Logs/Summary of Bird Nesting Monitoring

Contractor shall submit as specified, logs and summary of monitoring detailing nesting and nesting success.

### Comprehensive Final Report

Contractor shall submit as specified, a compilation of all data and maps prepared during the surveys and all information regarding relocation of gopher tortoises.

## 1.6 SUBCONTRACTORS

Assurance of compliance with this section by subcontractors shall be the responsibility of the Contractor.

## 1.7 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, State, or local laws or regulations, permits and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails 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 time extensions shall be granted or costs or damages allowed to the Contractor for any such suspension.

Additionally, the Contractor shall notify the Contracting Officer, in writing, of the absence or occurrence of environmental incidents, as required on the Project Environmental Summary Sheet, copy on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below. Refer to paragraph SUBMITTALS above.

## 1.8 CONTRACTOR PERSONNEL QUALIFICATIONS IN POLLUTION CONTROL

The Contractor's personnel shall be qualified to perform all phases of environmental protection, including methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and careful installation and monitoring of the project to ensure adequate and continuous environmental pollution control. Quality Control and supervisory personnel shall be thoroughly knowledgeable of Federal, State, and local laws, regulations, and permits as listed in the Environmental Protection Plan submitted by the Contractor. Quality Control personnel will be identified in the Quality Control Plan submitted in accordance with Section 01 45 04 CONTRACTOR QUALITY CONTROL.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PROTECTION OF ENVIRONMENTAL RESOURCES

For contract work, the Contractor shall comply with all applicable Federal, State, or local laws and regulations. The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected at least during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications. Deviations from drawings or specifications (e.g., proposed alternate borrow areas, disposal areas, staging areas, and alternate access routes) could result in the need for the Government to reanalyze and re-approve the project from an environmental standpoint. Environmental protection shall be as stated in the following subparagraphs.

3.1.1 General Project Environmental Design and Installation Criteria

Some project sites have features that shall not be impacted in any way, including cultural, historic, or archeological features. At all sites, the Contractor shall minimize disturbance to existing features at the site to the extent possible, including vegetative, topographic, and drainage pattern features. Wetland impacts (temporary access, detours, staging areas, and other work area impacts) to project sites should be avoided and may require separate permitting action. Any wetlands temporarily impacted shall have its soil restored upon project completion. Expansion of previously permitted project footprints may likewise require separate permitting action.

In all cases, the design and/or installation of project system shall provide for protection of the environment during handling, installing, storing, utilizing, transporting, servicing, testing, refilling, transferring, pumping, processing, removing waste products, repairing and maintaining systems and their components. Necessary design protection shall also be considered that would prevent contamination of the environment from impacts to the system caused by storm water runoff and flooding. Retrofit of connected systems on project sites to modern environmental protection design standards shall also be considered.

In the event environmental protection measures fail, the Contractor shall implement procedures to control and correct environmental damage.

3.1.1.1 Petroleum-Based Systems Environmental Design and Installation Criteria

For petroleum-based systems, a statement of site suitability shall be provided and shall include what would be necessary to prevent adverse impact to water quality; natural resources; habitat; historic, cultural, and archeological sites; and fragile local resources in the event of a fuel spill. Human error and mechanical/electrical failure of components without human intervention shall also be considered in the design with regard to spills. Additionally, appropriate noise and emissions controls shall be incorporated into the design, including vapor and exhaust controls.

At a minimum, environmental protection design requirements shall also include the following: (1) stationary tanks and piping shall have secondary containment features; (2) approved materials and corrosion

protection systems shall be utilized; (3) system leaks shall be readily detected and contained without human intervention; and, (4) overfill containment systems shall be provided.

Applicable Federal, State, and local codes and requirements shall be strictly adhered to in the design, including those of the U.S. Environmental Protection Agency (EPA), the State of Florida, the South Florida Water Management District (SFWMD), and other local governing agencies such as those of counties and municipalities. In the case of the State, requirements include Chapter of the Florida Administrative Code (FAC) such as 62-17 (Approved Materials), 62-252 (Vapor Emissions), 62-296 (Emissions), 62-761 (Underground Storage Tanks), and 62-762 (Aboveground Tanks). Note that Chapters 62-761 and 62-762 of the FAC may be combined into one Chapter. Best Management Practices from the applicable agencies shall also be adhered to in the design.

#### 3.1.1.2 Sewage-Based Systems Environmental Design and Installation Criteria

In general, there shall be no waste or debris discharges of any kind for a project unless authorized by the Contracting Officer. This shall include the Contractor's providing sufficient temporary sanitary equipment and facilities for the project. The design and/or installation of temporary or permanent sewage systems shall ensure that waters will be free of effects of sewage discharges. Applicable Federal, State, or local codes and requirements regarding sewage shall be strictly adhered to in the design, such as those of the EPA and, in the case of the State, Chapter 62-620 (Wastewater Facilities) of the FAC. Best Management Practices from the applicable agencies shall also be adhered to in the design.

#### 3.1.2 Protection of Land Resources

Prior to the beginning of any construction, the Contractor shall identify all land resources to be preserved or avoided within the Contractor's work area. Materials displaced into uncleared areas shall be removed. The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without special permission from the Contracting Officer. The Contractor shall engage a qualified tree surgeon to perform all tree surgery. The Contractor shall be responsible to repair injuries to bark, trunk, branches, and roots of protected trees by dressing, cutting, and painting as specified for Class I Fine Pruning, of the National Arborist Association Pruning Standards for Shade Tree or as per State's Agricultural Extension Agency Guidelines, immediately as occurrences arise. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

##### 3.1.2.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that are not required to accomplish all work to be performed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. The Contractor shall protect from damage all existing trees designated to remain. Protection of tree roots shall be provided against noxious materials in solution caused by run-off or spillage. Fires shall be located outside the canopy of protected trees. No materials, trailers, or equipment shall be stored within the drip line of any protected tree. Monuments and markers shall be

protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

The Contractor shall thoroughly clean all construction equipment and tools at the prior job site in a manner that ensures all residual soil is removed and that egg deposits from plant pests are not present. The Contractor shall consult with the U.S. Department of Agriculture (USDA) regarding additional cleaning requirements that may be necessary. In addition, if this contract involves the identification, shipping, storage, testing, or disposal of soils from such a quarantined area, the Contractor agrees to comply with the provisions of COE ER 1110-1-5 and attachments. The Contractor agrees to assure compliance with this obligation by all subcontractors.

#### 3.1.2.2 Protection of Landscape

Trees and their roots, shrubs, vines, grasses, land forms, and other landscape features shall be clearly identified and protected by fencing or any other approved techniques. Protection of trees shall be as illustrated in the Tree Protection Plan Detail on the web site indicated in the paragraph CONSTRUCTION FORMS AND DETAILS below. Tree protection fencing shall be placed before excavation or grading is begun and maintained in place until construction is complete. Branches of protected trees, if required, shall be removed to clear for construction and pruning shall subsequently be performed to restore the natural shape of the entire tree. Branches or roots, if required, shall be cut with sharp pruning instruments and not broken or chopped. Protected trees shall be fertilized to compensate for root loss with 6-6-6 as per manufacturer's application direction. Any damage to tree crowns or roots shall be repaired promptly after damage occurs.

a. Trench or Bore Under Trees: Where trenching for utilities is required within tree driplines, the Contractor shall hand dig under and around roots or bore under them. The Contractor shall protect roots from drying and cover exposed roots within an hour as specified in subparagraph "Excavation for Structures" below. No lateral roots which interfere with new construction shall be cut. Boring is permitted.

b. Excavation for Structures: Where excavating for new construction is required within tree drip lines, the Contractor shall hand excavate to minimize damage to root systems. The Contractor shall use narrow tine pitchforks and comb soil to expose roots. The Contractor shall relocate roots in backfill areas. If large, main lateral roots are encountered that are exposed beyond the excavation limits, the Contractor shall bend and relocate these roots without breaking or girdling. If roots are encountered immediately adjacent to new construction such that relocation is not practical, the Contractor shall saw roots approximately 3" back from the new construction, seal with tree wound dressing, and protect any exposed embankment of roots from drying by covering with straw and black plastic. The Contractor shall irrigate affected areas daily until final grade conditions are established and the exposed roots are backfilled properly for continued plant growth.

c. Replacement: The Contractor shall remove dead or damaged protected trees determined, by the Government, to be incapable of restoration to normal health growth. The Contractor shall replace each

removed tree up to 4" caliper with tree of equal specie and size. For each tree removed larger than a 4" caliper, the Contractor shall replace the tree with one 4" caliper tree per 4" caliper increment or fraction thereof.

#### 3.1.2.2.1 Red Bay Tree

There is the potential for the presence of the red bay tree (*Persea borbonia*) within and/or adjacent to the proposed access roads and ramps for this contract. A survey was completed by USACE staff on 29 October 2013 in which red bay trees were not observed within the proposed access road footprints. The red bay tree is a culturally significant plant within the Seminole Tribe. A survey shall be completed prior to construction of the access roads and ramps to the site to ensure the absence of the red bay tree. If red bay trees are discovered, the Contractor shall contact the Contracting Officer prior to removal of trees to allow for coordination with the Seminole Tribe.

#### 3.1.2.3 Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in instances where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be totally cleared. Clearing of such areas shall progress in reasonably sized increments as needed to use the areas developed as approved by the Contracting Officer.

#### 3.1.2.4 Disturbed Areas

The Contractor shall effectively prevent erosion and control sedimentation through approved methods including, but not limited to, the following:

a. Retardation and Control of Runoff: Runoff from the construction site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, and by any measures required by area wide plans approved under paragraph 208 of the Clean Water Act.

b. Erosion and Sedimentation Control Devices: The Contractor shall construct or install temporary and permanent erosion and sedimentation control features as directed by the Contracting Officer. Temporary velocity dissipation devices shall be placed along drainage courses so as to provide for non-erosive flows. Temporary erosion and sediment control measures such as berms, dikes, drains, sediment traps, sedimentation basins, grassing, mulching, baled hay or straw, and silt fences shall be maintained until permanent drainage and erosion control facilities are completed and operative. For silt fences, the filter fabric is to be of nylon, polyester, propylene, or ethylene yarn of at least 50 lb/in strength and able to withstand a flow rate of at least 0.3 gal/ft sq/minute. The fabric should contain ultraviolet ray inhibitors and stabilizers and be a minimum of 36 inches in width. The toe of the fence shall be buried at least 8 inches deep to prevent undercutting and shall be secured to posts by suitable staples, tie wire, or hog rings. Posts shall have a cross section of at least 2"x4" softwood or 1.5"x1.5" hardwood, and a minimum length of 4 feet. Fence shall be overlapped to the next post if fabric joints are necessary.

c. Sediment Basins: Sediment from construction areas shall be trapped in temporary or permanent sediment basins. The basins shall accommodate the runoff of a local 24-hour storm. After each storm, the basins shall be pumped dry and accumulated sediment shall be removed as necessary to maintain basin effectiveness. Overflow shall be controlled by paved weir or by vertical overflow pipe, draining from the surface. The collected topsoil sediment shall be reused for fill on the construction site, and/or conserved (stockpiled) for use at another site(s). The Contractor shall institute effluent quality monitoring programs as required by State and local environmental agencies.

#### 3.1.2.5 Contractor Facilities and Other Work Areas

Locate facilities, staging and other work areas as indicated in Section 01 50 02 TEMPORARY CONSTRUCTION FACILITIES, and in compliance with permits listed in the paragraph PERMITS AND AUTHORIZATIONS above and obtained for performance of work. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby watercourses, wetlands, or lakes. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby watercourses, wetlands, or lakes. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment. If there is suspicion that sediment may be unsuitable for disposal at a specified location, the Contractor shall immediately take measures to contain the suspect sediment and notify the Contracting Officer.

#### 3.1.2.6 Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Solid wastes shall not be stored for longer than 30 days on-site (see DEP ERP permit conditions). All handling and disposal shall be conducted to prevent contamination. Solid waste materials shall be hauled to an approved solid waste disposal site designated by the Contracting Officer. The Contractor shall comply with Federal, State, and local regulations pertaining to the use of the solid waste disposal site.

#### 3.1.2.7 Fuel, Oil, and Lubricants

Fuel, oil, and lubricants shall be managed so as to prevent spills and evaporation. To prevent spills, fuel dispensers shall have a 4-foot square, 16-gauge metal pan with borders banded up and welded at corners right below the bibb. Edges of the pans shall be 8-inch minimum in depth to ascertain that no contamination of the ground takes place. Pans shall be cleaned by an approved method immediately after every dispensing of fuel and wastes disposed of offsite in an approved area. Should any spilling of fuel occur, the Contractor shall immediately recover the contaminated ground and dispose of it offsite in an approved area. Petroleum waste generated shall be stored in marked corrosion-resistant containers and recycled or disposed of in accordance with 40 CFR 279, State, and local regulations.

#### 3.1.2.8 Hazardous Waste

Hazardous wastes are defined in 40 CFR 261. The Contractor shall ensure



that hazardous wastes are stored and disposed of in accordance with 40 CFR 261 and State and local regulations. The Contractor shall ensure that hazardous wastes are packed, labeled, and transported in accordance with 49 CFR 173 and State and local regulations.

#### 3.1.2.9 Hazardous Materials

The Contractor shall ensure that hazardous materials are labeled, stored, and transported in accordance with 49 CFR 173, State, and local regulations.

#### 3.1.3 Preservation and Recovery of Historic, Archeological, and Cultural Resources

##### 3.1.3.1 Applicable Law

A number of Federal laws require protection of cultural resources. One law, in particular, can be potentially involved with construction activities: (1) the National Historic Preservation Act, as amended.

##### 3.1.3.2 Known Resources

If known historic, archeological and cultural resources within the Contractor's work area(s) are present, it will be designated as a "potentially significant cultural resource" on the contract drawings or other documents. If so designated, the Contractor shall install protection for these resources and shall be responsible for their preservation during the contract's duration. The Contractor shall not distribute maps or other information on these resource locations except for distribution among the Contractor's staff with a "need to know" technical responsibility for protecting the resources.

##### 3.1.3.3 Inadvertent Discoveries

If, during construction activities, the Contractor observes items that may have historic or archeological value, such observations shall be reported immediately to the Contracting Officer so that the appropriate Corps staff may be notified and a determination for what, if any, additional action is needed. Examples of historic, archeological and cultural resources are bones, remains, artifacts, shell, midden, charcoal or other deposits, rocks or coral, evidences of agricultural or other human activity, alignments, and constructed features. The Contractor shall cease all activities that may result in the destruction of these resources and shall prevent his employees from further removing, or otherwise damaging, such resources.

Once reported, the Corps staff will initiate coordination with the appropriate federal, tribal and state agencies. Additional work in the area of the discovery will be suspended at the site until all federal and state regulations have been successfully completed and the Corps staff members provide further directive. Project activities in the vicinity of the discovery may not resume until the Contracting Officer approves work to proceed. No interview or other contact with the media shall occur without clear authorization from the Contracting Officer or the appropriate Corps representative.

##### 3.1.3.4 Claims for Downtime due to Inadvertent Discoveries

Upon discovery and subsequent reporting of a possible inadvertent discovery of cultural resources, the Contractor shall seek to continue work well away from, or otherwise protectively avoiding, the area of interest, or in some

other manner that strives to continue productive activities in keeping with the contract. Should an inadvertent discovery be of the nature that substantial impact(s) to the work schedule are evident, such delays shall be coordinated with the Contracting Officer. Contract adjustments resulting from compliance with this paragraph shall be determined in accordance with Clause DIFFERING SITE CONDITIONS of Section 00700 CONTRACT CLAUSES in Volume 1.

#### 3.1.3.5 Protection of Trees Significant to Seminole Brighton Reservation

The red bay tree is a culturally significant plant within the Seminole Brighton Reservation near the Harney Pond (HP) culverts. Follow the procedures indicated in subparagraph "Red Bay Tree" above prior to construction.

#### 3.1.4 Protection of Water Resources

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface, ground waters, and wetlands. The Contractor shall plan his operation and perform all work necessary to minimize adverse impact or violation of the water quality standard. Special management techniques as set out below shall be implemented to control water pollution by the listed construction activities which are included in this contract. The Contractor's construction methods shall protect wetland and surface water areas from damage due to mechanical grading, erosion, sedimentation and turbid discharges. There shall be no storage or stockpiling of equipment, tools, or materials within wetlands or along the shoreline within the littoral zone unless specifically authorized.

##### 3.1.4.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. These waste waters shall be collected and placed in retention ponds where suspended materials can be settled out or the water evaporates so that pollutants are separated from the water. Analysis shall be performed and results reviewed and approved by Corps staff before water in retention ponds is discharged.

##### 3.1.4.2 Stream Crossings

Stream crossings shall be controlled during construction. Crossings shall provide movement of materials or equipment without violating water pollution control standards of the Federal, State, or local government.

##### 3.1.4.3 Monitoring of Water Areas

Monitoring of water areas affected by construction activities shall be the responsibility of the Contractor. All water areas affected by construction activities shall be monitored by the Contractor.

##### 3.1.4.4 Turbidity

See Section 01 57 25 TURBIDITY AND DISPOSAL MONITORING

##### 3.1.4.5 Oil, Fuel, and Hazardous Substance Spill Prevention and Mitigation

The Contractor shall prevent oil, fuel, or other hazardous substances from entering the air, ground, drainage, local bodies of water, or wetlands.

This shall be accomplished by design and procedural controls. In the event that a spill occurs despite the design and procedural controls, the following shall occur:

(1) Immediate action shall be taken to contain and cleanup any spill of oil, fuel or other hazardous substance.

(2) Spills shall be immediately reported to the Contracting Officer.

(3) Spill contingency planning shall be strictly in accordance with the criteria of 40 CFR, Part 109.

(4) To control the spread of any potential spill, absorbent materials shall be readily available and capable of absorbing the contents of the single largest tank.

(5) To control the spread of any potential spill, the Contractor shall provide a written certification of commitment of manpower, equipment, and materials required to expeditiously cleanup and dispose of spill materials.

a. Spill Preventive Systems: System design and installation requirements have been discussed at the beginning of this Section. Temporary or portable tanks shall conform to applicable Federal, State, and local codes and requirements and shall not be placed where they may be affected by storm, flooding, or washout. Diversionary structures for spills shall be put in place in advance where practical. Both spill preventive systems and any deviations from associated requirements must be approved by the Contracting Officer prior to implementation.

b. Liabilities: The Contractor shall be liable in the amounts established in 40 CFR, Part 113 when it can be shown that oil was discharged as a result of willful negligence or willful misconduct. The penalty for failure to report the discharge of oil shall be in accordance with the provision of 33 CFR, Part 153.

### 3.1.5 Protection of Fish and Wildlife Resources

The Contractor shall keep construction activities under surveillance, management, and control to minimize interference with, disturbance to, and damage of fish and wildlife. Species that require specific attention along with measures for their protection shall be listed in the Contractor's Environmental Protection Plan prior to the beginning of construction operation.

In the event that a threatened or endangered species is harmed as a result of construction activities, the Contractor shall cease all work and notify the Contracting Officer. The order of contact within the Corps of Engineers shall be as follows:

#### Order of Contact of Corps Personnel

<u>Title</u>	<u>Telephone Number</u>	
	<u>Work Hours</u>	<u>After Hours</u>
Corps, Inspector	On site	Lodging Location
Area Engineer, South Florida Area Office		

(CESAJ-CD-W)	561-626-8143	*
Chief, Environmental Branch		
Planning Division (CESAJ-PD-E)	904-232-1665	*
Chief, Construction Division		
(CESAJ-CD)	904-232-1118	*

\* Telephone numbers will be provided during the Preconstruction Conference.

#### 3.1.5.1 Endangered Species Protection

The Contractor shall instruct all personnel associated with the project of the potential presence of manatees in the area, and the need to avoid collisions with and harming these animals. All construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and/or the Florida Manatee Sanctuary Act. The Contractor shall be held responsible for any manatee, harmed, harassed, or killed as a result of construction activities.

a. Siltation Barriers: If siltation barriers are used, they shall be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment. Barriers must not block manatee entry to or exit from essential habitat.

b. Special Operating Conditions:

(1) All vessels associated with the project shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom, and vessels shall follow routes of deep water whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light-displacement category, where navigational safety permits. Mooring bumpers shall be placed on all barges, tugs, and similar large vessels wherever and whenever there is a potential for manatees to be crushed between two moored vessels. The bumpers shall provide a minimum stand-off distance of four feet.

(2) If a manatee(s) is sighted within 100 yards of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 feet of a manatee. If a manatee is closer than 50 feet to moving equipment or the project area, the equipment shall be shut down and all construction activities shall cease within the waterway to ensure protection of the manatee. Construction activities shall not resume until the manatee has departed the project area.

c. Manatee Signs: Prior to commencement of construction, each vessel involved in construction activities shall display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8-1/2" x 11" reading, "CAUTION: MANATEE HABITAT/IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA." In the absence of a vessel, a temporary 3' x 4' sign reading "CAUTION: MANATEE AREA" shall be posted adjacent to the issued construction permit. A second temporary sign measuring 8-1/2" x 11"

reading "CAUTION: MANATEE HABITAT. EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION" shall be posted at the dredge operator control station and at a location prominently adjacent to the issued construction permit. The Contractor shall remove the signs upon completion of construction. Sample Manatee Caution Signs are on the first web site indicated in the paragraph CONSTRUCTION FORMS AND DETAILS below.

In addition, the Contractor shall instruct all personnel associated with the project of the potential presence of Eastern Indigo Snakes, Bald Eagles, Gopher Tortoise, Snail Kite, Caracara, Wood Stork, Burrowing Owls and Okeechobee Gourd plants in the area, and the need to avoid collisions with and harming these animals and plants. The Contractor shall be held responsible for any of the above mentioned animals and plants harmed, harassed, or killed as a result of construction activities. In the event that a threatened or endangered species is harmed as a result of construction activities, the Contractor shall cease work and notify the Contracting Officer.

a. The Contractor shall conduct preconstruction surveys for protected species, making note of suitable nesting habitat with and adjacent to the project work limits, prior to the start of construction activities.

b. There are many trees (such as cypress and palms) within and adjacent to the project work limits that may provide suitable nesting habitat for protected species. In addition, nesting platforms could be present within the project work limits.

#### 3.1.5.2 Report Submission

The Contractor shall maintain a log detailing all incidents, including sightings, collisions with, injuries, or killing of Manatees, Eastern Indigo Snakes, Burrowing Owls, Gopher Tortoise, Snail Kite, Caracara, Wood Stork, Bald Eagles and Okeechobee Gourd occurring during the contract period. The data shall be recorded on forms provided by the Contracting Officer (sample forms are on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below). All data in original form shall be forwarded directly to Chief, Environmental Branch, P. O. Box 4970, Jacksonville, Florida, 32232-0019, within 10 days of collection and copies of the data shall be supplied to the Contracting Officer. Following project completion, a report summarizing the above incidents and sightings shall be submitted to the following:

Florida Fish and Wildlife Conservation Commission  
Imperiled Species Management Section  
620 South Meridian Street, Mail Stop 6A  
Tallahassee, Florida 32399-1600

Chief, Environmental Branch  
U.S. Army Corps of Engineers (CESAJ-PD-E)  
P.O. Box 4970  
Jacksonville, Florida 32232-0019

Area Engineer, South Florida Area Office  
U.S Army Corps of Engineers (CESAJ-CD-W)  
4400 PGA Boulevard, Suite 203  
Palm Beach Gardens, Florida 33410

U.S. Fish and Wildlife Service  
1339 20th Street  
Vero Beach, Florida 32960-3559

### 3.1.5.3 Protection of Migratory Bird Species

The Contractor shall keep construction activities under surveillance, management, and control to prevent impacts to migratory birds and their nests. All construction personnel shall be advised that migratory birds are protected by the Florida Endangered and Threatened Species Act of 1977, Title XXVIII, Chapter 372.072, and the U.S. Fish and Wildlife Service pursuant to the Migratory Bird Treaty Act of 1918 and the Endangered Species Act of 1973, as amended. The Contractor may be held responsible for harming or harassing the birds, their eggs or their nests as a result of the construction. The Contractor shall conduct preconstruction surveys for protected species, making note of suitable nesting habitat within and adjacent to the project work limits, prior to the start of construction activities.

a. Monitoring of Construction Area: In order to meet these responsibilities, the Contractor shall conduct monitoring of the construction area beginning 1 April through 31 August, if construction activities occur during that period. Daily monitoring using the Daily Bird Monitoring Report shall be conducted during the dawn or dusk time frames by a bird monitor approved by the Contracting Officer. (Caution shall be taken by the monitor to avoid disturbance to the nesting birds.) The Contractor shall maintain a daily log detailing monitoring and nesting activity (not all bird species are listed). Sample monitoring report and qualification sheet are on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below. Within 30 days after completion of construction, a summary of monitoring shall be submitted to the Corps detailing nesting and nesting success/failure including species, number of nests created, location, number of eggs, number of offspring generated during the project and reasons for nesting success or failure, if known.

b. Nesting Activity Notification: Any nesting activity observed by the Contractor shall be reported immediately to the Contracting Officer who shall have sole authority for any work stoppages, creation of the buffer area, or restart of construction activities. In addition, notify the personnel indicated in the table "Order of Contact of Corps Personnel" above, and FWC Regional Director at (561) 625-5122.

c. Presence/Absence Survey: At least 3 visits must be made to each site during April-July. A 6-minute point count (variable circular plot) should be conducted between sunrise and 3 hours after or 1 hour prior to sunset. If breeding birds are encountered, nests shall be located and observed without disturbance to the nesting activity. Nests shall be marked and visited every 3-5 days to determine fate.

d. Nesting Within Construction Area:

(1) Should nesting begin within the construction area, a temporary, 200-foot buffer shall be created around the nests and marked to avoid entry (the Contracting Officer will provide signs). The area shall be left undisturbed until nesting is completed or terminated, and the chicks fledge. The decision to allow construction in a former nesting site will be determined by the Contracting Officer in consultation with the U.S. Fish and

Wildlife Service and the FF&WCC. Access to the nesting sites by humans (except limited access when accompanied by the bird monitor or Contracting Officer), equipment or pets under control of the Contractor is prohibited.

(2) If nesting occurs within the construction area, a bulletin board shall be placed and maintained by the Contractor in the contracting shed with the location map of the construction site showing the bird nesting areas and a warning, clearly visible, stating that "BIRD NESTING AREAS ARE PROTECTED BY THE FLORIDA THREATENED AND ENDANGERED SPECIES ACT AND THE FEDERAL MIGRATORY BIRD TREATY ACT".

(3) Birds will find the top of the dike or the flat interior desirable nesting habitat. If construction activity ceases for any period of time, nesting may occur before work can resume. Any stoppage of activity could induce nesting, subsequently, construction could be altered or stopped to avoid impacting the birds. Areas which are potentially suitable for nesting can be altered to make the area undesirable. One approved method is the placement of stakes at 10- to 15-foot intervals and tie flagging between the stakes in a web fashion. This may dissuade bird nesting until construction can be resumed. In addition, the disposal area basin can be flooded prior to the beginning of nesting season to the elevation required for displacement from the disposal of dredged material in order to make the basin undesirable for bird nesting.

(4) Nesting platforms are present within, and adjacent to, the project work limits. Osprey and other protected species have nested on these platforms historically. In addition, there are many trees protected (such as cypress and palms) within the project work limits that may provide suitable nesting habitat for protected species. If an inactive bird nest is present within the project work limits, the Contractor may apply for a nest removal permit from FFWCC at [http://myfwc.com/license/wildlife/#nest\\_removal](http://myfwc.com/license/wildlife/#nest_removal) to remove the inactive nest to prevent impacts to construction. If the Contractor removes any nesting platform(s), the Contractor shall replace the platform(s) prior to completion of work.

e. Bird Monitoring Qualifications: The Contractor's Environmental Protection Plan shall contain the qualifications of the bird monitor and the steps to be taken to construct the project in such a manner as not to impact migratory birds or induce their nesting. The qualifications of the bird monitor are a demonstrated ability to identify bird species, general and nesting behavior characteristics, nests and eggs, and a knowledge of habitat requirements. In addition, references must be provided to verify non-educational experience. The qualifications shall be submitted on the Bird Monitoring Qualification Sheet.

f. Work Delay: Delays in work due to the fault of negligence of the Contractor or the Contractor's failure to comply with this specification shall not be compensable. Any adjustments to the contract performance period or price that are required as a result of compliance with this section shall be made in accordance with the Clause SUSPENSION OF WORK of Section 00700 CONTRACT CLAUSES in Volume 1.

3.1.5.4 Bald Eagle (*Haliaeetus leucocephalus*)

A survey for bald eagles' nests shall be conducted prior to any construction activities. A preliminary survey has been conducted by the Government.

a. A 660-foot no activity buffer zone shall be maintained around the nest under the following conditions: (a) building construction at any height, and (b) where the project footprint is any size, and (c) the activity will be visible from the nest, and (d) if there is no similar activity within 1 mile of the nest.

(1) If there is existing tolerated activity for similar scope closer than 1 mile from the nest, the buffer zone may be adjusted to the same distance as that activity or structure occurs within the 660 feet.

b. A 330-foot no activity buffer zone shall be maintained around the nest under the following conditions: (a) building construction of any height, and (b) project footprint is 0.5 acre or less, and (c) the activity will not be visible from the nest, and (d) there is no similar activity within 1 mile of the nest.

(1) If there is existing tolerated activity of similar scope closer than 1 mile from the nest, the buffer zone may be adjusted to the same distance as that activity or structure occurs within the 330 feet for any project footprint larger than 0.5 acre.

c. If bald eagles nest within 660 feet of a construction zone, the Contractor shall be required to obtain the applicable disturbance permits from USFWS and FF&WCC.

The Service and FWC recommend biological monitoring of the nesting territory if new development, specifically residential, commercial, and /or industrial construction, is proposed to occur within 660 feet of the nest tree during the nesting season (October 1-May 15, Service 1987). If work will occur during nesting season, the Contractor shall obtain a take permit under the Bald & Golden Eagle Protection Act from USFWS. In addition, the Contractor shall obtain a disturbance permit from FFWCC. If the hatchlings fledge prior to the May 15 date, activity within the 660 foot buffer would be allowed. There are limited exceptions where individual construction projects may be granted closer access to nests; this will be determined by USFWS Florida Ecological Field Offices (FEFO) staff. In the event that construction within the interior of the buffer is unavoidable within nesting season, the Bald Eagle Monitor Guidelines, September, 2006, will be implemented accordingly.

3.1.5.5 Protection of The Florida Burrowing Owl (*Athene cunicularia floridana*)

The Contractor shall keep construction activities under surveillance, management, and control to prevent impacts to burrowing owls and their nests. All construction personnel shall be advised that burrowing owls are protected by the U.S. Fish and Wildlife Service under the Federal Migratory Bird Treaty Act. Burrowing owls are listed as a Species of Special Concern by the State of Florida, and therefore it is illegal to take (pursue, hunt, capture, molest, or kill) them and their nest burrows or eggs without a permit issued by the Executive Director of the Commission. The Contractor may be held responsible for harming or harassing the birds, their eggs, or



their nests as a result of the construction.

a. Monitoring of Construction Area: In order to meet these responsibilities, the Contractor shall conduct monitoring of the construction area beginning 15 February through 10 July, if construction activities occur during that period. Daily monitoring using the Daily Bird Monitoring Report shall be conducted during the dawn or dusk time frames by a bird monitor approved by the Contracting Officer. Caution shall be taken by the monitor to avoid disturbance to the nesting birds. The Contractor shall maintain a daily log detailing monitoring and nesting activity (not all bird species are listed). Sample monitoring report and qualification sheet are on the web site indicated in the paragraph CONSTRUCTION FORMS AND DETAILS below. Within 30 days after completion of construction, a summary of monitoring shall be submitted to the Corps detailing nesting and nesting success/failure including species, number of nests created, location, number of eggs, number of offspring generated during the project and reasons for nesting success or failure, if known.

b. Nesting Within Construction Area:

(1) Should nesting begin within the construction area, a temporary, 150-foot buffer shall be created around the nests and marked to avoid entry (the Contracting Officer will provide signs). The area shall be left undisturbed until nesting is completed or terminated, and the chicks fledge. The decision to allow construction in a former nesting site will be determined by the Contracting Officer in consultation with the U.S. Fish and Wildlife Conservation Commission. Access to the nesting sites by humans (except limited access when accompanied by the bird monitor or Contracting Officer), equipment or pets under control of the Contractor is prohibited.

(2) If a temporary buffer is infeasible, a take permit can be requested by submitting an application packet to the Protected Species Permit Coordinator, Bureau of Wildlife Diversity Conservation, Florida Fish and Wildlife Conservation Commission, 620 S. Meridian St., Mail Station WLD-BLX, Tallahassee, FL 32399-1600, (850) 921-5990, ext 17310.

c. Bird Monitoring Qualifications: The Contractor's Environmental Protection Plan shall contain the qualifications of the bird monitor and steps to be taken to construct the project in such a manner as not to impact migratory birds or induce their nesting. The qualifications of the bird monitor are a demonstrated ability to identify bird species, general and nesting behavior characteristics, nests and eggs, and a knowledge of habitat requirements. In addition, references must be provided to verify non-educational experience.

d. Work Delay: Delays in work due to the fault or negligence of the Contractor or the Contractor's failure to comply with this specification shall not be compensable. Any adjustments to the contract performance period or price that are required as a result of compliance with this section shall be made in accordance with the Clause SUSPENSION OF WORK of Section 00700 CONTRACT CLAUSES.

#### 3.1.5.6 Protection of Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*)

No activities will be conducted within 1,640 feet of Everglade snail kite

nests during the breeding season (January through June) or around roosting sites throughout the year. If the snail kite is documented on site, project activities shall be modified to not disturb the birds. If project activities in snail kite habitat during this breeding season are unavoidable, then a knowledgeable site monitor will be used to determine when activities are disturbing the birds. Project activities will cease if the snail kites are disturbed, and the Contracting Officer and Environmental Branch Chief shall be contacted. If disturbance is expected then an incidental take permit is needed, and shall be acquired by the Contractor.

The Contractor shall keep construction activities under surveillance, management, and control to prevent impacts to Everglade snail kites and their nests. All construction personnel shall be advised that Everglade snail kites are protected by the U.S. Fish and Wildlife Service pursuant to the Endangered Species Act of 1973, as amended (87 Stat. 884: 16 U.S.C. 1531 et seq.). Speed limits are limited to 30 to 35 mph where traffic is not common (behind gates) during the day. At dawn and dusk, speed limits will be limited from 15-25 mph where traffic is not common (behind gates). The Contractor may be held responsible for harming or harassing the birds, their eggs or their nests as a result of the construction. The Contractor must follow the Terms and Conditions outlined by U.S. Fish and Wildlife Service as outlined in the Project Concurrence Letter. Requirements include:

- a. Monitoring of Construction Area. In order to meet these responsibilities, the Contractor shall conduct monitoring within 1,640 feet of the construction area January through June, and immediately prior to construction. Surveys will follow the appropriate procedures outlined in the Management Guidelines for Everglade snail kites from the USFWS.
- b. Survey. Pre-nesting surveys shall be conducted between sunrise and about 1100 hours or between about 1600 hours and sunset. At least one pre-nesting survey shall be conducted weekly beginning December 1. Pre-nesting surveys shall cover an area at least 1,640 feet surrounding all project activities, which include but might not be limited to access roads, channels, or other routes; equipment storage facilities; and construction sites.
- c. Monitoring. A knowledgeable biologist will monitor active snail kite nests during all project activities within 1,640 feet of active snail kite nests. Nest monitors will record snail kite and project activities sufficiently to observe if/when project activities disturb snail kites. Snail kite disturbance behaviors include, but might not be limited to, responsive movement, agitation, or flushing. If disturbance behaviors are observed, project activities shall cease. The nest monitors shall report disturbance behaviors to the Corps, who in consultation with the USFWS will determine which activities are allowed to resume.
- d. Project Modifications. If the nesting snail kites are documented, project activities shall be modified to avoid disturbance. No activities shall be conducted within 425 feet of the nests during breeding season or around roosting sites throughout the year. Disturbance will be avoided within a 425-foot zone established around active nests. Habitat disturbances, such as anthropogenic water level changes and vegetative alterations shall be avoided within a 1,640-foot area surrounding active nests during the breeding season (January to

June).

e. Injured or Dead Snail Kite. If a dead, injured, or sick snail kite is found in the project footprint or along access roads to the project site, notification shall be made to the Contracting Officer and Chief of the Environmental Branch in the Jacksonville District Office, and to U.S. Fish and Wildlife Service Law Enforcement Office Robert Register, Special Agent, 1339 20th Street, Vero Beach, Florida 32960; 772-562-3909, extension 224. Notification shall also be made to the Florida Fish and Wildlife Conservation Commission, South Region, 3900 Drane Field Road, Lakeland, FL 33811, Wildlife Alert Number 1-800-404-3922. A dead specimen shall be bagged and frozen. In conjunction with the care of sick or injured snail kite or preservation of biological material from a dead animal, the finder also has the responsibility to carry out instructions provided by the U.S. Fish and Wildlife Service Law Enforcement office to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

#### 3.1.5.7 Protection of Wood Stork (*Mycteria americana*)

The Contractor shall keep construction activities under surveillance, management, and control to prevent impacts to wood storks and their nests. Speed limits are limited to 30 to 35 mph where traffic is not common (behind gates) during the day. At dawn and dusk, speed limits will be limited from 15-25 mph where traffic is not common (behind gates). All construction personnel shall be advised that wood storks are protected by the U.S. Fish and Wildlife Service pursuant to the Endangered Species Act of 1973, as amended. The Contractor may be held responsible for harming or harassing the birds, their eggs or their nests as a result of the construction. The Contractor must follow the Terms and Conditions outlined by the U.S. Fish and Wildlife Service as outlined in the Project Concurrence Letter. Requirements include:

a. Monitoring of Construction Area. In order to meet these responsibilities, the Contractor shall conduct monitoring within 1,000-1,500 feet of the construction area January through June, and immediately prior to construction. Surveys shall follow the appropriate procedures outlined in the wood stork Habitat Management Guidelines from the USFWS.

b. Survey. Surveys shall be conducted between sunrise and about 1100 hours or between about 1600 hours and sunset. Wood storks are most actively nest building, foraging, or feeding young between sunrise and about 1100 hours, and again between about 1600 hours and sunset. Wood storks are rarely active during the heat of midday, especially in the summer months.

c. Monitoring. A knowledgeable biologist shall monitor active wood stork nests during all project activities within 1,000 feet of active wood stork nests. Nest monitors will record snail kite and project activities sufficiently to observe if/when project activities disturb wood storks. Wood stork disturbance behaviors include but might not be limited to responsive movement, agitation, or flushing. If disturbance behaviors are observed, project activities shall cease. The nest monitors shall report disturbance behaviors to the Corps, who in consultation with the USFWS will determine which activities are allowed to resume.

d. Project Modifications. If the nesting wood storks are documented,

project activities shall be modified to avoid disturbance. No activities shall be conducted within 1,000 feet of the nests during breeding season or around roosting sites throughout the year. Disturbance will be avoided within a 1,000-foot zone established around active nests. Habitat disturbances, such as anthropogenic water level changes and vegetative alterations shall be avoided within a 1,500-foot area surrounding active nests during the breeding season (January to June).

e. Injured or Dead Wood Stork. If a dead, injured, or sick wood stork is found in the project footprint or along access roads to the project site, notification shall be made to the Contracting Officer and Chief of the Environmental Branch in the Jacksonville District Office, and to the U.S. Fish and Wildlife Service Law Enforcement Office Robert Register, Special Agent, 1339 20th Street, Vero Beach, Florida 32960, 772-562-3909, extension 224. Notification shall also be made to the Florida Fish and Wildlife Conservation Commission, South Region, 3900 Drane Field Road, Lakeland, Florida 33811, Wildlife Alert Number 1-800-404-3922. A dead specimen shall be bagged and frozen. In conjunction with the care of sick or injured wood stork or preservation of biological material from a dead animal, the finder also has the responsibility to carry out instructions provided by the U.S. Fish and Wildlife Service Law Enforcement office to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

3.1.5.8 Protection of Audubon's Crested Caracara (*Polyborus plancus audubonii*)

The Contractor shall keep construction activities under surveillance, management, and control to prevent impacts to caracara and their nests. Speed limits are limited to 30 to 35 mph where traffic is not common (behind gates) during the day. At dawn and dusk, speed limits shall be limited from 15-25 mph where traffic is not common (behind gates). All construction personnel shall be advised that caracara are protected by the U.S. Fish and Wildlife Service pursuant to the Endangered Species Act of 1973, as amended. The Contractor may be held responsible for harming or harassing the birds, their eggs or their nests as a result of the construction. The Contractor must follow the Terms and Conditions outlined by U.S. Fish and Wildlife Service as outlined in the Project Concurrence Letter. Requirements include:

- a. Monitoring of Construction Area. In order to meet these responsibilities, the Contractor shall conduct monitoring within 985-4,920 feet of the construction area between January and April, and immediately prior to construction. Surveys shall follow the appropriate procedures outlined in the Survey Protocol for caracara Territories from the USFWS.
- b. Surveys are best conducted early in the morning or late in the afternoon. Caracaras are most actively nest building, foraging, or feeding young between sunrise and about 1100 hours, and again between about 1600 hours and sunset. Caracaras are rarely active during the heat of midday, especially in the summer months.
- c. Monitoring. A knowledgeable biologist will monitor active caracara nests during all project activities within 985 feet of active caracara nests. Nest monitors will record caracara and project activities sufficiently to observe if/when project activities disturb caracara. Caracara disturbance behaviors include, but might not be limited to

responsive movement, agitation, or flushing. If disturbance behaviors are observed, project activities shall cease. The nest monitors shall report disturbance behaviors to the Corps, who in consultation with the USFWS shall determine which activities are allowed to resume.

d. Project modifications. If nesting caracaras are documented, project activities shall be modified to avoid disturbance. No activities shall be conducted within 985 feet of the nests during breeding season or around roosting sites throughout the year. Disturbance shall be avoided within a 985-foot zone established around active nests. Habitat disturbance, such as anthropogenic water level changes and vegetative alterations, shall be avoided within a 4,920-foot area surrounding active nests during the breeding season (January to June).

e. Injured or Dead Caracara. If a dead, injured, or sick caracara is found in the project footprint or along access roads to the project site, notification should be made to the Contracting Officer and Chief of the Environmental Branch in the Jacksonville District Office, and to U.S. Fish and Wildlife Service Law Enforcement Officer Robert Register, Special Agent, 1339 20th Street, Vero Beach, Florida 32960; 772-562-3909, extension 224. Notification should also be made to the Florida Fish and Wildlife Conservation Commission; South Region; 3900 Drane Field Road; Lakeland, FL 33811; Wildlife Alert Number 1-800-404-3922. A dead specimen should be bagged and frozen. In conjunction with the care of sick or injured caracara or preservation of biological material from a dead animal, the finder also has the responsibility to carry out instructions provided by the U.S. Fish and Wildlife Service Law Enforcement officer to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

#### 3.1.5.9 Protection of Gopher Tortoise (GT) Populations (*Gopherus polyphemus*)

The Contractor shall keep construction activities under surveillance, management, and control to prevent impacts to GTs and their burrows. All construction personnel shall be advised that GTs are listed by the State of Florida as a Species of Special Concern and protected by the FAC, Chapter 39027.002(4). The Contractor may be held responsible for taking, harming, or harassing the tortoises, their eggs or their burrows as a result of the construction. The destruction of GT burrows constitutes taking under this law except as authorized by specific permit.

a. General. In order to meet these responsibilities, the Contractor shall conduct GT surveys prior to the beginning of construction activities. The surveys shall be conducted by a qualified GT biologist. A list of qualified individuals may be obtained from the FF&WCC. The Contractor shall stay at least 25 feet from entrances of individual burrows.

b. State Permit Applications. Pursuant to the requirements of Rules 68-25.002 and 68-27.002 of the Wildlife Code of the State of Florida (Title 68A, FAC), a permit for a GT capture/relocation release project must be secured from the FF&WCC prior to initiating any relocation work. Applications shall be submitted at least 30 days prior to the time needed from Office of Environmental Services, Division of Wildlife, Florida Fish and Wildlife Conservation Commission, 620 S Meridian Street, Tallahassee, Florida 32399-1600, ATTN: Mr. Rick McCann, Endangered Species Coordinator, telephone 850-488-6661. Permits to capture and release GTs on site will be issued by regional

Division of Wildlife or Office of Environmental Services personnel based on telephone requests (field verifications may be conducted by FF&WCC personnel if deemed necessary).

c. Application Information. The application will contain, but not be limited to, aerial photography of the donor and recipient sites, a detailed map showing the location of the active and inactive burrow sites, the location and number of acres of GT habitat, the carrying capacity of the recipient site and any management plans for the recipient site.

d. Applicant Qualifications. Applicants for relocation permits shall be suitably trained or experienced in such work. Copies of applicant credentials demonstrating such shall be appended to applications. A list of qualified individuals may be obtained from the FF&WCC.

#### 3.1.5.10 Protection of Eastern Indigo Snake (*Drymachon couperi*)

a. Monitoring of Construction Area: The Contractor shall coordinate with the Jacksonville District Corps of Engineers, Environmental Branch, South Florida Section (CESAJ-PD-ES) and the U.S. Fish and Wildlife Service's (FWS) South Florida Field Office during the establishment and implementation of an indigo snake protection/education plan.

b. Qualified Observer: A qualified observer shall be present on site to watch for indigo snakes during all construction phases, including clearing phases of the project. The name(s) and qualifications of the proposed observer shall be submitted to the Contracting Officer for approval. The information submitted should indicate what experience the individual has that would qualify the person to act as an indigo snake observer.

c. Indigo Snake Protection/Education Plan: An indigo snake protection/education plan shall be developed for all construction crews to follow. The plan shall be provided to the Contracting Officer for review and approval at least 30 days prior to any construction or clearing activities. The educational materials for the plan could consist of a combination of posters or videos, pamphlets, and lectures and should include the following information:

(1) Description of the indigo snake, its habits, and protection under Federal Law;

(2) Instructions not to injure, harm, harass or kill this species;

(3) Directions to notify the qualified observer(s) if an indigo snake is sighted;

(4) Directions to cease construction activity, notify the qualified observer, and allow the indigo snake sufficient time to move away from the site on its own before resuming construction (only a qualified individual, who has been either authorized by a Section 10(a)(1)(A) permit issued by the FWS, or designated as an agent of the State of Florida by the FF&WCC for such activities, is permitted to come in contact with an indigo snake);

(5) Telephone numbers of pertinent agencies to be contacted

if a dead indigo snake is encountered; and,

(6) Instructions that, if necessary, indigo snakes shall be held in captivity only long enough to transport them to a release site; at no time shall two snakes be kept in the same container during transportation.

3.1.5.11 Protection of the West Indian (Florida) Manatee (*Trichechus manatus latirostris*)

a. Civil and Criminal Penalties: All construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and the Florida Manatee Sanctuary Act. The Contractor may be held responsible for any manatee harmed, harassed, or killed as a result of construction activities.

b. Siltation Barriers: If siltation barriers are used, they shall be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment. Barriers must not block manatee entry to or exit from essential habitat.

c. Vessel/Boat Operation: All vessels associated with the project shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot clearance from the bottom, and vessels shall follow routes of deep water whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light-displacement category, where navigational safety permits. Mooring bumpers shall be placed on all barges, tugs, and similar large vessels wherever and whenever there is a potential for manatees to be crushed between two moored vessels. The bumpers shall provide a minimum stand-off distance of 4 feet.

d. Preconstruction Surveys. Preconstruction surveys shall be conducted prior to cofferdam construction to ensure manatees are not present. Protection measures may include, but are not limited to, surveying, identifying, and avoiding manatees (which may include ceasing activities until manatees leave the area).

e. Manatee Sighting: If a manatee(s) is sighted within 100 yards of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 feet of a manatee. If a manatee is closer than 50 feet to moving equipment or the project area, the equipment shall be shut down and all construction activities shall cease within the waterway to ensure protection of the manatee. Construction activities shall not resume until the manatee has departed the project area. If construction activity shall cease, notify the Contracting Officer.

f. Manatee Signs: Prior to commencement of construction, each vessel involved in construction activities shall display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8-1/2" x 11" reading, "CAUTION: MANATEE HABITAT/IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA." In the absence of a vessel, a temporary 3' x 4' sign reading "CAUTION: MANATEE AREA" will be posted adjacent to the issued

construction permit. A second temporary sign measuring 8-1/2" x 11" reading "CAUTION: MANATEE HABITAT. EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION" shall be posted at the dredge operator control station and at a location prominently adjacent to the issued construction permit. The Contractor shall remove the signs upon completion of construction. Sample Manatee Caution Signs are on the first web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

g. Manatee Sighting Reports: Any collisions with a manatee or sighting of any injured or incapacitated manatee shall be reported immediately to the Corps of Engineers by notifying the personnel indicated in the table "Order of Contact of Corps Personnel" above. The Contractor shall also immediately report any collision with and/or injury to a manatee to the Florida Wildlife Conservation Commission "Manatee Hotline" 1-888-404-FWCC (3922) as well as the U.S. Fish and Wildlife Service, Vero Beach Field Office at 772-562-3909 for South Florida.

#### 3.1.5.12 Okeechobee Gourd Protection Measures (*Cucurbita okeechobeensis* ssp. *okeechobeensis*)

The Contractor shall be aware of the potential presence of the Okeechobee Gourd. A qualified botanist shall survey and flag the location of the Okeechobee Gourd within the construction area prior to commencement of construction activities. If the gourd is found, the Contracting Officer's Representative and the U.S. Fish and Wildlife Service shall be notified for management measures.

#### 3.1.6 Protection of Air Resources

The Contractor shall keep construction activities under surveillance, management, and control to minimize pollution of air resources. All activities, equipment, processes and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the applicable air pollution standards of the State of Florida (Florida Statute, Chapter 403 and others and Chapters 200 series of the FAC) and all Federal emission and performance laws and standards, including the U.S. Environmental Protection Agency's Ambient Air Quality Standards. Information regarding Florida Statutes can be obtained from the following web site: <http://www.dep.state.fl.us>.

##### 3.1.6.1 Particulates

Particulates, such as dust, shall be controlled at all times, including weekends, holidays, and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and work areas within or outside the project boundaries free from particulates that would cause air pollution standards to be exceeded or that would cause a hazard or nuisance. The Contractor shall have the necessary equipment and approved methods to control particulates as the work proceeds and before a problem develops.

##### 3.1.6.2 Burning

All burning shall be subject to State and local requirements, including requirements for burn permits and bans during certain conditions such as droughts.



#### 3.1.6.3 Odors

Odors shall be controlled at all times for all construction activities.

#### 3.1.7 Protection of Sound Intrusions

The Contractor shall keep construction activities under surveillance and control to minimize damage to the environment by noise.

#### 3.2 POSTCONSTRUCTION CLEANUP

The Contractor shall clean up any area(s) used for construction.

#### 3.3 PRESERVATION AND RESTORATION OF LANDSCAPE AND MARINE VEGETATION DAMAGES

The Contractor shall restore all landscape features and marine vegetation damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be a part of the Environmental Protection Plan as defined in subparagraph "Environmental Protection Plan" of paragraph SUBMITTALS above. This work shall be accomplished at the Contractor's expense.

#### 3.4 INVASIVE AND NUISANCE SPECIES

##### 3.4.1 Prevention of Invasive and Nuisance Species Transfer

The Contractor shall thoroughly clean equipment prior to and following work on the project to ensure that soil, vegetative debris, eggs, mollusk larvae, seeds, and vegetative propagules are not transported from a previous work location to this project site, nor transported from this project site to another location. Decontamination protocols include cleaning all equipment surfaces, including but not limited to, undercarriages, tires, and sheet metal. All equipment, including but not limited to, heavy equipment, vehicles, trailers, ATV's, and chippers must be decontaminated. Smaller equipment, including chainsaws, loppers, shovels, and backpack sprayers, must be cleaned and inspected to ensure they are free of eggs, vegetative debris, and vegetative propagules. The Contractor may utilize any method accepted by the Government; common accepted methods include pressure washing and steam cleaning/washing equipment. Decontamination protocols should also address clothing and personal protective equipment.

Prior to the commencement of work, the Contractor shall complete and provide a nuisance species decontamination plan to the COR/QA for approval. This plan shall be part of the Environmental Protection Plan as defined in subparagraph "Environmental Protection Plan" of paragraph SUBMITTALS above. The decontamination plan shall identify specific decontamination procedures and decontamination sites/locations. Decontamination protocols may vary depending upon the nature of the project site. It will be the responsibility of the COR/QA to inspect all equipment prior to work commencing at the project site, as well as inspecting equipment when it will be transported off the project site. Work delays due to the fault and/or negligence of the Contractor or the Contractor's failure to comply with this specification shall not be compensable. Any adjustments to the contract performance period or price that are required as a result of compliance with this section shall be made in accordance with the Clause SUSPENSION OF WORK of Section 00700 CONTRACT CLAUSES in Volume 1.

### 3.4.2 Invasive and Nuisance Species Reporting

The Contractor shall report sightings of invasive and nuisance species within 24 hours. The reporting shall include the date, time, location (latitude and longitude preferred), prevailing environmental conditions, circumstances surrounding the sighting, and disposition/behavior of the species. Pictures of the reported species are desirable. Reporting shall be made to the Jacksonville District Corps of Engineers:

Planning Division, Environmental Branch

Operations Division, Invasive Species Management Branch

### 3.4.3 Monitoring for Exotic, Nuisance, and Invasive Species

Upon removal of the lakeside cofferdam at S-286 (HP-3), the Contractor shall monitor the impact area. Exotic, nuisance, and invasive aquatic plant species shall be removed to allow for natural recruitment of bulrush and other native emergent aquatic vegetation. Monitoring and removal shall occur for six (6) months or until acceptance of work by the Government, whichever occurs earlier. Upon completion of monitoring, percent cover of exotic, nuisance, and invasive species shall be no greater than the original documented site condition. See subparagraph "Protection of Wetland and/or Emergent Aquatic Vegetation" above.

## 3.5 MAINTENANCE OF POLLUTION CONTROL FACILITIES

The Contractor shall maintain all constructed facilities and pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

## 3.6 CONSTRUCTION FORMS AND DETAILS

See the "Construction Forms & Details" module at the following web address:  
<http://www.saj.usace.army.mil/About/DivisionsOffices/Engineering/DesignBranch/SpecificationsSection.aspx>.

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SECTION 01 57 25

TURBIDITY AND DISPOSAL MONITORING

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all labor, materials, and equipment, and performing all work required to obtain, analyze, and report the results of turbidity and disposal monitoring.

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 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Calibration Standard

The Contractor shall furnish to the Contracting Officer a copy of the operating instructions and standards used in calibrating equipment used in collecting samples for turbidity.

SD-06 Test Reports

Turbidity Monitoring

All required turbidity test reports shall be submitted (by electronic mail in Excel format) to the Contracting Officer and the Environmental Branch (CESAJ-PD-E) within 7 days after completion of each test, and to the Florida Department of Environmental Protection (FDEP) on a quarterly basis as required by permit conditions.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 MONITORING REQUIREMENTS

3.1.1 General

Water samples shall be obtained and analyzed for turbidity. Sampling shall be conducted in accordance with techniques described in the latest edition of "Standard Methods" published by the American Public Health Association (APHA), American Waterworks Association (AWWA), and Water Pollution Control Federation (WPCF), and other current techniques recognized by the scientific community and approved by the Jacksonville District, Corps of Engineers. Samples obtained for turbidity analysis shall be analyzed within 30 minutes of collection. Samples shall be taken with a sampler

obtaining samples uncontaminated by water from any other depth.

#### 3.1.1.1 Turbidity Monitoring Equipment

Monitoring required for turbidity shall be measured in Nephelometric Turbidity Units (NTU) using a standard Nephelometer. Global Positioning System (GPS) is also required to record sampling stations. The Contractor shall provide the Government with a certification, attesting to the accuracy of his testing equipment and procedure. The Contractor shall also provide the Contracting Officer with a duplicate of the standard used to calibrate his testing instrument as well as a complete set of operating instructions for the turbidity testing equipment. The Contractor and the Contracting Officer will use this standard throughout the project to maintain the calibration of the equipment.

#### 3.1.2 Monitoring Frequency and Locations

Routine monitoring shall occur at the following locations:

##### 3.1.2.1 Monitoring Frequency

Samples to be analyzed for turbidity shall be taken twice daily (one between the hours of 12 midnight and 12 noon and the other between 12 noon and 12 midnight) at least 4 hours apart at surface and mid-depth at the following locations. Additional sampling shall be performed when the Contracting Officer determines that there may be non-compliance with water quality standards.

##### 3.1.2.2 Monitoring Locations

a. Background Sample(s): One background sample station in the landward toe ditch and another background sample station in the Lake, at least 150 meters up-current of the work area(s), collected outside of containment barriers, and outside any visible plume generated by the construction; and

b. Compliance Sample(s): One monitoring station located in either the landward toe ditch or lateral canal adjacent to the work area and one monitoring station in the Lake, no greater than 150 meters down-current from the work area(s) within the densest portion of any visible plume generated by construction. If the discharge is occurring at a temporary ditch dam that is within 150 meters of the intersection of the landward toe ditch with a lateral water supply canal, or if a visible turbidity plume is within 150 meters of a lateral canal, then a compliance sample will be taken in the lateral canal. If there are multiple work zones where the construction crew is creating a visible turbidity plume at more than one location, each work zone shall be monitored separately.

#### 3.2 TURBIDITY TESTS

##### 3.2.1 Testing

Whenever there is doubt as to the adequacy of the testing or validity of the results, the Contracting Officer may direct that additional tests be performed at no additional cost to the Government.

### 3.2.2 Reporting

The monitoring data shall be recorded on summary forms that contain the pertinent information in the following paragraphs. Example forms are on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below. Other data shall be submitted in the form supplied by the laboratory chosen to do the analysis. All data shall be forwarded (electronically) to the Contracting Officer, Environmental Branch (CESAJ-PD-E), and FDEP within 7 days of collection. Electronic mail addresses of the Corps and FDEP personnel to receive these reports are provided below. Reports shall be provided in Excel Spreadsheet (.xls) files.

NAME	ORGANIZATION	E-MAIL ADDRESS
*	USACE ACO	*
*	CESAJ-PD-E POC	*
FDEP Compliance Officer	FDEP	RPPS_comp@dep.state.fl.us

\* Names and e-mail addresses will be provided in the Preconstruction Conference. CESAJ-PD-E POC may also be indicated in the Environmental Compliance Matrix (ECM). See Section 01 57 20 ENVIRONMENTAL PROTECTION.

#### 3.2.2.1 Report Contents

- a. Permit application number.
- b. Dates of sampling and analysis.
- c. A statement describing the methods used in collection, handling, storage, and quality control methods used in the analysis of the samples.
- d. A map indicating the sampling location and plume configuration, if any.
- e. A statement by the individual responsible for implementation of the sampling program concerning the authenticity, precision, limits of detection, and accuracy of the data.
- f. Results of the analyses.
- g. A description of any factors influencing the construction operation or the sampling program. Reports shall be furnished daily even when no sampling is conducted. When sampling is not conducted, a brief statement shall be given in the report explaining the reason for not conducting the sampling.
- h. State plane coordinates (x and y) shall be provided for all sampling stations for each sampling event to demonstrate compliance with the stated sampling distances.

#### 3.2.2.2 Monitoring Reports

Monitoring reports shall also include the following information for each day that samples are taken:

- a. Time of day and date samples were taken.
- b. Depth of water body.
- c. Depth of sample.
- d. Antecedent weather conditions.
- e. Water stage and direction of flow.
- f. Salinity (provided for heavy metal and ammonia analysis only).
- g. pH (provided for heavy metal and ammonia analysis only).
- h. Water temperature, C degrees (heavy metal and ammonia analysis only).
- i. Site location (station location and map).

- j. Water sample location.
- k. Wind direction and velocity.

#### 3.2.2.3 Notification

If turbidity exceeds background levels by more than 29 NTU, the Contractor shall immediately notify Chief, Environmental Branch at 904-232-1665 and the Contracting Officer, or on the morning of the following work day if it occurs after normal work hours. In addition, all construction activity shall cease immediately and all measures to reduce turbidity shall be taken. Construction shall not resume until corrective measures have been taken and turbidity has returned to acceptable levels as determined by proper testing described in subparagraph "Monitoring Locations" above.

#### 3.3 WORK DELAY

Delays in work due to the fault or negligence of the Contractor or the Contractor's failure to comply with this specification shall not be compensable. Any adjustments to the contract performance period or price that are required as a result of compliance with this section shall be made in accordance with the provisions of the Clause SUSPENSION OF WORK of Section 00700 CONTRACT CLAUSES in Volume 1.

#### 3.4 CONSTRUCTION FORMS AND DETAILS

See the "Construction Forms & Details" module at the following web address:  
<http://www.saj.usace.army.mil/About/DivisionsOffices/Engineering/DesignBranch/SpecificationsSection.aspx>.

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SECTION 01 57 50

DRILLING PROGRAM PLAN

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-1-1807

(2014) Engineering and Design -- Drilling  
in Earth Embankment Dams and Levees

1.2 SYSTEM DESCRIPTION

The work specified in this section consists of the requirements of the Contractor to develop a Drilling Program Plan, in the event that any method of subsurface exploration is required to construct the project, or any other drilling requested by the Contractor on, through or around the embankment and foundation.

The Contractor shall propose methods for boring advancement, instrumentation installation, closure and abandonment, consistent with the local geology. The proposed methods shall be chosen to eliminate or reduce risk to the embankment or structure.

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Drilling Program Plan; G, DO

The Drilling Program Plan shall be submitted to the Government at least 30 calendar days prior to the beginning of any in-situ field work that does not include the use of drill fluids. A Drilling Protection Plan that proposes the advancement of borings, including jetting, with fluids which includes both air and/or water shall be submitted at least 90 calendar days prior to any field work as it will require a more complex review process. Revisions to the Drilling Program Plan shall be handled through the submittal process. See paragraph DRILLING PROGRAM PLAN (DPP) below.

1.4 DRILLING PROGRAM PLAN (DPP)

A written Drilling Program Plan (DPP) shall be submitted by the Contractor

prior to any invasive subsurface drilling program into, in close proximity to, or through the embankment and foundation. The subsurface drilling programs include borehole advancement, jetting, subsurface testing, instrumentation installation, piezometer, monitoring wells, dewatering wells, borehole completion, and boring/well abandonment. Verification drilling for a cementitious cutoff wall is excluded from this plan. The DPP shall include but not limited to the following information:

a. Objective and justification for drilling: This is to explain the purpose and reasoning for performing this work.

b. Exploration team who develops the DPP: Provide a listing of the contractors (primary and subs) exploration team of engineers and geologists, with years of experience, who developed the DPP.

c. Summary of existing information review: A summarized listing of information reviewed to understand the site conditions, and possible risks associated with drilling on the site.

d. Essential geologic and engineering drawings to support drilling program: Geologic and engineering drawings depicting the current understanding of the subsurface conditions based on information provided in the contract documents, as they relate to the proposed drilling which shall include a plan and cross sectional view of the site drilling plan/design.

e. Drilling scope and boring abandonment for drilling program: A detailed drilling scope and methodology including method of advancement, tooling, equipment to be used, instrumentation installed including completion, abandonment procedures, and names and years of experience of field personnel.

f. Risk evaluation of drilling plan. A risk evaluation based on information provided in the contract documents demonstrating what measures will be used to reduce or eliminate the risk of hydraulic fracturing, erosion, contamination of drainage features, heave, or any other damage.

For additional information on the procedure and required detail to be included in the DPP, refer to [ER 1110-1-1807](#). No drilling shall be performed until this plan has been approved and no deviation from the approved plan will be permitted without prior approval by the Contracting Officer.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

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SECTION 01 78 02

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

ERDC/ITL TR-12-2 (2012) A/E/C CADD Standard, Release 4.0  
Obtain from the following web site:  
<https://cadbim.usace.army.mil/CAD>

U.S. ARMY CORPS OF ENGINEERS (USACE)

District PPM (2013) Plans Preparation Manual,  
Jacksonville District, Design Branch;  
Obtain from the following web site:  
<http://www.saj.usace.army.mil/About/DivisionsOffices/Engineering/DesignBranch/CADDManagementSupport.aspx>

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. For each submittal identified in this section an equal number of electronic copies shall be submitted on CD-ROM media in Adobe Acrobat format, most recent version. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

As-Builts; G, RO

Submit as indicated in the subparagraph "Preparation of As-Builts" of paragraph PROJECT RECORD DOCUMENTS below. All drawing revisions and as-builts will be checked for compliance with ERDC/ITL TR-12-2 and District PPM.

SD-03 Product Data

As-Built Record of Equipment and Materials; G, RO

Six copies of the record listing the as-built materials and equipment as approved during shop drawing submittal, review and approval process, incorporated into the construction of the

project.

**Warranty Management Plan; G, RO**

Six sets of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

**Warranty Tags; G, RO**

Six record copies of the warranty tags showing the layout and design.

**Final Cleaning; G, RO**

Six copies of the listing of completed final clean-up items.

**1.3 PROJECT RECORD DOCUMENTS**

**1.3.1 Definitions**

**1.3.1.1 Design Files**

Design files are the latest version electronic CADD files.

**1.3.1.2 Working As-Built Drawings**

Working as-built drawings are full-sized contract drawings (hard copy) marked up in red to indicate as-built conditions.

**1.3.1.3 Completed Working As-Built Drawings**

Completed working as-built drawings are the final working as-built drawings (hard copy) for a completed feature certified by the Contractor.

**1.3.1.4 As-Built Files**

As-built files are corrected design files (CADD) showing the as-constructed condition identical to the completed working as-built drawings. As-built files are produced by making changes to the design files using CADD.

**1.3.1.5 As-Builts**

As-builts are the complete set, as indicated below, including as-built files (CADD) and completed working as-built drawings in hard copy and electronic format.

**1.3.1.6 As-Built Shop Drawings**

As-built shop drawings are detailed shop drawings of components incorporated into the completed work indicating as-built conditions.

**1.3.2 Preparation of As-Builts**

This paragraph covers obtaining completed working as-built drawings and as-built files (CADD), as a requirement of the contract. These as-builts

are part of the permanent records of this project and will be retained by the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

1.3.2.1 Government-Furnished Materials

One set of electronic CADD files (design files) in the specified software and format revised to reflect all bid amendments will be provided by the Government at the Preconstruction Conference for projects requiring CADD file as-built drawings (as-built files).

1.3.2.2 Working As-Built and Completed Working As-Built Drawings

The Contractor shall revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These working as-built drawings shall be kept current on a weekly basis and at least one set shall be available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. All mechanical and electrical changes due to field Request for Information (RFI) process, equipment shop drawings reflecting modified data due to submittal and approval process, and contract field and design modifications shall be incorporated in the working as-built drawings. Completed working as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built drawings and completed working as-built drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. The working as-built drawings and completed working as-built drawings shall show, but shall not be limited to, the following information:

- a. The actual location, kinds and sizes of all subsurface utility lines.
- b. Drawings shall depict actual location of all underground and above ground water, wastewater, and reclaimed water improvements and related appurtenances.
- c. Drawings shall clearly depict all details not on the original contract drawings, but constructed in the field. The location of all equipment and piping relocation shall be accurately depicted to scale.
- d. The location of existing utilities where crossed or uncovered during the course of the work shall be depicted.
- e. Dimensions between all manholes shall be field verified and depicted. The inverts and grade elevations of all lines entering and leaving manholes shall be depicted. Sewer laterals shall be accurately located and depicted.
- f. The depth from finish grade to the top of potable water mains, reclaimed water mains and sewer force mains shall be indicated at all valve and fitting locations.
- g. 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, these 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.

h. The location, dimensions, and finished floor elevations of the building structures installed or affected as part of the project construction.

i. As-built grade, elevations, cross sections, or alignment of canals, levees, roads, earthwork, structures or utilities, including any changes that were made from contract plans. Cross sections shall be provided at increments of 100 feet.

j. Changes in details of design or additional information obtained from shop drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

k. The topography, invert elevations, pipe sizes, and grades of drainage installed or affected as part of the project construction.

l. The invert elevations for all water control structures (including weir crest elevations, culverts, etc.). The completed as-built drawings shall depict all elevations at NAVD 88 and NGVD 29. The NGVD 29 elevation shall be italicized, bracketed and underscored.

m. Changes or modifications which result from the final inspection.

n. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the completed working as-built drawings, or as an alternative, options not constructed shall be boxed, drawn over with an "X" (corner to corner), and labeled with a note stating "Option Not Exercised".

o. Systems designed or enhanced by the Contractor; such as, but not limited to, HVAC controls, fire alarm, fire sprinkler, irrigation systems, pumping equipment, hydraulic operating system, fuel system, electrical controls, one-line diagram telemetry and SCADA system, conduit and piping layout, etc.

p. Modifications (change order price shall include the Contractor's cost to change working as-built drawings and completed as-built drawings to reflect modifications) and compliance with the following procedures.

(1) Directions in the modification for posting descriptive changes shall be followed.

(2) A revision symbol shall be placed at the location of each deletion.

(3) For new details or sections which are added to a drawing, a revision symbol shall be placed by the detail or section title.

(4) For minor changes, a revision symbol shall be placed by the area changed on the drawing (each location).

(5) For major changes to a drawing, a revision symbol shall be placed by the title of the affected plan, section, or detail at each location.

(6) For changes to schedules or drawings, a revision symbol shall be placed either by the schedule heading or by the change in the schedule.

(7) The revision symbol shown on plan shall be 1.5 times larger than the corresponding revision symbol shown in the revision block.

q. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, the Contractor shall furnish a contour map of the final borrow pit/spoil area elevations.

#### 1.3.2.3 Record Drawing Preparation

The record drawings (CADD) shall correctly show the features of the project as it has been constructed by bringing the contract design files into agreement with approved completed as-built drawings, and adding such additional drawings as may be necessary. The completed as-built drawings and record drawing shall be neat, legible and accurate. Record drawings (CADD) shall remain in the originally provided design file digital file format.

#### 1.3.2.4 Electronic Record Drawings

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the design files and prepare additional new drawings files when preparing the record drawings.

a. All drawing revisions shall be performed and conform to ERDC/ITL TR-12-2 and District PPM.

b. Additions and corrections to the record drawings shall be equal in quality and detail to that of the original design files. Line colors, line weights, lettering, and symbols shall be the same as the original line colors, line weights, lettering, and symbols. If additional drawings are required in the record drawings, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new drawings in the record drawings shall be identical to that used on the design file drawings. Additions and corrections to the record drawings shall be accomplished using CADD program/system to prepare the design files. The Contractor will be furnished Microstation design files. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall use the electronic design files provided by the Government at the Preconstruction Conference to prepare changes and additions to the electronic record drawings. New drawings added to the original set of drawings shall be prepared in CADD format. The Contractor shall be responsible for providing all programs and hardware necessary to prepare the record drawings. The Contractor shall provide a digital to-scale version of the record drawings in Portable Document Format (PDF) to the Contracting Officer for review. The Contractor shall make required corrections, changes, additions, and deletions as indicated by



the Contracting Officer.

c. CADD drawings shall utilize Computer Aided Design named levels to add text, redlines and revision areas to the CADD drawings. The first character of the levels shall start with the discipline designator of the sheet type as listed on Table 2-1 of the AEC CADD Standard. The next set of characters is ANNO to represent the annotation field. The final characters represent the type of information TEXT (text), REDL (redlines), and REVS (revisions). An example for an architectural discipline sheet level is A-ANNO-TEXT, A-ANNO-REDL, and A-ANNO-REVS.

d. Record drawings shall be created by appending an uppercase R to the design file name in the first user definable character. For a previously amended or modified design file, replace an existing A identifier or M identifier user defined character in the design file name with an uppercase R in the first user definable character. Completed as-built drawing changes shall be made only to those renamed files. The renamed files corrected to reflect the "as-built" condition are hereafter referred to as "record drawings".

e. As an alternative, the Government may exercise the option of preparing the record drawings (CADD) with their own resources, and reduce the contract amount to cover the cost of this work.

#### 1.3.2.5 Completion of As-Builts

The completed as-built drawings (hard copy) and record drawings (CADD) shall be completed as follows:

a. When final revisions have been completed, the cover sheet drawing shall show the wording "COMPLETED AS-BUILT" followed by the name of the Contractor in letters at least 3/16 inch high. All other completed as-built drawings and record drawings shall be marked either "AS-BUILT" drawing denoting no revisions on the sheet or "REVISED AS-BUILT" denoting one or more revisions. All completed as-built drawings and record drawings requiring revisions on the sheet shall have an entry entered into the revision block. The Contractor shall sign the cover sheet of the marked-up completed as-built drawings in the following manner: "I CERTIFY THAT THESE CORRECTED AS-BUILT DRAWINGS INDICATE CONSTRUCTION AS ACTUALLY PERFORMED AND ARE AN ACCURATE REPRESENTATION OF THE SPECIFIED WORK. THESE CORRECTED AS-BUILT DRAWINGS ARE APPROVED FOR PREPARATION OF RECORD CONSTRUCTION DRAWINGS."

b. Within 20 days after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the record drawings (CADD) for that phase of work and submit two sets of prints of these drawings along with a digital copy in PDF format on a CD for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days, the Contractor shall revise the record drawings accordingly at no additional cost and submit one set of final prints and one digital copy in PDF format on a CD for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, the Contractor shall submit the final record drawings for the entire project. The submittal shall consist of 4 sets of CADD-generated record drawings in PDF format on compact disc(s), 4 sets of record drawing CADD files on compact disc(s); 2 sets of full size record drawing prints, 2 sets of the completed approved working as-built drawings; and 2 sets of the completed approved working

as-built drawings scanned and saved into PDF format on compact disc(s). Compact discs shall be read-only memory (CD-ROM). They shall be complete in all details and identical in form and function to the design files supplied by the Government. The .PDF files produced from the approved completed working as-built drawings shall be of high resolution and quality, and easily readable. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible. Paper prints and storage media submitted will become the property of the Government upon final approval. Failure to submit as-builts and record drawings as specified shall be cause for withholding any payment due the Contractor as retainage under the clause PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section 00700 CONTRACT CLAUSES in Volume 1. Approval and acceptance of as-builts and record drawings shall be accomplished before final payment is made to the Contractor.

#### 1.3.3 As-Built Record of Equipment and Materials

The Contractor shall furnish Two copies of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Six sets of final record of equipment and materials shall be submitted 10 days after final inspection. The designations shall be keyed to the related area depicted on the contract drawings. The record shall list the following data:

##### RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used
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#### 1.3.4 As-Built Shop Drawings

The Contractor shall furnish final approved as-built shop drawings 30 days after transfer of the completed facility.

#### 1.3.5 Real Property Equipment

The Contractor shall furnish a list of installed equipment furnished under this contract. The list shall include all information usually listed on manufacturer's name plate. The "EQUIPMENT-IN-PLACE LIST" shall include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. A draft list shall be furnished at time of transfer. The final list shall be furnished 30 days after transfer of the completed facility.

#### 1.4 WARRANTY MANAGEMENT

##### 1.4.1 Warranty Management Plan

The Contractor shall develop a Warranty Management Plan which shall contain information relevant to the Clause WARRANTY OF CONSTRUCTION of Section

00700 CONTRACT CLAUSES in Volume 1. At least 30 days before the planned pre-warranty conference, the Contractor shall submit the Warranty Management Plan for Government approval. The Warranty Management Plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The Plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the Warranty Management Plan shall include, but shall not be limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC, motors, transformers, and for all commissioned systems such as security alarm systems, SCADA system, lightning protection systems, etc.

c. A list for each warranted equipment, item, feature of construction or system indicating:

1. Name of item.
2. Model and serial numbers.
3. Location where installed.
4. Name and phone numbers of manufacturers or suppliers.
5. Names, addresses and telephone numbers of sources of spare parts.
6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.
7. Cross-reference to warranty certificates as applicable.
8. Starting point and duration of warranty period.
9. Summary of maintenance procedures required to continue the warranty in force.
10. Cross-reference to specific pertinent Operation and Maintenance Manuals.
11. Organization, names and phone numbers of persons to call for warranty service.
12. Typical response time and repair time expected for various warranted equipment.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by

extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

g. The Contractor shall maintain QCS capabilities during the warranty period to correspond with the Government regarding the correction of warranty items.

#### 1.4.2 Performance Bond

The Contractor's Performance Bond shall remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

#### 1.4.3 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 section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty 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 shall furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, shall be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

#### 1.4.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a

report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the time frames specified, the Government will perform the work and back charge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

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

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems

- (1) Recreational support.
- (2) Air conditioning leak in part of building, if causing damage.
- (3) Air conditioning system not cooling properly.

Code 1-Doors

- (1) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors

- (1) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical

- (1) Power failure (entire area or any building operational after 1600 hours).
- (2) Security lights.
- (3) SCADA System.

Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

Code 3-Interior

- (1) Floors damaged.
- (2) Paint chipping or peeling.
- (3) Casework.

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 3-All other work not listed above.

#### 1.4.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information.

- a. Type of product/material\_\_\_\_\_.
- b. Model number\_\_\_\_\_.
- c. Serial number\_\_\_\_\_.
- d. Contract number\_\_\_\_\_.
- e. Warranty period\_\_\_\_\_from\_\_\_\_\_to\_\_\_\_\_.
- f. Inspector's signature\_\_\_\_\_.
- g. Construction Contractor\_\_\_\_\_.
- Address\_\_\_\_\_.
- Telephone number\_\_\_\_\_.
- h. Warranty contact\_\_\_\_\_.
- Address\_\_\_\_\_.
- Telephone number\_\_\_\_\_.
- i. Warranty response time priority code\_\_\_\_\_.
- j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

#### 1.5 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and approved by the Contracting Officer as specified in applicable technical specification sections.

#### 1.6 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted as specified. Operation manuals and maintenance manuals provided in a common volume shall be clearly differentiated and shall be separately indexed. Refer to Section 01 78 23 OPERATION AND MAINTENANCE DATA.

#### 1.7 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment

shall be replaced. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs, and construction facilities removed. A list of completed clean-up items shall be submitted on the day of final inspection.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

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SECTION 01 78 23

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SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data/Manuals specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this Section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.1.1 Quantity

Submit five copies and one reproducible original for total of six copies of the supplier/manufacturers' O&M information specified herein for the components, assemblies, subassemblies, attachments, and accessories. Submit six electronic copies of the above submittal in Adobe Acrobat (.pdf) format on CD-ROM media. The items for which O&M Data/Manuals are required are listed in the Technical Sections which specifies those particular items.

1.1.2 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.1.3 Package Content

Data package content shall be as shown in the paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES below. Comply with the data package requirements specified in the individual Technical Sections, including the content of the packages and addressing each product, component, and system designated for data package submission.

1.1.4 Delivery

Submit O&M Data Manuals to the Contracting Officer for review and acceptance; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

a. In the event the Contractor fails to deliver O&M Data/Manuals within the time limits set forth above, the Contracting Officer may withhold from progress payments the retained percentage for the contract in accordance with Clause PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section 00700 CONTRACT CLAUSES in Volume 1.

1.1.5 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions

required by the Contracting Officer for final acceptance of submitted data, shall be submitted within 30 calendar days of the notification of this change requirement.

## 1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

### 1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

#### 1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

#### 1.2.1.2 Operator Prestart

Include procedures required to set up and prepare each system for use.

#### 1.2.1.3 Startup, Shutdown, and Postshutdown Procedures

Provide narrative description for startup, shutdown, and postshutdown operating procedures including the control sequence for each.

#### 1.2.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

#### 1.2.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shutdown the equipment to prevent further damage to system and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

#### 1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

#### 1.2.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item of equipment should not be allowed to run.

### 1.2.2 Preventive Maintenance

Include the following information for preventative and scheduled maintenance to minimize corrective maintenance and repair.

#### 1.2.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication in accordance with subparagraph "Operator Service Requirements" above:

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

#### 1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

#### 1.2.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

##### 1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

##### 1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation numbering.

##### 1.2.3.3 Maintenance and Repair Procedures

Include instructions and a list tools required to repair or restore the product or equipment to proper condition or operating standards.

##### 1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

#### 1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Parts lists shall include the identifications, nomenclature, part numbers, required number of parts, recommended list of spare parts to be stocked at the project, and actual spare parts supplied. All data shall match the actual equipment furnished, and standard catalog sheets, cuts, and diagrams will not be acceptable unless all irrelevant parts are marked out and relevant parts are identified by heavy arrows at each side of the applicable data. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.

#### 1.2.3.6 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

#### 1.2.4 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

##### 1.2.4.1 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

##### 1.2.4.2 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as electric motor actuator for lift gates.

##### 1.2.4.3 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

#### 1.2.4.4 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

#### 1.2.4.5 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name, address, and telephone number of the manufacturer's representatives and service organization most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

### 1.3 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M Data Package specified in individual Technical Sections. The required information for each O&M Data Package is as follows:

#### 1.3.1 Data Package 1

- a. Safety precautions
- b. Maintenance and repair procedures
- c. Warranty information
- d. Contractor information
- e. Spare parts and supply list

#### 1.3.2 Data Package 2

- a. Safety precautions
- b. Normal operations
- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan and schedule
- f. Maintenance and repair procedures
- g. Removal and replacement instructions
- h. Spare parts and supply list
- i. Parts identification
- j. Warranty information
- k. Contractor information

1.3.3 Data Package 3

- a. Safety precautions
- b. Normal operations
- c. Emergency operations
- d. Environmental conditions
- e. Lubrication data
- f. Preventive maintenance plan and schedule
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring diagrams and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Parts identification
- m. Warranty information
- n. Testing equipment and special tool information
- o. Contractor information

1.3.4 Data Package 4

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and postshutdown procedure
- d. Normal operations
- e. Emergency operations
- f. Operator service requirements
- g. Environmental conditions
- h. Lubrication data
- i. Preventive maintenance plan and schedule
- j. Troubleshooting guides and diagnostic techniques
- k. Wiring diagrams and control diagrams
- l. Maintenance and repair procedures
- m. Removal and replacement instructions

- n. Spare parts and supply list
  - o. Corrective maintenance man-hours
  - p. Parts identification
  - q. Warranty information
  - r. Personnel training requirements
  - s. Testing equipment and special tool information
  - t. Contractor information
- 1.3.5 Data Package 5
- a. Safety precautions
  - b. Operator prestart
  - c. Startup, shutdown, and postshutdown procedures
  - d. Normal operations
  - e. Environmental conditions
  - f. Preventive maintenance plan and schedule
  - g. Troubleshooting guides and diagnostic techniques
  - h. Wiring and control diagrams
  - i. Maintenance and repair procedures
  - j. Spare parts and supply list
  - k. Testing equipments and special tools
  - l. Warranty information
  - m. Contractor information

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 DATA PACKAGE SUBMITTALS

The following O&M Manuals shall be furnished for the identified Data Packages, in addition to the requirements specified in Technical Section of the specifications. The O&M Manuals not listed here shall be furnished as required under each Technical Section of the specifications.

Item	Data Package
Electric Motor Actuator (Per Section 26 29 10 ELECTRIC MOTOR ACTUATOR FOR LIFT GATES)	3



Air Conditioning Unit (Per Electrical Drawings)	3
Remote Terminal Unit (Per Section 25 31 01 STRUCTURE REMOTE TERMINAL UNIT (RTU))	5
Electrical Systems (Per Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM) for the following items:	5
- Wire and Cable	
- Underground Cable System	
- Grounding	
- Miscellaneous Electrical	
- Lightning Protection System	
Gate Operating Unit (Per Section 35 20 16 VERTICAL LIFT SLIDE GATES)	3
Solar Photovoltaic (PV) Components (Per Section 26 31 00 SOLAR PHOTOVOLTAIC (PV) COMPONENTS)	5

### 3.2 PACKAGE FORMAT REQUIREMENTS

In addition to the above requirements, the above data for each group or type of equipment shall be assembled in a durable plastic or leatherette binder. Binders shall be for 8-1/2 by 11-inch sheets with slide binding or fastening with screwposts (with sufficient length for future expansion to add additional sheets) enabling ready replacement of sheets. An identifying title shall be provided, which shall be visible from the front cover, giving the name of project, equipment or system title, contract number and bid item number. Ring-type loose lead binders will not be acceptable. Shop drawings, assembly drawings or specially prepared drawings for these manuals or parts catalogs shall be of a size that requires folding only in left-to-right coordinates as the manual or catalog is opened. A permanent film or cloth reproducible shall be furnished for all drawings specially prepared and of special sizes as specified in the preceding sentences. This permanent reproducible shall be in addition to the drawings required to provide the five complete copies specified above. Each sheet in the binder shall be numbered and an index provided for ready reference to the data. All standard catalog cuts, manufacturer's printed data or descriptive literature parts sheets, or illustrations, shall be either original manufacturer sheet or reproduced copies equal in clarity and durability to the original copies. At least one copy of such manual shall contain all original copies of such data. Thermofax and similar nonpermanent copies are not acceptable. All non-applicable data, such as descriptive literature for other drawings, sketches, or data, that data shall be included or the referenced marked out. The final section of each manual shall consist of a list of equipment covered by the manual, the equipment manufacturer and the name, address and telephone number of the local manufacturer's representative or equipment supplier. The procurement order number of the equipment for this contract shall also be listed. Electronic copies of the above package shall be submitted on CD-ROM media in Adobe Acrobat (.pdf) format, latest version.

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SECTION 02 22 13

VIBRATION MONITORING REQUIREMENTS FOR EXISTING STRUCTURES

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 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Vibration Control Specialist; G, DO  
Vibration Control Specialist Alternate; G, DO  
Vibration Monitoring Technician(s); G, DO  
Structural Inspection/Evaluation Engineer; G, DO

Within 5 calendar days after Notice to Proceed, submit qualifications for the Vibration Control Specialist and his Alternate; Vibration Monitoring Technician(s); and, Structural Inspection/Evaluation Engineer. Refer to qualifications in paragraph PERSONNEL QUALIFICATIONS below for each person.

Pre-Construction Structural Survey; G, DO

Within 30 calendar days after Notice to Proceed and prior to mobilization of equipment, submit 3 copies of the Pre-Construction Structural Survey. Refer to requirements in paragraph PRE-CONSTRUCTION STRUCTURAL SURVEY below.

Vibration Control Plan; G, DO

Within 45 calendar days after Notice to Proceed and prior to mobilization of equipment, submit 3 copies of a Vibration Control Plan. Submit the Vibration Control Plan for compliance with the requirements in paragraph VIBRATION CONTROL PLAN below. The Plan shall include, but not be limited to, the following:

- a. List of structures that are susceptible to vibration damage.
- b. Number of monitors (seismographs) required for the project and location of monitors that will operate simultaneously in each work area.
- c. Calibration data for each seismograph that will be used for the project. Calibrations shall be current, not older than one year, and follow the manufacturer's recommended procedures.
- d. List of methods and procedures to reduce ground vibrations induced by construction activities to below the pre-determined

maximum allowable vibration level for the designated vibration sensitive structure(s); i.e., reducing equipment speed, changing fill placement method, reducing equipment size, and using manual labor.

e. Plan for each work area showing the proposed construction equipment in the area, the description of susceptible structure(s) in the work area, monitors in the work area, and the list of methods and procedures in subparagraph d. above.

f. The minimum safe working distance that vibration producing equipment may operate from each vibration sensitive structure(s).

g. The maximum allowable ground vibration level that is permissible without causing threshold damage to each vibration sensitive structure(s).

## SD-06 Test Reports

### Vibration Monitoring Report

Submit a Vibration Monitoring Report every 30 days for compliance with the requirements in paragraph VIBRATION MONITORING REPORT below. Submit the Vibration Monitoring Report and the Daily Instrument Logs concurrently.

### Daily Instrument Logs

Submit the Daily Instrument Logs every 30 days for compliance with the requirements in paragraph DAILY INSTRUMENT LOGS below. Submit the Daily Instrument Logs and the Vibration Monitoring Report concurrently.

### Post-Construction Structural Survey; G, DO

Submit 3 copies of the Post-Construction Structural Survey within 15 calendar days after completion of the inspection. Submit the Post-Construction Structural Survey for compliance with the requirements in paragraph POST-CONSTRUCTION STRUCTURAL SURVEY below.

## 1.2 PERSONNEL QUALIFICATIONS

### 1.2.1 Vibration Control Specialist

The Vibration Control Specialist shall have a background in structural and/or geotechnical engineering, have a minimum of three years of demonstrated experience in vibration monitoring and related work, and be a registered professional engineer or registered professional geologist. The alternate may serve in the event of the Vibration Control Specialist's absence. Periods of absence shall not exceed one week at any one time and not more than fifteen workdays during a calendar year. The requirements for the alternate are the same as for the Vibration Control Specialist. The Vibration Control Specialist shall be designated in the Vibration Control Plan.

### 1.2.2 Vibration Monitoring Technician(s)

Personnel responsible for operation, maintenance and calibration of

seismographs shall have a minimum of three years of demonstrated experience in vibration monitoring and related work.

#### 1.2.3 Structural Inspection/Evaluation Engineer

Structural inspections shall be performed by professional engineer with a specialty in structures registered in the State of Florida with a minimum of three years of demonstrated experience in structural condition inspections. The Structural Inspection Engineer shall have responsibility for pre-construction and post-construction structural surveys. The Structural Inspection Engineer shall be designated in the Vibration Control Plan.

#### 1.2.4 Organizational Changes

When it is necessary to make changes to personnel, resubmit qualifications in accordance with paragraph SUBMITTALS above.

### PART 2 PRODUCTS (NOT APPLICABLE)

### PART 3 EXECUTION

#### 3.1 VIBRATION CONTROL PROGRAM

Implement a program that protects existing structures from damages that result from construction equipment operations and vibrations. The purpose of the program is to avoid damages and potential claims that allege damages were caused by construction activities. The Contractor is responsible to document pre-existing conditions, to avoid damaging existing structures that were determined to be susceptible to vibration damage, and to avoid damaging existing structures that were not determined to be susceptible to vibration damage; related responsibilities include inspection, damage claims, and work stoppage that results from monitoring.

The Contractor's attention is called to Clauses PERMITS AND RESPONSIBILITIES and PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS of Section 00700 CONTRACT CLAUSES in Volume 1 of this contract that define the Contractor's responsibilities. The Contractor shall process any claim arising from his operation; in particular, all property damage claims shall be acknowledged by the Contractor (or his agent) immediately, and the claimed damage inspected within 30 calendar days following initial notification, and processed to a conclusion (honored, denied, or compromised) within 90 calendar days after completion of the contract; but, in no case shall the claim(s) remain unresolved for a period exceeding six months.

#### 3.2 PRE-CONSTRUCTION STRUCTURAL SURVEY

Evaluate existing structures within 500 feet from the work limits as to their potential susceptibility to vibration damage from construction equipment induced ground vibration. Visible structural and/or cosmetic damage to bridges, culverts, pump stations, buildings, exterior walls, foundations, decks, and pools shall be documented by photographs, sketches, and field notes.

Factors to consider in determining potential susceptibility shall include but not be limited to: foundation design; foundation conditions; soils testing data; changes in structural loads and local water levels due to construction; structural condition including construction materials; past

damage history and existing stresses, magnitude, frequency, and duration of predicted vibrations from construction equipment and distance from fill placement.

Inspect all existing structures that are determined to be vibration sensitive. Any damage found shall be documented thoroughly by photographs (supplemented with video as necessary), sketches of visible structural and/or cosmetic damage, and field notes. Photographs shall be at least 3- by 5-inch (or digital) and shall provide a detailed visual explanation of the damage. Include a reference scale in each close-up photograph. Sketches shall show the general damage location and extent. All inspection items shall be indexed and cross-referenced and shall use the stationing and locations shown on the contract drawings. Include hotel/motel names and addresses where applicable. Structural damage shall be additionally documented by measuring crack or damage size, width, and length. Every effort shall be made to inspect and document the condition of the building's interior where the building has been determined to be extremely susceptible to vibration damage. Structure(s) determined not to be susceptible to vibration damage shall be noted as such.

### 3.3 VIBRATION CONTROL PLAN

Use the results of the Pre-Construction Structural Survey to develop the Vibration Control Plan. The Plan shall include procedures to monitor vibration sensitive structures, adjust daily mobilization and demobilization activities, and alter operations that create vibrations approaching maximum allowable levels. The Plan shall include the appropriate tolerable ground vibration level for each structure that has been determined to be susceptible to vibration damage. The vibration control specialist shall determine the tolerable ground vibration level, but in no case will this value be greater than 0.5 inches per second. Should ground vibrations equal or exceed the pre-determined maximum tolerable vibration level(s), construction operations shall be halted and corrective measures taken in accordance with the approved Plan.

The minimum safe working distance that vibration producing equipment may operate from each vibration sensitive structure shall be documented in the Plan.

The maximum allowable ground vibration level that is permissible without causing threshold damage to each vibration sensitive structure shall be documented in the Plan. Threshold damage is defined as the occurrence of cosmetic damage.

Each seismograph shall have the capability to measure peak particle velocity and frequency and shall be equipped with an alarm system to alert the on-site Vibration Control Specialist that ground vibrations are approaching the maximum tolerable ground vibration level.

The Contractor's personnel responsible for implementation of the Plan is hereinafter called Vibration Control Specialist. The Vibration Control Specialist shall be on the site during mobilization, demobilization and operation of equipment that creates ground vibrations of concern.

### 3.4 DAILY INSTRUMENT LOGS

Daily instrument logs shall document satisfactory performance of the equipment during monitoring periods. Strip charts shall be documented daily with monitoring station number, date, technician signature, and

instrument serial number.

### 3.5 VIBRATION MONITORING REPORT

The monitoring report shall detail the daily activities of the vibration monitoring program. This report shall include, but not be limited to, locations of monitoring equipment; instrument serial number; date and times of readings; magnitude of vibration levels; a sketch and photograph (3- by 5-inch) of each monitoring station showing the relationship of the monitor to vibration sensitive structures; daily instrument logs; instructions transmitted to the Contractor's personnel regarding the modification or stoppage of work operations to keep vibrations below the allowable levels; description of complaint(s); and, any other information pertinent to the vibration monitoring program.

### 3.6 POST-CONSTRUCTION STRUCTURAL SURVEY

Immediately after completion of work, conduct a post-construction inspection of the structures previously inspected under the Pre-Construction Structural Survey. Documentation procedures shall be identical to those performed under the Pre-Construction Structural Survey. Changes or deviations from the pre-construction inspection conditions in any structure shall be identified and described in the inspection documentation. All citizen complaints and remedies that occurred during the construction period shall be summarized and included in the report.

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SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 Safety and Health Requirements Manual

The most recent USACE EM 385-1-1 can be viewed at the web site indicated in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

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

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 Demolition/Deconstruction Plan

Prepare a [Demolition Plan](#) and submit proposed demolition and removal procedures for approval before work is started. Refer to construction and resource drawings. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reused or recycling with reference to subparagraph "Existing Facilities to be Removed". Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use. Coordinate with Waste Management Plan. Provide procedures for safe conduct of the work in accordance with [EM 385-1-1](#). Plan shall be approved by the Contracting Officer prior to work beginning.

1.2.2 General Requirements

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas

specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

### 1.3 BURNING

Comply with Section 01 57 20 ENVIRONMENTAL PROTECTION.

### 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Demolition Plan; G, RO

### 1.5 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6. Use of explosives will not be permitted.

#### 1.5.1 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

### 1.6 PROTECTION

#### 1.6.1 Protection of Personnel

Before, during and after the demolition work, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

## PART 2 PRODUCTS

### 2.1 FILL MATERIAL

a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill voids, depressions or excavations resulting from demolition of structures.

b. Fill material shall conform to Section 35 41 00 EMBANKMENT

CONSTRUCTION.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite, and review construction and resource drawings. Existing construction scheduled to be removed for salvage shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified.

3.1.1 Structures

- a. Remove existing structures above excavation grades shown on construction drawings, except those items to be salvaged.
- b. Demolish structures in a systematic manner from the top of the structure to the ground. Demolish concrete in small sections.
- c. Locate demolition equipment throughout the structure and remove materials so as to not impose excessive loads to supporting members.

3.1.2 Chain Link Fencing

Salvage existing chain link fencing in a manner to prevent damage. Transport fencing and components to a designated area as directed by the Contracting Officer. Scrap metal shall become the Contractor's property.

3.1.3 Concrete

Saw or break concrete and dispose off site.

3.1.4 Structural Steel

Dismantle and remove structural steel sheet pile at field connections and in a manner that will prevent bending or damage. Existing sheet pile may have tie backs and anchors. Salvage for reuse or recycle structural steel sheet pile, cap, tie rods and dead man anchors. Flame-cutting torches are permitted when other methods of dismantling are not practical. Transport structural steel shapes to a designated area as directed by the Contracting Officer, stacked according to size, type of member and length, and stored off the ground, protected from the weather.

3.1.5 Stone

Remove existing stone riprap and stockpile onsite.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting

Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

### 3.2.2 Salvaged Materials and Equipment

Remove materials and equipment that are indicated in the drawings and specified herein to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as directed within 45 miles of the work site.

- a. Salvage items and material to the maximum extent possible.
- b. Store all materials salvaged for the Contractor as approved by the Contracting Officer and remove from Government property before completion of the contract. On site sales of salvaged material is prohibited.
- c. Remove salvaged items to remain the property of the Government in a manner to prevent damage, and pack or crate to protect the items from damage while in storage or during shipment. Items damaged during removal or storage must be repaired or replaced to match existing items. Properly identify the contents of containers. Deliver the following items reserved as property of the Government to the areas designated:
  - (1) Existing riprap shall be stockpiled for reuse by the South Florida Operations Office.
  - (2) Culvert flap gates, winch assembly including cables, hoists, and sheaves. Deliver to South Florida Operations Office (SFOO).
  - (3) Coordinate with the Contracting Officer and the South Florida Water Management District for removal of the control building.
  - (4) Culvert slide gates, gate frame, actuators, associated telemeter and instrumentation, and associated control equipment. Coordinate with the Contracting Officer for delivery location.

### 3.2.3 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable material off the site in accordance with federal, state and local laws and regulations.

## 3.3 CLEANUP

Remove debris and rubbish from excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

## 3.4 DISPOSAL OF REMOVED MATERIALS

### 3.4.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations off the site in accordance with federal,

state and local laws and regulations. Storage of removed materials on the project site is prohibited.

#### 3.4.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

#### 3.4.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed by the Contracting Officer and in accordance with Section 01 57 20 ENVIRONMENTAL PROTECTION.

#### 3.5 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

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STRUCTURAL CAST-IN-PLACE CONCRETE FORMING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 347 (2004; Errata 2008; Errata 2012) Guide to Formwork for Concrete

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA PS 1 (2009) Structural Plywood (with Typical APA Trademarks)

ASTM INTERNATIONAL (ASTM)

ASTM C1077 (2013) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

ASTM C31/C31M (2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C39/C39M (2012) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

1.2 SYSTEM DESCRIPTION

The design, engineering, and construction of the formwork is the responsibility of the Contractor. Design formwork in accordance with methodology of ACI 347 for anticipated loads, lateral pressures, and stresses, and capable of withstanding the pressures resulting from placement and vibration of concrete. Comply with the tolerances specified in Section 03 31 01 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS, paragraph CONSTRUCTION TOLERANCES. However, for surfaces with an ACI Class A surface designation, limit the allowable deflection for facing material between studs, for studs between walers and walers between bracing to 0.0025 times the span. Design the formwork as a complete system with consideration given to the effects of cementitious materials and mixture additives such as fly ash, cement type, plasticizers, accelerators, retarders, air entrainment, and others. Monitor the adequacy of formwork design and construction prior to and during concrete placement as part of the Contractor's approved Quality Control Plan. Submit design analysis and calculations for form design and methodology used in the design. Calculations and drawings shall be sealed by a registered professional

engineer.

### 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Formwork; G|DO

#### SD-03 Product Data

Design  
Form Materials  
Form Releasing Agents

#### SD-06 Test Reports

Inspection  
Formwork Not Supporting Weight of Concrete; G|DO.

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

Submit manufacturer's data, including literature describing form materials, accessories, and form releasing agents.

#### 2.1.1 Forms For Class B Finish

This class of finish shall apply to all surfaces except those specified to receive Class A, Class C, or Class D. Forms for Class B finished surfaces shall be plywood panels conforming to APA PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type. Steel lining on wood sheathing will not be permitted.

#### 2.1.2 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

#### 2.1.3 Pan-Form Units

Pan-form units for one-way or two-way concrete joist and slab construction shall be factory-fabricated units of the approximate section indicated. Units shall consist of steel or molded fiberglass concrete form pans. Closure units shall be furnished as required.

#### 2.1.4 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable



or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Provide solid backing for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inch in diameter. Terminate the embedded portion of metal ties not less than 2 inches from any concrete surface exposed to water. Removable tie rods shall be not more than 1-1/2 inches in diameter. Plastic snap ties may be used in locations where the surface will not be exposed to view. Embedded form tie clearances shall be indicated on the formwork submittal.

#### 2.1.5 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds. If special form liners are to be used, follow the recommendation of the form coating manufacturer. Submit manufacturer's recommendation on method and rate of application of form releasing agents.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Formwork

Forms shall be constructed true to the structural design and required alignment. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03 31 01 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS and conforming to construction tolerance given in TABLE 1. Continuously monitor the alignment and stability of the forms during all phases to assure the finished product will meet the required surface class or classes specified. Failure of any supporting surface either due to surface texture, deflection or form collapse shall be the responsibility of the Contractor as will the replacement or correction of unsatisfactory surfaces. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. When forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be re-used if there is any evidence of defects which would impair the quality of the resulting concrete surface. All surfaces of used forms shall be cleaned of mortar and any other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker. Submit drawings showing details of formwork, including dimensions of joints, supports, studding and shoring, and sequence of form and shoring removal.

#### 3.2 CHAMFERING

All exposed joints, edges and external corners shall be chamfered by molding placed in the forms unless the drawings specifically state that chamfering is to be omitted or as otherwise specified. Chamfered joints shall not be permitted where earth or rockfill is placed in contact with concrete surfaces. Chamfered joints shall be terminated twelve inches outside the limit of the earth or rockfill so that the end of the chamfers will be clearly visible.

### 3.3 COATING

Forms for Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

### 3.4 FORM REMOVAL

Forms shall not be removed without approval. The minimal time required for concrete to reach a strength adequate for removal of formwork without risking the safety of workers or the quality of the concrete depends on a number of factors including, but not limited to, ambient temperature, concrete lift heights, type and amount of concrete admixture, and type and amount of cementitious material in the concrete. It is the responsibility of the Contractor to consider all applicable factors and leave the forms in place until it is safe to remove them. In any case forms shall not be removed unless the minimum time requirements below are met, except as otherwise directed or specifically authorized. When conditions are such as to justify the requirement, forms will be required to remain in place for a longer period. All removal shall be accomplished in a manner which will prevent damage to the concrete and ensure the complete safety of the structure. Where forms support more than one element, the forms shall not be removed until the form removal criteria are met by all supported elements. Form removal shall be scheduled so that all necessary repairs can be performed as specified in Section 03 31 01 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS. Evidence that concrete has gained sufficient strength to permit removal of forms shall be determined by tests on control cylinders. All control cylinders shall be stored in the structure or as near the structure as possible so they receive the same curing conditions and protection methods as given those portions of the structure they represent. Control cylinders shall be removed from the molds at an age of no more than 24 hours. All control cylinders shall be prepared and tested in accordance with ASTM C31/C31M and ASTM C39/C39M at the expense of the Contractor by an independent laboratory that complies with ASTM C1077 and shall be tested within 4 hours after removal from the site.

#### 3.4.1 Formwork Not Supporting Weight of Concrete

Formwork for walls, columns, sides of beams, gravity structures, and other vertical type formwork not supporting the weight of concrete shall not be removed in less than 24 hours after concrete placement is completed. If forms are to be removed in less than 24 hours on formwork not supporting the weight of concrete, submit the evaluation and results of the control cylinder tests shall be submitted to and approved before the forms are removed.

#### 3.4.2 Formwork Supporting Weight of Concrete

Formwork supporting weight of concrete and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction or other superimposed loads to which the supported concrete may be subjected. As a minimum, forms shall be left in place until control concrete test cylinders indicate

evidence the concrete has attained at least 70 percent of the compressive strength required for the structure in accordance with the quality and location requirements.

### 3.5 INSPECTION

Forms and embedded items shall be inspected in sufficient time prior to each concrete placement 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. Submit field inspection reports for concrete forms and embedded items.

TABLE 1 TOLERANCES FOR FORMED SURFACES	
1. Variations from the plumb:	
a. In the lines and surfaces of columns, piers, walls and in arises	1/4 inch in any 10 feet of length Maximum for entire length -- 1 inch
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	1/4 inch in any 20 feet of length Maximum for entire length -- 1/2 inch
2. Variation for the level or from the grades indicated on the drawings:	
a. In slab soffits, ceilings beam soffits, and in arises, measured before removal of supporting shores	1/4 inch in any 10 feet of length 3/8 inch in any bay or in any 20 feet of length Maximum for entire length -- 3/4 inch
b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	1/4 inch in any bay or in any 20 feet of length Maximum for entire length -- 1/2 inch
3. Variation of the linear building lines from established position in plan	1/2 inch in any 10 feet 1 inch maximum
4. Variation of distance between walls, columns, partitions	1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1 inch total variation
5. Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus 1/4 inch, Plus 1/2 inch
6. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus 1/4 inch, Plus 1/2 inch

TABLE 1 TOLERANCES FOR FORMED SURFACES	
7. Footings:	
a. Variation of dimensions in plan	Minus 1/2 inch, plus 2 inches when formed or plus 3 inches when placed against unformed excavation
b. Misplacement of eccentricity	2 percent of the footing width in the direction of misplacement but not more than 2 inches
c. Reduction in thickness	Minus 5 percent of the specified thickness
8. Variation in steps:	
a. In a flight of stairs	Riser -- 1/8 inch Tread -- 1/4 inch
b. In consecutive steps	Riser -- 1/16 inch Tread -- 1/8 inch

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DIVISION 03 - CONCRETE

SECTION 03 15 00

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-- End of Section Table of Contents --

SECTION 03 15 00

CONCRETE ACCESSORIES

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 HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995; R 2004) Basic Hardboard

ASTM INTERNATIONAL (ASTM)

ASTM C919 (2012) Use of Sealants in Acoustical Applications

ASTM C920 (2011) Standard Specification for Elastomeric Joint Sealants

ASTM D1751 (2004; R 2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D1752 (2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion

ASTM D2628 (1991; R 2011) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASTM D2835 (1989; R 2012) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

ASTM D471 (2012a) Standard Test Method for Rubber Property - Effect of Liquids

ASTM D5249 (2010) Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513 (1974) Corps of Engineers Specifications for Rubber Waterstops

COE CRD-C 572 (1974) Corps of Engineers Specifications

for Polyvinylchloride Waterstops

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Waterstops; G|DO

SD-03 Product Data

Preformed Expansion Joint Filler  
Sealant  
Waterstops

SD-04 Samples

Lubricant for Preformed Compression Seals  
Field-Molded Type  
Non-metallic Materials  
Waterstops  
Splicing Waterstops; G|DO

SD-07 Certificates

Preformed Expansion Joint Filler  
Sealant  
Waterstops

1.3 DELIVERY, STORAGE, AND HANDLING

Protect material delivered and placed in storage off the ground from moisture, dirt, and other contaminants. Deliver sealants in the manufacturer's original unopened containers. Remove sealants from the site whose shelf life has expired.

PART 2 PRODUCTS

2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D1751 or ASTM D1752, Type I, or resin impregnated fiberboard conforming to the physical requirements of ASTM D1752. Submit certified manufacturer's test reports for premolded expansion joint filler strips, compression seals and lubricant, and metallic waterstops to verify compliance with applicable specification. Unless otherwise indicated, filler material shall be 3/8

inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D5249.

## 2.3 SEALANT

Joint sealant shall conform to the following:

### 2.3.1 Preformed Polychloroprene Elastomeric Type

ASTM D2628.

### 2.3.2 Lubricant for Preformed Compression Seals

ASTM D2835. Submit a piece not less than 9 ft of 1 inch nominal width or wider seal or a piece not less than 12 ft of compression seal less than 1 inch nominal width. Provide one quart of lubricant.

### 2.3.3 Field-Molded Type

ASTM C920. Sealant shall be Type M, Grade P or NS, Class 25, Use NT for horizontal joints. Type M, Grade NS, Class 25, Use NT for vertical joints. Except, the joint sealant that will be submerged underwater for part or all of its service life shall meet the requirements of USE I. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber. Submit One gallon of field-molded sealant and one quart of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.

## 2.4 WATERSTOPS

Shop fabricate intersection and change of direction waterstops. Submit a sample of each material consisting of a piece not less than 12 inches long cut from each 200 feet of finished waterstop furnished, but not less than a total of 4 linear feet of each type and size furnished. For spliced segments of waterstops to be installed in the work, furnish one spliced sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site for inspection and testing. Make the spliced samples using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each spliced sample shall be not less than 12 inches long. Submit waterstop materials and splice samples for inspection and testing identified to indicate manufacturer, type of material, size and quantity of material and shipment represented.

### 2.4.1 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D471. Submit a piece not less than 12 inch long cut from each 200 ft of finished waterstop furnished, but not less than a total of 4 ft of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. Make the



splice samples using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 12 inches long.

## 2.5 TESTS, INSPECTIONS, AND VERIFICATIONS

### 2.5.1 Materials Tests

#### 2.5.1.1 Field-Molded Sealants

Samples of sealant and primer, when use of primer is recommended by the manufacturer, as required in paragraph FIELD MOLDED TYPE, shall be tested by and at the expense of the Government for compliance with paragraph FIELD MOLDED TYPE. If the sample fails to meet specification requirements, provide new samples and the cost of retesting will be deducted from payments due the Contractor at a rate of \$500.00 per sample.

#### 2.5.1.2 Non-Metallic Waterstops

Samples of materials and splices will be visually inspected and tested by and at the expense of the Government for compliance with COE CRD-C 513 or COE CRD-C 572 as applicable. If a sample fails to meet the specification requirements, provide new samples and the cost of retesting will be deducted from payments due the Contractor at the rate of \$500.00 per material sample retested and \$500.00 per spliced sample retested.

### 2.5.2 Splicing Waterstops

#### 2.5.2.1 Procedure and Performance Qualifications

Demonstrate procedure and performance qualifications for splicing waterstops in the presence of the Contracting Officer. Submit procedures for splicing waterstops for approval.

#### 2.5.2.2 Non-Metallic Waterstops

Demonstrate procedure and performance qualifications for splicing non-metallic waterstops by the manufacturer at the factory and the Contractor at the job site by each making three spliced samples of each size and type of finished waterstop.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Joint locations and details, including materials and methods of installation of joint fillers and waterstops, shall be as specified and indicated. In no case shall any fixed metal be continuous through an expansion or contraction joint.

#### 3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Make joints 1/8 inch to 3/16 inch wide and extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

#### 3.1.1.1 Joint Strips

Provide strips of the required dimensions and as long as practicable. After the first floating, groove the concrete with a tool at the joint locations. Insert the strips in the groove and depress them until the top edge of the vertical surface is flush with the surface of the slab. Float and finish the slab as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, saw out the top portion of the strip after the curing period to form a recess for sealer. Discard the removable section of PVC or HIPS strips and leave the insert in place. Maintain true alignment of the strips during insertion.

#### 3.1.1.2 Sawed Joints

Saw joints early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent raveling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Use concrete sawing machines that are adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Cut joints to true alignment and in sequence of concrete placement. Remove sludge and cutting debris. Form reservoir for joint sealant.

#### 3.1.1.3 Bond Breaker

Coat joints requiring a bond breaker with curing compound or with bituminous paint. Protect waterstops during application of bond breaking material to prevent them from being coated.

#### 3.1.2 Expansion Joints

Use preformed expansion joint filler in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. Extend the filler to the full slab depth, unless otherwise indicated. Neatly finish the edges of the joint with an edging tool of  $\frac{1}{8}$  inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. Remove the wood strip after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. Thoroughly clean the groove of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust. If blowing out the groove use oil-free compressed air.

#### 3.1.3 Joint Sealant

Fill sawed contraction joints and expansion joints in slabs with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Apply joint sealant as recommended by the manufacturer of the sealant.

### 3.1.3.1 Joints With Preformed Compression Seals

Install compression seals with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. Cover the sides of the joint and, if necessary, the sides of the compression seal with a coating of lubricant. Coat butt joints with liberal applications of lubricant.

### 3.1.3.2 Joints With Field-Molded Sealant

Do not seal joints when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C919 shall be followed. Coat joints requiring a bond breaker with curing compound or with bituminous paint. Install bond breaker and back-up material where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

## 3.2 WATERSTOPS, INSTALLATION AND SPLICES

Install waterstops at the locations shown to form a continuous water-tight diaphragm. Make adequate provision to support and completely protect the waterstops during the progress of the work. Repair or replace any waterstop punctured or damaged. Protect exposed waterstops during application of form release agents to avoid being coated. Provide suitable guards to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Accomplish splices with certified trained personnel using approved equipment and procedures.

### 3.2.1 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Maintain continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) across the splice.

#### 3.2.1.1 Rubber Waterstop

Spllices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Spllices for TPE-R shall be as specified for PVC.

#### 3.2.1.2 Polyvinyl Chloride Waterstop

Make spllices by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. Use the correct temperature to sufficiently melt without charring the plastic. Reform waterstops at spllices with a remolding iron with ribs or corrugations to match the pattern of the waterstop. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

### 3.2.1.3 Quality Assurance

Edge welding will not be permitted. Compress or close centerbulbs when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than  $1/16$  inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than  $1/16$  inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of  $1/2$  inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

### 3.2.2 Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a  $1$  inch overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

## 3.3 CONSTRUCTION JOINTS

Treat construction joints coinciding with expansion and contraction joints as expansion or contraction joints as applicable.

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SECTION 03 20 00

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-- End of Section Table of Contents --

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318 (2011; Errata 2011; Errata 2012) Building Code Requirements for Structural Concrete and Commentary

ACI SP-66 (2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4/D1.4M (2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1035/A1035M (2011) Standard Specification for Deformed and Plain, Low-carbon, Chromium, Steel Bars for Concrete Reinforcement

ASTM A184/A184M (2006; E2011) Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

ASTM A185/A185M (2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A370 (2012a) Standard Test Methods and Definitions for Mechanical Testing of Steel Products

ASTM A496/A496M (2007) Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

ASTM A497/A497M (2007) Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A615/A615M (2012) Standard Specification for Deformed

and Plain Carbon-Steel Bars for Concrete  
Reinforcement

ASTM A675/A675M (2003; R 2009) Standard Specification for  
Steel Bars, Carbon, Hot-Wrought, Special  
Quality, Mechanical Properties

ASTM A706/A706M (2009b) Standard Specification for  
Low-Alloy Steel Deformed and Plain Bars  
for Concrete Reinforcement

ASTM A82/A82M (2007) Standard Specification for Steel  
Wire, Plain, for Concrete Reinforcement

ASTM A884/A884M (2012) Standard Specification for  
Epoxy-Coated Steel Wire and Welded Wire  
Reinforcement

ASTM C1116/C1116M (2010a) Standard Specification for  
Fiber-Reinforced Concrete

ASTM E94 (2004; R 2010) Radiographic Examination

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP (2009; 28th Ed) Manual of Standard Practice

## 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Reinforcement; G|DO

### SD-03 Product Data

Welding  
Butt-Splices; G|DO  
Material; G|DO

### SD-06 Test Reports

Material; G|DO  
Tests, Inspections, and Verifications; G|DO

### SD-07 Certificates

Reinforcing Steel  
Qualification of Steel Bar Butt-Splicers

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Welding Qualifications

Welders shall be qualified in accordance with AWS D1.4/D1.4M. Qualification test shall be performed at the worksite and notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4/D1.4M. Submit a list of qualified welders names.

#### 1.3.2 Qualification of Steel Bar Butt-Splacers

Qualification of steel bar butt-splacers shall be certified to have satisfactorily completed a course of instruction in the proposed method of butt-splicing or have satisfactorily performed such work within the preceding year. Submit certificates on the Qualifications of Steel Bar Butt-Splacers prior to commencing butt-splicing.

#### 1.3.3 Qualification of Butt-Splicing Procedure

As a condition of approval of the butt-splicing procedure, make three test butt-splices of steel bars of each size to be spliced using the proposed butt-splicing method, in the presence of the Contracting Officer. These test butt-splices and unspliced bars of the same size shall be tension tested to destruction with stress-strain curves plotted for each test. Test results shall show that the butt-splices meet the specified strength and deformation requirements in order for the splicing procedure to be approved.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

## PART 2 PRODUCTS

### 2.1 DOWELS

Dowels shall conform to ASTM A675/A675M, Grade 80 or ASTM A1035/A1035M. Steel pipe conforming to ASTM A53/A53M, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

### 2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A184/A184M.

### 2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A615/A615M, Grade 60, sizes as indicated. Welded deformed bars shall conform to ASTM A706/A706M, Grade 60. Cold drawn wire used for spiral reinforcement shall conform to ASTM A82/A82M.

Submit certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.



## 2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A185/A185M, ASTM A496/A496M or ASTM A497/A497M. When directed by the Contracting Officer for special applications, welded wire fabric shall conform to ASTM A884/A884M. For wire with a specified yield strength (fy) exceeding 60,000 psi, fy shall be the stress corresponding to a strain of 0.35 percent.

## 2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

## 2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI 10MSP and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

Bar supports shall comply with the requirements of ACI SP-66. Supports for bars in concrete with formed surfaces exposed to view or to be painted shall be plastic-coated wire, stainless steel or precast concrete supports. Precast concrete supports shall be wedged-shaped, not larger than 3-1/2 by 3-1/2 inches, of thickness equal to that indicated for concrete cover and have an embedded hooked tie-wire for anchorage. Bar supports used in precast concrete with formed surfaces exposed to view shall be the same quality, texture and color as the finish surfaces.

## 2.7 SYNTHETIC FIBER REINFORCEMENT

Synthetic fiber shall be polypropylene with a denier less than 100 and a nominal fiber length of 2 inches.

## 2.8 TESTS, INSPECTIONS, AND VERIFICATIONS

Perform material tests, specified and required by applicable standards, by an approved laboratory and certified to demonstrate that the materials are in conformance with the specifications. Tests, inspections, and verifications shall be performed and certified at the Contractor's expense. Submit certified tests reports of reinforcement steel showing that the steel complies with the applicable specifications for each steel shipment and identified with specific lots prior to placement. Submit three copies of the heat analyses for each lot of steel furnished certifying that the steel conforms to the heat analyses.

### 2.8.1 Reinforcement Steel Tests

Mechanical testing of steel shall be in accordance with ASTM A370 except as otherwise specified or required by the material specifications. Tension tests shall be performed on full cross-section specimens using a gage

length that spans the extremities of specimens with welds or sleeves included. Chemical analyses of steel heats shall show the percentages of carbon, phosphorous, manganese, sulphur and silicon present in the steel.

## 2.8.2 Radiographic Examination of Welds

Radiographic examination of welds shall be in accordance with [ASTM E94](#) and shall be performed and evaluated by an approved testing agency adequately equipped to perform such services. Radiographs of welds and evaluations of the radiographs submitted for approval shall become the property of the Government.

## PART 3 EXECUTION

### 3.1 REINFORCEMENT

Reinforcement steel and accessories shall be fabricated and placed as specified and shown and approved shop drawings. Fabrication, bar bending, and placement details of steel and accessories not specified or shown shall be in accordance with [ACI SP-66](#) and [ACI 318](#). Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. All steel shall be bent cold unless authorized. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms. Submit detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

#### 3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with [ACI 318](#) at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by [ACI 318](#). If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

#### 3.1.2 Splicing

Splices of reinforcement shall conform to [ACI 318](#) and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to [AWS D1.4/D1.4M](#). Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or [6 inches](#). Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt

spliced in a straight line.

### 3.1.3 Placing Tolerances

#### 3.1.3.1 Spacing

The spacing between adjacent bars and the distance between layers of bars may not vary from the indicated position by more than one bar diameter nor more than 1 inch.

#### 3.1.3.2 Concrete Cover

The minimum concrete cover of main reinforcement steel bars shall be as shown. The allowable variation for minimum cover shall be as follows:

MINIMUM COVER (inch)	VARIATION (inch)
6	plus 1/2
4	plus 3/8
3	plus 3/8
2	plus 1/4
1-1/2	plus 1/4
1	plus 1/8
3/4	plus 1/8

### 3.1.4 Splicing

Splices in steel bars shall be made only as required. Bars may be spliced at alternate or additional locations at no additional cost to the Government subject to approval.

#### 3.1.4.1 Lap Splices

Lap splices shall be used only for bars smaller than size 14 and welded wire fabric. Lapped bars may be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than 1/5 the required length of lap or 6 inches.

#### 3.1.4.2 Butt-Splices

Use butt-splices only for splicing size 14 and 18 bars and for splicing #11 bars to larger bars except where otherwise shown or authorized. Make butt-splices by a method which develops splices suitable for tension, compression and stress reversal applications. Welded butt-splices shall be full penetration butt welds. Butt-splices shall develop 90 percent of the specified minimum ultimate tensile strength of the smallest bar of each splice. Bars shall be cleaned of all oil, grease, dirt, rust, scale and other foreign substances and shall be flame dried before splicing. Adequate jigs and clamps or other devices shall be provided to support, align and hold the longitudinal centerline of the bars to be butt-spliced

in a straight line. Submit proposed procedure for butt-splicing steel bars prior to making the test butt-splices for qualification of the procedure. Properties and analyses of steel bars and splicing materials shall be included in the submitted procedure. Physical properties of splicing sleeves shall include length, inside and outside diameters, and inside surface details.. Butt-splices shall be as follows:

a. Thermit Welded Butt Splices - Bars to be thermit welded shall be restricted to steel shown by heat analysis to have a sulfur content not exceeding 0.05 percent. The ends of bars to be thermit welded shall be cut square and smooth. Flame cutting will be permitted provided grinding is employed to remove the resulting scale and to square and smooth the cut ends to a condition equivalent to a saw cut. No shearing will be permitted. Bars shall be cleaned and flame dried before splicing. The joint shall be properly aligned in the mold with a gap opening in accordance with the manufacturer's recommendations. Charging and firing shall conform to the manufacturer's recommendations. The end of bars and the welded mold shall be preheated before welding to a temperature of not less than 100 degrees F and the mold shall be left in place for at least 15 minutes after ignition. Risers shall be broken or burned off after removing the mold. Tension splices shall be staggered longitudinally a minimum of 5 feet so that no more than half of the bars are spliced at any one section or as otherwise indicated.

b. Mechanical Butt-Splices - Mechanical butt-splices shall be an approved exothermic, threaded coupling, swaged sleeve or other positive connecting type. Bars to be spliced by a mechanical butt-splicing process may be sawed, sheared or flame cut provided the ends of sheared bars are reshaped after shearing and all slag is removed from the ends of flame cut bars by chipping and wire brushing prior to splicing. Surfaces to be enclosed within a splice sleeve or coupling shall be cleaned by wire brushing or other approved method prior to splicing. Splices shall be made using manufacturer's standard jigs, clamps, ignition devices and other required accessories. In addition to the strength requirements specified paragraph BUTT-SPLICES the additional deformation of number 14 and smaller bars due to slippage or other movement within the splice sleeve shall not exceed 0.015 inches (unit strain 0.0015 inches/inch) beyond the elongation of an unspliced bar based upon a 10 inch gage length spanning the extremities of the sleeve at a stress of 30,000 psi. The additional deformation of number 18 bars shall not exceed 0.03 inches (unit strain 0.003 inches/inch) beyond the elongation of an unspliced bar based upon a 10 inch gage length spanning the extremities of the sleeve at a stress of 30,000 psi. The amount of the additional deformation shall be determined from the stress-strain curves of the unspliced and spliced bars tested as required paragraph QUALIFICATION OF BUTT-SPLICING PROCEDURE for qualification of the butt-splicing procedure. Tension splices of number 14 or smaller bar shall be staggered longitudinally a minimum of 5 feet or as otherwise indicated so that no more than half of the bars are spliced at any one section. Tension splices of number 18 bars shall be staggered longitudinally a minimum of 5 feet so that no more than 1/3 of the bars are spliced at any one section.

### 3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated.

Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

### 3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

### 3.4 SYNTHETIC FIBER REINFORCED CONCRETE

Fiber reinforcement shall be added to the concrete mix in accordance with the applicable sections of ASTM C1116/C1116M and the recommendations of the manufacturer, and in an amount of 0.1 percent by volume.

### 3.5 FIELD TESTS AND INSPECTIONS

#### 3.5.1 Identification of Splices

Establish and maintain an approved method of identification of all field butt-splices which will indicate the splicer and the number assigned each splice made by the splicer.

#### 3.5.2 Examining, Testing, and Correcting

Perform the following during the butt-splicing operations as specified and as directed:

a. Visual Examination - All welded splices shall be visually examined for the presence of cracks, undercuts, inadequate size and other visible defects. Respliced connections resulting from correction of visual defects may be radiographically examined at the option of the Contracting Officer as specified in paragraph SUPPLEMENTAL EXAMINATION. Exothermic mechanical butt-splices shall be visually examined to determine if the filler metal is clearly visible at the tap holes and completely fills the sleeves at both ends except for spaces of not more than 3/8 inch occupied by packing.

b. Tension Tests - Tensions tests to 90 percent of the minimum specified ultimate tensile strength of the spliced bars or to destruction shall be performed on one test specimen made in the field for every 25 splices made. Test specimens shall be made by the splicers engaged in the work, using the approved splicing procedure and the same size bars placed in the same relative position, and under the same conditions as those in the groups represented by the specimens. Stress-strain curves shall be furnished for each butt-splice tested.

c. Radiographic Examination - Not less than one of each 25 welded splices selected at random by the Contracting Officer shall be examined radiographically and evaluated for defects. The greatest dimension of any porosity (gas pocket or similar void) or fusion-type defect (slag inclusion, incomplete fusion or similar generally elongated defect in weld fusion) shall not exceed 1/4 inch. The minimum clearance between edges of porosity or fusion-type defects shall not be less than 1 inch.

d. Correction of Deficiencies - No splice shall be embedded in concrete until satisfactory results of visual examination and the required tests or examinations have been obtained. All splices having visible defects or represented by test specimens which do not satisfy the tests or examinations shall be removed. If any of the tension test specimens fail to meet the strength requirements or deformation limitations two production splices from the same lot represented by the test specimens which failed shall be cut out and tension tested. If both of the retests pass the strength requirements and deformation limitations all of the splices in the lot will be accepted. If one or both of the retests fail to meet the strength requirements or deformation limitations all of the splices in the lot will be rejected. All costs of removal, testing and resplicing of the additional production splices shall be borne by the Contractor. The bars of rejected splices shall be cut off outside the splice zone of weld metal, filler metal contact, coupling or sleeve. The cut ends shall be finished as specified and the joints shall be respliced and reinspected at no additional cost.

e. Supplemental Examination - The Contracting Officer may require additional or supplemental radiographic examination and/or tension test of any completed splice. For costs of such examinations and tests see paragraph UNIT PRICES.

-- End of Section --

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SECTION 03 31 01

CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

- |               |  |
|---------------|--|
| ACI 117       | (2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary |
| ACI 207.2R-07 | (2007) Report on Thermal and Volume Change Effects on Cracking of Mass Concrete                          |
| ACI 211.1     | (1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete     |
| ACI 214R      | (2011) Evaluation of Strength Test Results of Concrete   |
| ACI 318       | (2011; Errata 2011; Errata 2012) Building Code Requirements for Structural Concrete and Commentary       |

ASTM INTERNATIONAL (ASTM)

- |                   |   |
|-------------------|---|
| ASTM C1059/C1059M | (1999; R 2008) Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete   |
| ASTM C1064/C1064M | (2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete  |
| ASTM C1077        | (2013) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation |
| ASTM C1107/C1107M | (2011) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)  |
| ASTM C143/C143M   | (2012) Standard Test Method for Slump of Hydraulic-Cement Concrete  |
| ASTM C150/C150M   | (2012) Standard Specification for Portland Cement   |

ASTM C192/C192M	(2012a) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C31/C31M	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39/C39M	(2012) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2013) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C494/C494M	(2012) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2012; E 2012) Standard Specification for Blended Hydraulic Cements
ASTM C597	(2009) Pulse Velocity Through Concrete
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C803/C803M	(2003; R 2010) Penetration Resistance of Hardened Concrete
ASTM C805/C805M	(2013) Rebound Number of Hardened Concrete
ASTM C881/C881M	(2010) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C94/C94M	(2013) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2012a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C172/C172M	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C231/C231M	(2010) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates

FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT)

Construction Aggregates Manual (2004) Construction Aggregates Manual,

State Materials Office, Gainesville,  
Florida

FDOT Standard (2010) Standard Specifications for Road  
and Bridge Construction

Materials Manual (LR 2010) Topic No.: 675-000-000 Materials  
Manual

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100 (2000; R 2006) Concrete Plant Standards

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400 (1963) Requirements for Water for Use in  
Mixing or Curing Concrete

COE CRD-C 521 (1981) Standard Test Method for Frequency  
and Amplitude of Vibrators for Concrete

COE CRD-C 94 (1995) Corps of Engineers Specification  
for Surface Retarders

## 1.2 DESIGN REQUIREMENTS

For each portion of the structure, select concrete mixture proportions so that the strength and W/C requirements are met. Submit concrete mixture proportions as determined by the Contractor and submitted for review. The submission shall be accompanied by test reports from a laboratory complying with ASTM C1077 showing that proportions thus selected will produce concrete of the qualities indicated. No substitution shall be made in the source or type of materials used in the work without additional tests to show that the quality of the new materials and concrete are satisfactory. The concrete mixture quantities of all ingredients per cubic yard and nominal maximum coarse aggregate size that will be used in the manufacture of each quality of concrete shall be stated. Proportions shall indicate the mass of cement, pozzolan and ground granulated blast-furnace (GGBF) slag when used, and water; the mass of aggregates in a saturated surface-dry condition; and the quantities of admixtures. Nominal maximum-size coarse aggregate shall be 1-1/2 inch except 3/4 inch nominal maximum-size coarse aggregate shall be used when any of the following conditions exist: the narrowest dimension between sides of forms is less than 7-1/2 inches, the depth of the slab is less than 4 inches, or the minimum clear spacing between reinforcing is less than 2-1/4 inches.

A thermal analysis was performed for 4,000 psi concrete at 56 days assuming a mix design which used 490 pounds of Type II cement and 123 pounds of Class F fly ash. A Contractor mix design, which deviates more than plus or minus 5 percent from the assumed 490 pounds of cement and 123 pounds of fly ash, shall be accompanied by a thermal analysis which follows the procedures outlined in ACI 207.2R-07. The thermal analysis shall be reviewed and approved by the Contracting Officer.

The 2,500 psi mix design for the mud mat shall include synthetic fiber reinforcement in accordance with Section 03 20 00 CONCRETE REINFORCING.

#### 1.2.1 Air Content

Air content as delivered to the forms and as determined by [ASTM C231/C231M](#) shall be between 1.5 and 4.5 percent.

#### 1.2.2 Slump

The slump shall be determined in accordance with [ASTM C143/C143M](#) and shall be within the range of 3 to 6 inches. Where placement by pump is approved, the slump shall not exceed 7 inches, measured at the pump discharge.

#### 1.2.3 Concrete Proportioning

Trial batches and testing requirements for various qualities of concrete specified are the responsibility of the Contractor. Obtain samples of aggregates in accordance with the requirements of [ASTM D75/D75M](#). Samples of materials other than aggregate shall be representative of those proposed for the project and shall be accompanied by the manufacturer's test reports indicating compliance with applicable specified requirements. Make trial mixtures having proportions, consistencies, and air content suitable for the work based on methodology described in [ACI 211.1](#), using at least three different water-cement ratios, which will produce a range of strength encompassing those required for the work. The maximum water-cement ratios required in paragraph MAXIMUM WATER-CEMENT (W/C) RATIO below, will be converted to a weight ratio of water to cement plus pozzolan by mass or GGBF slag by mass equivalency as described in [ACI 211.1](#). In the case where GGBF slag is used, include the weight of the slag in the equations for the term P, which is used to denote the mass of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent of the total cementitious material. Proportion trial mixtures for maximum permitted slump and air content with due consideration to the approved conveying and placement method. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with [ASTM C192/C192M](#); they shall be tested at 7 days and at the design age specified in accordance with [ASTM C39/C39M](#). From these test results, a curve will be plotted showing the relationship between water-cement ratio and strength.

#### 1.2.4 Required Average Compressive Strength

In meeting the strength requirements specified below, the selected mixture proportion shall produce a required average compressive strength  $f'_{cr}$  exceeding the specified strength  $f'_c$  by the amount indicated below.

##### 1.2.4.1 Average Compressive Strength from Test Records

Where a concrete production facility has test records, establish a standard deviation in accordance with the applicable provisions of [ACI 214R](#). Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected, shall represent concrete produced to meet a specified strength or strengths ( $f'_c$ ) within 1,000 psi of that specified for proposed work, and shall consist of at least 30 consecutive tests. 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 or at another test age designated for determination of  $f'_c$ . Required average compressive strength  $f'_{cr}$  used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'_{cr} = f'_c + 1.34S$$
$$f'_{cr} = f'_c + 2.33S - 500$$

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS*	MODIFICATION FACTOR FOR STANDARD DEVIATION
less than 15	Use tabulation in paragraph REQUIRED AVERAGE COMPRESSIVE STRENGTH
15	1.16
20	1.08
25	1.03
30 or more	1.00
*Interpolate for intermediate numbers of tests.	

#### 1.2.4.2 Average Compressive Strength without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, determine the required average strength  $f_{cr}$  as follows:

If the specified compressive strength  $f'_c$  is less than 3,000 psi,

$$f'_{cr} = f'_c + 1,000$$

If the specified compressive strength  $f'_c$  is 3,000 to 5,000 psi,

$$f'_{cr} = f'_c + 1,200$$

If the specified compressive strength  $f'_c$  is over 5,000 psi,

$$f'_{cr} = f'_c + 1,400.$$

#### 1.2.5 Concrete Strength

Specified compressive strength  $f'_c$  shall be as follows:

COMPRESSIVE STRENGTH (PSI)	STRUCTURE OR PORTION OF STRUCTURE
4,000 @ 56 days	Structures, All
2,500 @ 28 days	Mud Mat

#### 1.2.6 Maximum Water-Cement (W/C) Ratio

Maximum W/C shall be as follows:

WATER-CEMENT RATIO, BY MASS	STRUCTURE OR PORTION OF STRUCTURE
0.45	All

These W/C's may cause higher strengths than that required by paragraph  
CONCRETE STRENGTH.

#### 1.2.7 Construction Tolerances

Except as specified otherwise, a plus tolerance increases and a minus tolerance decreases the dimension to which it applies. A tolerance without sign means plus or minus. Where only one sign is specified, there is no limit in the other direction. Tolerances are not cumulative. The most restrictive tolerance will control. Tolerances shall not extend the structure beyond legal boundaries.

- a. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing. When forms or shoring are used, the measurements shall be made prior to removal.
- b. Construction tolerances shall meet the requirements of **ACI 117** and any of the following requirements that are applicable.

##### 1.2.7.1 Tunnel Linings, Conduits, Filling & Emptying Culverts

Water Conveying:

Lateral alignment	
Centerline alignment	1/2 inch
Inside dimensions	0.005 times inside dimension
Level alignment	
Profile grade	1/2 inch
Cross-Sectional dimension	
Tunnel and culvert lining	0 inch

##### 1.2.7.2 Appearance

Permanently exposed surfaces shall be cleaned, if stained or otherwise discolored, by a method that does not harm the concrete and that is approved by the Contracting Officer.

#### 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

##### On-Site Batch Plant; G, RO

Submit a copy of the plant Quality Control Plan (QCP) for review and approval. Refer to PART 2 PRODUCTS paragraph EQUIPMENT below for on-site batch plant requirements.

##### Concrete Mixture Proportions; G, RO

Concrete mixture proportions shall be determined by the Contractor and submitted for review. The concrete mixture quantities of all ingredients per cubic yard and nominal maximum coarse aggregate size that will be used in the manufacture of each quality of concrete shall be stated. Proportions shall indicate the mass of cement, pozzolan and ground granulated blast-furnace (GGBF) slag when used, and water; the mass of aggregates in a saturated surface-dry condition; and the quantities of admixtures. The submission shall be accompanied by test reports from a laboratory complying with ASTM C1077 which show that proportions thus selected will produce concrete of the qualities indicated. No substitution shall be made in the source or type of materials used in the work without additional tests to show that the quality of the new materials and concrete are satisfactory.

##### Testing Technicians

##### Conveying Equipment; G, RO

Submit data as indicated in paragraph EQUIPMENT below for approval prior to commencement of related work.

##### Concrete Construction Inspector (CCI)

Statements that the concrete testing technicians and the concrete inspectors meet the specified requirements.

##### Construction Joint Treatment; G, RO

The method and equipment proposed for joint cleanup and waste disposal shall be submitted for review and approval.

##### Curing and Protection; G, RO

The curing medium and methods to be used shall be submitted for review and approval.

##### Hot Weather Placing; G, RO

If concrete is to be placed under hot weather conditions, the proposed materials and methods shall be submitted for review and approval. Describe the equipment and procedures intended for use to monitor placement temperature. Refer to subparagraph "Hot Weather Placing" in PART 3 EXECUTION below for requirements.

Cold Weather Placing; G, RO

Submit proposed materials and methods for cold weather conditions for review and approval. Describe the equipment and procedures intended for use to monitor placement temperature. Refer to subparagraph "Cold Weather Placing" in PART 3 EXECUTION below for requirements.

Thermal Analysis; G, RO

Submit a thermal analysis for review and approval if required by the conditions indicated in paragraph DESIGN REQUIREMENTS above.

SD-06 Test Reports

Quality of Aggregates; G, RO

Aggregate quality tests shall be submitted at least 30 days prior to start of concrete placement.

Tests and Inspections; G, RO

Test results and inspection reports shall be submitted daily and weekly.

Mixer Uniformity; G, RO

SD-07 Certificates

Batch Plant/Ready Mix Plant; G|RO

Off-site batch plants shall have a quality control program approved by the Florida Department of Transportation. Provide a copy of the Concrete Plant Approval Letter signed by the District Materials Engineer.

Cementitious Materials

Cementitious Materials, including Cement, Ground Granulated Blast-Furnace Slag and Pozzolan, will be accepted on the basis of the manufacturer's certification of compliance, accompanied by mill test reports that materials meet the requirements of the specification under which they are furnished. Certification and mill test reports shall be from samples taken from the particular lot furnished. No cementitious materials shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious materials will be subject to check testing from samples obtained at the source, at transfer points, or at the project site, as scheduled by the Contracting Officer, and such sampling will be by or under the supervision of the Government at its expense. Material not meeting specifications shall be promptly removed from the site of work.

Aggregates; G|RO

Acceptance of aggregates shall be based on the requirements in PART 2 PRODUCTS below.



#### Impervious-Sheet Curing Materials

Impervious-Sheet Curing Materials shall be certified for compliance with all specification requirements.

#### Air-Entraining Admixture

Air-Entraining Admixture shall be certified for compliance with all specification requirements.

#### Membrane-Forming Curing Compound

Membrane-Forming Curing Compound shall be certified for compliance with all specification requirements.

#### Epoxy Resin Latex Bonding Compound

Epoxy Resin and Latex Bonding Compound shall be certified for compliance with all specification requirements.

#### Nonshrink Grout

Descriptive literature of the Nonshrink Grout proposed for use shall be furnished together with a certificate from the manufacturer stating that it is suitable for the application or exposure for which it is being considered.

### 1.4 QUALITY ASSURANCE

The Government will sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with [ASTM D75/D75M](#). Concrete will be sampled in accordance with [ASTM C172/C172M](#). No material shall be used until notice has been given by the Contracting Officer that test results are satisfactory. The individuals who sample and test concrete or the constituents of concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field [Testing Technicians](#), Grade I. The individuals who perform the inspection of concrete construction shall have demonstrated a knowledge and ability equivalent to the ACI minimum guidelines for certification of [Concrete Construction Inspector \(CCI\)](#). Submit statements that the concrete testing technicians and the concrete inspectors meet the specified requirements.

#### 1.4.1 Concrete Strength

Compressive strength test specimens will be made by the Government and cured in accordance with [ASTM C31/C31M](#) and tested in accordance with [ASTM C39/C39M](#). 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 [500 psi](#). A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including nondestructive testing, 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.

- a. Investigation of Low-Strength Test Results - When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, take steps to ensure that the load-carrying capacity of the structure is not jeopardized. Nondestructive testing in accordance with ASTM C597, ASTM C803/C803M, or ASTM C805/C805M may be permitted by the Contracting Officer to estimate the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests shall not be used as a basis for acceptance or rejection.
- b. Testing of Cores - When the strength of concrete in place is considered potentially deficient, obtain cores and test them in accordance with ASTM C42/C42M. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the performance of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement.
- c. Load Tests - If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318. Concrete work evaluated by structural analysis or by results of a load test shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies will be performed and approved by the Contracting Officer at the expense of the Contractor, except that if all concrete is in compliance with the plans and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

#### 1.4.2 Cementitious Materials, Admixtures, and Curing Compound

At least 60 days in advance of concrete placement, notify the Contracting Officer of the sources for cementitious materials, admixtures, and curing compound, along with sampling location, brand name, type, and quantity to be used in the manufacture and/or curing of the concrete. Cementitious Materials, including Cement and Pozzolan, and Ground Granulated Blast-Furnace Slag will be accepted on the basis of the manufacturer's certification of compliance. See submittals under SD-07 Certificates in paragraph SUBMITTALS above. No cementitious materials shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious materials will be subject to check testing from samples obtained at the source, at transfer points, or at the project site, as scheduled by the Contracting Officer, and such sampling will be by or under the supervision of the Government at its expense. Material not meeting specifications shall be promptly removed from the site of work. Submit samples of materials for Government testing and approval.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Chemical admixtures that have been in storage at the project site for

longer than 6 months or that have been subjected to freezing shall be retested at the expense of the Contractor when directed by the Contracting Officer and rejected if test results are not satisfactory. Chemical admixtures will be accepted based on compliance with the requirements of paragraph CHEMICAL ADMIXTURES.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Submit mill test reports attesting that materials meet the requirements of the specification under which they are furnished. Certification and mill test reports shall be from samples taken from the particular lot furnished. The following shall be certified for compliance with all specification requirements: Impervious-Sheet Curing Materials, Air-Entraining Admixture, Other Chemical Admixtures, Membrane-Forming Curing Compound, Epoxy Resin and Latex Bonding Compound. Submit descriptive literature of the Nonshrink Grout proposed for use together with a certificate from the manufacturer stating that it is suitable for the application or exposure for which it is being considered.

#### 2.1.1 Cementitious Materials

Cementitious materials shall be portland cement, portland-pozzolan cement, portland blast-furnace slag cement, portland cement in combination with pozzolan or GGBF slag conforming to appropriate specifications listed below.

##### 2.1.1.1 Portland Cement

###### 2.1.1.1.1 4000 PSI Concrete

ASTM C150/C150M, Type II.

###### 2.1.1.1.2 2500 PSI Concrete

ASTM C150/C150M, Type I or II, except that the maximum amount of C3A in Type I cement shall be 15 percent.

##### 2.1.1.2 Pozzolan, Other than Silica Fume

Pozzolan shall conform to ASTM C618, Class F, with the optional requirements for drying shrinkage, and uniformity of Table 3.

##### 2.1.1.3 Ground Granulated Blast-Furnace Slag

2500 PSI Concrete: Ground Granulated Blast-Furnace Slag shall conform to ASTM C989/C989M, Grade 120.

##### 2.1.1.4 Blended Hydraulic Cement

2500 PSI Concrete: Portland blast-furnace slag cement shall conform to ASTM C595/C595M, Type IS. Portland-pozzolan cement shall conform to ASTM C595/C595M, Type IP.

#### 2.1.2 Aggregates

Aggregates shall be produced under the FDOT-approved Producer Quality Control Program (QC) that is in accordance with the FDOT's requirements and procedures for obtaining and maintaining FDOT approval of developed and

operational mineral aggregate sources (mines and redistribution terminals), and with the FDOT's [Construction Aggregates Manual](#). An individual certification shall be furnished with each haul unit load of materials shipped, attesting that those specific materials were produced under the FDOT-approved QC, and that they meet the requirements of either Sections 901 or 902 of the [FDOT Standard](#).

#### 2.1.3 Chemical Admixtures

Chemical admixtures to be used, when required or permitted, shall conform to the appropriate specification listed.

##### 2.1.3.1 [Air-Entraining Admixture](#)

The air-entraining admixture shall conform to [ASTM C260/C260M](#) and shall consistently cause the concrete to have an air content in the specified ranges under field conditions.

##### 2.1.3.2 [Accelerating Admixture](#)

Accelerators shall meet the requirements of [ASTM C494/C494M](#), Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

##### 2.1.3.3 [Water-Reducing or Retarding Admixture](#)

- a. Water-Reducing or Retarding Admixtures: [ASTM C494/C494M](#), Type A, B, or D, except that the 6-month and 1-year compressive strength tests are waived.
- b. High-Range Water Reducing Admixture: [ASTM C494/C494M](#), Type F or G except that the 6-month and 1-year strength requirements shall be waived. The admixture may be used only when approved by the Contracting Officer, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan.

#### 2.1.4 [Water](#)

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that nonpotable water may be used if it meets the requirements of [COE CRD-C 400](#).

##### 2.1.5 [Nonshrink Grout](#)

Nonshrink grout shall conform to [ASTM C1107/C1107M](#) and shall be a commercial formulation suitable for the application proposed.

##### 2.1.6 [Latex Bonding Compound](#)

Latex bonding compound agents for bonding fresh to hardened concrete shall conform to [ASTM C1059/C1059M](#).

##### 2.1.7 [Epoxy Resin](#)

Epoxy resin for use in repairs shall conform to [ASTM C881/C881M](#), Type III, Grade I or II.

## 2.2 EQUIPMENT

On-site batch plants shall conform to the requirements of [NRMCA CPMB 100](#) and shall be in accordance with [FDOT Materials Manual](#), Section 9.2, Volumes 1 and 2.

### 2.2.1 Concrete Mixers

#### 2.2.1.1 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of [ASTM C94/C94M](#). A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Equip each truck with two counters from which it will be possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed.

### 2.2.2 Conveying Equipment

Submit data on the conveying equipment and methods for transporting, handling, and depositing the concrete. The conveying equipment shall conform to the following requirements:

#### 2.2.2.1 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of [ASTM C94/C94M](#). Nonagitating equipment may be used for transporting plant-mixed concrete over a smooth road when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

#### 2.2.2.2 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

#### 2.2.2.3 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least three times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than [4 inches](#). Aluminum pipe shall not be used.

### 2.2.3 Vibrators

Vibrators of the proper size, frequency, and amplitude shall be used for the type of work being performed in conformance with the following requirements:

APPLICATION	HEAD DIAMETER Inches	FREQUENCY (VPM)	AMPLITUDE Inches
Thin walls, beams, etc.	1-1/4 to 2-1/2	9,000 to 13,500	0.02 to 0.04
General construction	2 to 3-1/2	8,000 to 12,000	0.025 to 0.05

Determine the frequency and amplitude in accordance with COE CRD-C 521.

### PART 3 EXECUTION

#### 3.1 PREPARATION FOR PLACING

##### 3.1.1 Embedded Items

Before placement of concrete, take care to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Embedded items shall be free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids.

##### 3.1.2 Concrete on Earth Foundations

Earth surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the earth foundation shall have been satisfactorily compacted.

##### 3.1.3 Concrete on Rock Foundations

Rock surfaces upon which concrete is to be placed shall be clean, free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached, or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, all rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as described in paragraph CONSTRUCTION JOINT TREATMENT. All rock surfaces shall be kept continuously wet for at least 24 hours immediately prior to placing concrete thereon.

##### 3.1.4 Construction Joint Treatment

Submit the method and equipment proposed for joint cleanup and waste disposal, for review and approval. Construction joint treatment shall conform to the following requirements:

###### 3.1.4.1 Joint Preparation

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next lift or adjacent concrete by cleaning with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Air-water cutting will not be permitted on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean, well bonded coarse aggregate is exposed uniformly throughout the lift surface. The edges of the coarse aggregate

shall not be undercut. The surface shall be washed clean again as the last operation prior to placing the next lift. There shall be no standing water on the surface upon which concrete is placed.

#### 3.1.4.2 Air-Water Cutting

Air-water cutting of a construction joint shall be performed at the proper time and only on horizontal construction joints. The air pressure used in the jet shall be 90 to 110 psi, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a retarder complying with the requirements of COE CRD-C 94 may be applied to the surface of the lift to prolong the period of time during which air-water cutting is effective. Prior to receiving approval, furnish samples of the material to be used and demonstrate the method to be used in applications. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, high-pressure water jet or sandblasting will be required as the last operation before placing the next lift.

#### 3.1.4.3 High-Pressure Water Jet

A stream of water under a pressure of not less than 3,000 psi may be used for cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the water jet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

#### 3.1.4.4 Wet Sandblasting

This method may be used when the concrete has reached sufficient strength to prevent undercutting of the coarse aggregate particles. The surface of the concrete shall then be washed thoroughly to remove all loose materials.

#### 3.1.4.5 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval.

### 3.2 PLACING

#### 3.2.1 Placing Procedures

The surfaces of horizontal construction joints shall be kept continuously wet for the first 12 hours during the 24-hour period prior to placing concrete. Surfaces may be dampened immediately before placement if necessary. Concrete placement will not be permitted when, in the opinion of the Contracting Officer, weather conditions prevent proper placement and consolidation. Deposit concrete as close as possible to its final position in the forms and, in so depositing, there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it may be effectively consolidated in horizontal layers 2.0 feet or less in thickness with a minimum of lateral movement. The amount deposited in each location shall be that which can be readily

and thoroughly consolidated. Sufficient placing capacity shall be provided so that concrete placement can be kept plastic and free of cold joints while concrete is being placed. Concrete shall be placed by methods that will prevent segregation or loss of ingredients. Any concrete transferred from one conveying device to another shall be passed through a hopper that is conical in shape. The concrete shall not be dropped vertically more than 5 feet, except where a properly designed and sized elephant truck with rigid drop chute bottom section is provided to prevent segregation and where specifically authorized. In no case will concrete be discharged to free-fall through reinforcing bars.

### 3.2.2 Placement by Pump

When concrete is to be placed by pump, the nominal maximum-size coarse aggregate shall not be reduced to accommodate the pumps. The distance to be pumped shall not exceed limits recommended by the pump manufacturer. The concrete shall be supplied to the concrete pump continuously. When pumping is completed, concrete remaining in the pipeline shall be ejected without contamination of concrete in place. After each operation, equipment shall be thoroughly cleaned, and flushing water shall be wasted outside of the forms. Grout used to lubricate the pumping equipment at the beginning of the placement will not be incorporated into the placement.

### 3.2.3 Time Interval Between Mixing and Placing

Place concrete within 30 minutes after discharge into nonagitating equipment. When concrete is truck-mixed or when a truck mixer or agitator is used for transporting concrete mixed by a concrete plant mixer, the concrete shall be delivered to the site of the work, and discharge shall be completed within 1-1/2 hours after introduction of the cement to the aggregates. When the length of haul makes it impossible to deliver truck-mixed concrete within these time limits, batching of cement and a portion of the mixing water shall be delayed until the truck mixer is at or near the construction site.

### 3.2.4 Cold Weather Placing

When cold-weather placing of concrete is likely to be subjected to freezing temperatures before the expiration of the curing period, concrete shall be placed in accordance with procedures previously submitted. The ambient temperature of the space adjacent to the concrete placement and surfaces to receive concrete shall be above 32 degrees F. When the average of the highest and lowest temperatures during the period from midnight to midnight is expected to drop below 40 degrees F for more than three successive days, deliver concrete to meet the following minimum temperatures immediately after placement:

- a. 55 degrees F for sections less than 12 inches.
- b. 50 degrees F for sections 12 to 36 inches.
- c. 45 degrees F for sections 36 to 72 inches.
- c. 40 degrees F for sections greater than 72 inches.

These requirements can be terminated when temperatures above 50 degrees F occur during more than half of any 24-hour period. Placing temperature shall be measured in accordance with ASTM C1064/C1064M. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals, or other materials shall not be mixed with the concrete to prevent freezing. Submit the proposed materials, methods, and protection for approval, if concrete is to be placed under cold-weather conditions.



### 3.2.5 Hot Weather Placing

Concrete shall be properly placed and finished with procedures previously submitted. The concrete placing temperature shall not exceed 90 degrees F when measured in accordance with ASTM C1064/C1064M. Cooling of the mixing water and aggregates, or both, may be required to obtain an adequate placing temperature. A retarder meeting the requirements of subparagraph "Water-Reducing or Retarding Admixture" (PART 2, above) may be used to facilitate placing and finishing. Steel forms and reinforcement shall be cooled prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature. Submit the proposed materials and methods for review and approval if concrete is to be placed under hot-weather conditions.

### 3.2.6 Consolidation

Immediately after placement, each layer of concrete, including flowing concrete, shall be consolidated by internal vibrating equipment. Vibrators shall not be used to transport concrete within the forms. Hand spading may be required, if necessary, with internal vibrating along formed surfaces permanently exposed to view. Form or surface vibrators shall not be used unless specifically approved. The vibrator shall be inserted vertically at uniform spacing over the entire area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding unhardened layer if such exists. It shall be held stationary until the concrete is consolidated and then withdrawn slowly.

## 3.3 SETTING OF BASE PLATES AND BEARING PLATES

### 3.3.1 Setting of Plates

After being plumbed and properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be provided with full bearing with nonshrink grout. The space between the top of concrete or masonry-bearing surface and the bottom of the plate shall be approximately 1/24 of the width of the plate, but not less than 1/2 inch for plates less than 12 inches wide. Concrete surfaces shall be rough, clean, and free of oil, grease, and laitance, and they shall be damp. Metal surfaces shall be clean and free of oil, grease, and rust.

### 3.3.2 Nonshrink Grout Application

Nonshrink grout shall conform to the requirements of paragraph NONSHRINK GROUT. Water content shall be the minimum that will provide a flowable mixture and fill the space to be grouted without segregation, bleeding, or reduction of strength.

#### 3.3.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be

discarded. The space between the top of the concrete or masonry-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for retaining the grout and shall be removed after the grout has set. If grade "A" grout as specified in [ASTM C1107/C1107M](#) is used, all surfaces shall be formed to provide restraint. The placed grout shall be worked to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be rettempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at [65 to 85 degrees F](#) until after setting.

#### 3.3.2.2 Treatment of Exposed Surfaces

After the grout has set, those types containing metallic aggregate shall have the exposed surfaces cut back [1 inch](#) and immediately covered with a parge coat of mortar proportioned by mass of one part portland cement, two parts sand, and sufficient water to make the mixture placeable. The parge coat shall have a smooth, dense finish. The exposed surface of other types of nonshrink grout shall have a smooth, dense finish.

#### 3.3.2.3 Curing

Grout and parge coats shall be cured in conformance with Section [03 39 00](#) CONCRETE CURING.

### 3.4 TESTS AND INSPECTIONS

Submit test results and inspection reports, daily and weekly. Tests and inspections shall conform to the following requirements:

#### 3.4.1 General

Perform the inspections and tests described below, and, based upon the results of these inspections and tests, he shall take the action required and submit reports as required. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease. The laboratory performing the tests shall be on site and shall conform with [ASTM C1077](#). The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with [ASTM C1077](#).

#### 3.4.2 Testing and Inspection Requirements

##### 3.4.2.1 On-Site Batch Plant Control

The measurement of all constituent materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating 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 weights per cubic [yard](#), amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic [yard](#) for each class of concrete batched during plant operation.

#### 3.4.2.2 Concrete Mixture

- a. Air Content Testing - Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government quality assurance representative. Tests shall be made in accordance with **ASTM C231/C231M**. Test results shall be plotted on control charts which shall at all times be readily available to the Government. Copies of the current control charts shall be kept in the field by the Contractor's quality control representatives and results plotted as tests are made. When a single test result reaches either the upper or lower action limit a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the control chart for air content and the control chart for range, and for determining the need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph AIR CONTENT. An upper warning limit and a lower warning limit lines shall be set 1.0 percentage point above and below the average line. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a control chart for range where an upper warning limit is set at 2.0 percentage points and upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer and the air content at the mixer controlled as directed.
- b. Air Content Corrective Action - Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as is practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the control chart range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted. All this shall be at no extra cost to the Government.
- c. Slump Testing - In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with **ASTM C143/C143M** for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government's quality assurance representative. Test results shall be plotted on control charts which shall at all times be

readily available to the Government. Copies of the current control charts shall be kept in the field by the Contractor's quality control representatives and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made on the same batch of concrete. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control chart for percent air and the chart for range, and for determining the need for any remedial action. An upper warning limit shall be set at  $1/2$  inch below the maximum allowable slump on separate control charts for percent air used for each type of mixture as specified in paragraph SLUMP, and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 2 inches. Samples for slump shall be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer and the slump at the mixer controlled as directed.

- d. Slump Corrective Action - Whenever points on the control chart for slump reach the upper warning limit, an adjustment shall be immediately made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum W/C specified, based upon aggregates which are in a saturated surface-dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted and take appropriate steps to bring the slump under control. Also, additional slump tests shall be made as directed. All this shall be at no additional cost to the Government.
- e. Temperature - The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C1064/C1064M. The temperature shall be reported along with the compressive strength data.
- f. Compressive-Strength Specimens - At least one set of test specimens shall be made each day on each different concrete mixture placed during the day. Additional sets of test cylinders shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A random sampling plan shall be developed and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength in accordance with paragraph DESIGN REQUIREMENTS shall consist of four cylinders, two to be tested at 7 days and two at 28 days. A set of test specimens for concrete with a 56-day strength shall consist of six cylinders, two tested at 7 days, two at 28 days, and two at 56 days. Test specimens shall be

molded and cured in accordance with ASTM C31/C31M and tested in accordance with ASTM C39/C39M. All compressive-strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength tests, moving average for strength, and moving average for range for each mixture. The charts shall be similar to those found in ACI 214R.

#### 3.4.2.3 Notification Before Placing

The Contractor shall notify the Government, upon completion of form work, preparation of construction joint, and placing of reinforcement, a minimum of 24 hours prior to a scheduled concrete pour. The Contractor shall identify the component completed as well as scheduled time of concrete pour and placement location.

#### 3.4.2.4 Inspection Before Placing

Foundation or construction joints, forms, and embedded items shall be inspected for quality in sufficient time prior to each concrete placement to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

#### 3.4.2.5 Placing

- a. Placing Inspection - The placing foreman shall supervise all placing operations, shall determine that the correct quality of concrete or grout is placed in each location as directed and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, yardage placed, and method of placement.
- b. Placing Corrective Action - The placing foreman shall not permit batching and placing to begin until he has verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

#### 3.4.2.6 Vibrators

- a. Vibrator Testing and Use - The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined at the same time the vibrator is operating in concrete with the tachometer held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing.
- b. Vibrator Corrective Action - Any vibrator not meeting the requirements of paragraph VIBRATORS shall be immediately removed from service and repaired or replaced.

#### 3.4.2.7 Mixer Uniformity

Submit the results of the initial mixer uniformity tests, at least 5 days prior to the initiation of placing.

- a. Truck Mixers - Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete shall be determined in accordance with ASTM C94/C94M. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

#### 3.4.2.8 Mixer Uniformity Corrective Action

When a mixer fails to meet mixer uniformity requirements, either the mixer shall be removed from service on the work, the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

#### 3.4.3 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such 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 test and inspection records.

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SECTION 03 35 00

CONCRETE FINISHING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117 (2010; Errata 2011) Specifications for  
Tolerances for Concrete Construction and  
Materials and Commentary

ACI 305R (2010) Guide to Hot Weather Concreting

ASTM INTERNATIONAL (ASTM)

ASTM C1059/C1059M (1999; R 2008) Standard Specification for  
Latex Agents for Bonding Fresh to Hardened  
Concrete

ASTM C881/C881M (2010) Standard Specification for  
Epoxy-Resin-Base Bonding Systems for  
Concrete

ASTM C940 (2010a) Expansion and Bleeding of Freshly  
Mixed Grouts for Preplaced-Aggregate  
Concrete in the Laboratory

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Latex Bonding Compound; G, DO  
Epoxy Resin; G, DO

PART 2 PRODUCTS

2.1 LATEX BONDING COMPOUND

Latex bonding compound agents for bonding fresh to hardened concrete shall conform to ASTM C1059/C1059M. Submit samples as required.



## 2.2 EPOXY RESIN

Epoxy resin for use in repairs shall conform to ASTM C881/C881M, Type III, Grade I or II. Submit samples as required.

## PART 3 EXECUTION

### 3.1 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03 11 13 STRUCTURAL CAST-IN-PLACE CONCRETE FORMING. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Maintain uniform color of the concrete by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class B finish. The form panels used to produce the finish shall be orderly in arrangement, with joints between panels planned in approved relation to openings and other architectural features. Forms shall not be reused if there is any evidence of surface wear or defects that would impair the quality of the surface.

#### 3.1.1 Class B Finish

Class B finish is required where indicated on the drawings. Remove fins, ravelings, and loose material, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in Section 03 11 13 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

#### 3.1.2 Class D Finish

Class D finish is required where indicated on the drawings. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03 11 13 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

### 3.2 REPAIRS

Except for major defects, as defined hereinafter, repair surface defects as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair below. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects below. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects

which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

### 3.2.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects, whose depth is at least as great as their surface diameter but not over 4 inches, shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Use only sufficient water to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

### 3.2.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or, for Class B finish, more than 1/2 inch in diameter and, for Class D finish, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Repair major defects as specified below.

#### 3.2.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Use approved equipment and procedures which will not cause cracking or microcracking of the sound concrete. If reinforcement is encountered, remove concrete so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Keep surfaces continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, as an option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, test each repair area for drumminess by firm tapping with a hammer and inspecting for cracks, both in the presence of the Contracting Officer, immediately before completion of the contract, and replacing any showing

drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Keep burlap continually wet.

#### 3.2.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Repair deep and large defects by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; design the paste portion of such concrete mixture to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C940. Provide a full width "chimney" at the top of the form on the placing side to ensure filling to the top of the opening. Use a pressure cap on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. Remove the form after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

#### 3.2.3 Resinous and Latex Material Repair

In lieu of the portland cement bonding coats specified above, an epoxy resin or a latex bonding agent may be used.

### 3.3 FORMED SURFACE REPAIR

After removal of forms, all ridges, lips, and bulges on surfaces permanently exposed shall be removed. All repairs shall be completed within 48 hours after form removal.

#### 3.3.1 Class B Finishes

Surfaces listed in Section 03 11 13 STRUCTURAL CAST-IN-PLACE CONCRETE FORMING and as shown to have class B finish shall have surface defects repaired as follows: defective areas, voids, and honeycombs smaller than 16 square inches in area and less than 1/2 inch deep and bug holes exceeding 1/2 inch in diameter shall be chipped and filled with dry-packed mortar.

Holes left by removal of tie rods shall be reamed and filled with dry-packed mortar as specified in paragraph MATERIAL AND PROCEDURE FOR REPAIRS below. Defective and unsound concrete areas larger than described shall be defined by 1/2 inch deep dovetailed saw cuts in a rectangular pattern with lines parallel to the formwork, the defective concrete removed by chipping, and the void repaired with replacement concrete. The prepared area shall be brush-coated with an epoxy resin meeting the requirements of paragraph EPOXY RESIN in PART 2, a latex bonding agent meeting the requirements of paragraph LATEX BONDING COMPOUND in PART 2, or a neat cement grout after dampening the area with water. The void shall be filled with replacement concrete in accordance with paragraph MATERIAL AND PROCEDURE FOR REPAIRS below.

### 3.3.2 Class D Finish

Surfaces listed in Section 03 11 13 STRUCTURAL CONCRETE FORMWORK and as shown to have class D finish shall have surface defects repaired as follows: defective areas, voids, and honeycombs greater than 48 square inches in area or more than 2 inches deep shall be defined by 1/2 inch deep dovetailed saw cuts in a rectangular pattern, the defective concrete removed by chipping and the void repaired with replacement concrete. The prepared area shall be brush-coated with an epoxy resin meeting the requirements of paragraph EPOXY RESIN in PART 2, a latex bonding agent meeting the requirements of paragraph LATEX BONDING COMPOUND in PART 2, or a neat cement grout after dampening the area with water. The void shall be filled with replacement concrete as specified below.

### 3.3.3 Material and Procedure for Repairs

The cement used in the dry-packed mortar or replacement concrete shall be a blend of the cement used for production of project concrete and white portland cement properly proportioned so that the final color of the mortar or concrete will match adjacent concrete. Trial batches shall be used to determine the proportions required to match colors. Dry-packed mortar shall consist of one part cement to two and one-half parts fine aggregate. The fine aggregate shall be that used for production of project concrete. The mortar shall be remixed over a period of at least 30 minutes without addition of water until it obtains the stiffest consistency that will permit placing. Mortar shall be thoroughly compacted into the prepared void by tamping, rodding, ramming, etc. and struck off to match adjacent concrete. Replacement concrete shall be produced using project materials and shall be proportioned by the Contracting Officer. It shall be thoroughly compacted into the prepared void by internal vibration, tamping, rodding, ramming, etc. and shall be struck off and finished to match adjacent concrete. Forms shall be used to confine the concrete. If an expanding agent is used in the repair concrete, the repair shall be thoroughly confined on all sides including the top surface. Metal tools shall not be used to finish permanently exposed surfaces. The repaired areas shall be cured for 7 days. The temperature of the in situ concrete, adjacent air, and replacement mortar or concrete shall be above 40 degrees F during placement, finishing, and curing. Other methods and materials for repair may be used only when approved in writing by the Contracting Officer. Repairs of the so called "plaster-type" will not be permitted.

### 3.4 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in Section 03 31 01 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS, when tested as specified herein.

### 3.4.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 40 degrees F. In hot weather all requirements of Section 03 31 01 CAST-IN-PLACE CONCRETE FOR CIVIL WORKS paragraph Hot Weather Placing shall be met. In hot weather when the rate of evaporation of surface moisture, as determined by use of Figure 2.1.5 of ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour, make provisions for windbreaks, shading, fog spraying, or wet covering with a light-colored material in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

### 3.4.2 Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish for slabs to receive mortar setting beds, the surface shall receive a rough slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

### 3.4.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. No water, cement, or mortar shall be added to the surface during the finishing operation. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Perform floating by use of suitable

hand floats or power driven equipment. Use sufficient pressure on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

#### 3.4.4 Troweled Finish

The headwall bay floors, culvert floors, and precast concrete building shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 3 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

#### 3.4.5 Non-Slip Finish

Construct non-slip floors in accordance with the following subparagraphs.

##### 3.4.5.1 Broomed

The operating platform and the service platform shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

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SECTION 03 39 00

CONCRETE CURING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 182 (2005; R 2009) Standard Specification for  
Burlap Cloth Made from Jute or Kenaf and  
Cotton Mats

ASTM INTERNATIONAL (ASTM)

ASTM C171 (2007) Standard Specification for Sheet  
Materials for Curing Concrete

ASTM C309 (2011) Standard Specification for Liquid  
Membrane-Forming Compounds for Curing  
Concrete

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 400 (1963) Requirements for Water for Use in  
Mixing or Curing Concrete

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Testing and Inspection for CQC; G|RO

1.3 DELIVERY, STORAGE, AND HANDLING

Materials shall be stored in such a manner as to avoid contamination and deterioration. Materials shall be capable of being accurately identified after bundles or containers are opened.



## PART 2 PRODUCTS

### 2.1 CURING MATERIALS

#### 2.1.1 Impervious-Sheet

Impervious-sheet materials shall conform to [ASTM C171](#), type optional, except, that polyethylene sheet shall not be used.

#### 2.1.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to [ASTM C309](#), Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in [ASTM C309](#) waived.

#### 2.1.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to [AASHTO M 182](#).

### 2.2 WATER

Water for curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of [COE CRD-C 400](#).

## PART 3 EXECUTION

### 3.1 CURING AND PROTECTION

#### 3.1.1 General

Concrete shall be cured by an approved method for the period of time given below:

Type I portland cement	7 days
Type IS or Type IP cement	7 days
Type II portland cement	14 days
Portland cement blended with 25 percent or less fly-ash or GGBF slag	14 days
Portland cement blended with more than 25 percent GGBF slag	21 days

Immediately after placement, protect concrete from premature drying, extremes in temperatures, rapid temperature change and mechanical injury for the duration of the curing period. Concrete shall be protected from the damaging effects of rain for 12 hours and from flowing water for 14 days. No fire or excessive heat including welding shall be permitted near

or in direct contact with concrete or concrete embedments at any time. Maintain air and forms in contact with concrete at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds in PART 2, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

### 3.1.2 Moist Curing

Maintain concrete, to be moist-cured, continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be carefully broken loose from the concrete, soon after the concrete hardens, and curing water continuously applied into the void so as to continuously saturate the entire concrete surface. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. Provide an approved work system to ensure that moist curing is continuous 24 hours per day. Horizontal construction joints may be allowed to dry for 12 hours immediately prior to the placing of the following lift.

### 3.1.3 Membrane Forming Curing Compounds

#### 3.1.3.1 Application Restrictions

Concrete may be cured with an approved membrane-forming curing compound in lieu of moist curing except that membrane curing will not be permitted on any surface to which a grout-cleaned finish is to be applied or other concrete is to be bonded, on any surface containing protruding steel reinforcement, on an abrasive aggregate finish. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam.

#### 3.1.3.2 Pigmented Curing Compound

A pigmented curing compound meeting the requirements of the above paragraph may be used on surfaces that will not be exposed to view when the project is completed.

### 3.1.3.3 Nonpigmented Curing Compound

A nonpigmented curing compound containing a fugitive dye may be used on surfaces that will be exposed to view when the project is completed. Concrete cured with nonpigmented curing compound must be shaded from the sun for the first 3 days when the ambient temperature is 90 degrees F or higher.

### 3.1.3.4 Application

Apply the curing compound to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. The surfaces shall be thoroughly moistened with water, and the curing compound applied as soon as free water disappears. The curing compound shall be applied to unformed surfaces as soon as free water has disappeared and bleeding has stopped. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces that have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. All concrete surfaces on which the curing compound has been applied shall be adequately protected for the duration of the entire curing period from pedestrian and vehicular traffic and from any other cause that will disrupt the continuity of the curing membrane.

### 3.1.4 Impervious Sheeting (Evaporative Retardant)

Use impervious-sheet curing only on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

### 3.1.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

### 3.1.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F maintain the temperature of the concrete above 40 degrees F for the first seven days after placing. During the period of protection removal, control the air temperature adjacent to the concrete surfaces so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F.

### 3.2 TESTING AND INSPECTION FOR CQC

Perform the inspection and tests described below for the time periods specified in paragraph CURING AND PROTECTION above and, based upon the results of these inspections and tests, take the action required. Submit certified copies of laboratory test reports, including curing compound proposed for use on this project.

#### 3.2.1 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per 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.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, compute the rate of coverage in square feet/gallon, and note whether or not coverage is uniform.
- d. Membrane Curing Corrective Action. 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.
- e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.
- f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

-- End of Section --

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SECTION 05 50 14

STRUCTURAL METAL FABRICATIONS

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.

ALUMINUM ASSOCIATION (AA)

AA ADM (2010) Aluminum Design Manual

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

ANSI/AGMA 2005 (2003D; R 2008) Design Manual for Bevel Gears

ANSI/AGMA 6001 (2008E) Design and Selection of Components for Enclosed Gear Drives

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189 (2011) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN WELDING SOCIETY (AWS)

AWS B2.1/B2.1M (2009) Specification for Welding Procedure and Performance Qualification

AWS D1.1/D1.1M (2015) Structural Welding Code - Steel

AWS D1.2/D1.2M (2014) Structural Welding Code - Aluminum

AWS D1.3/D1.3M (2008; Errata 2008) Structural Welding Code - Sheet Steel

AWS D1.6/D1.6M (2007) Structural Welding Code - Stainless Steel

ASME INTERNATIONAL (ASME)

ASME B4.1 (1967; R 2009) Preferred Limits and Fits for Cylindrical Parts

ASME B46.1 (2009) Surface Texture, Surface Roughness, Waviness and Lay

ASTM INTERNATIONAL (ASTM)

ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A325M	(2013) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM A380	(2006) Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A490	(2014) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A490M	(2014) Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A514/A514M	(2005; R 2009) Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM D962	(1981; E 2008; R 2008) Aluminum Powder and Paste Pigments for Paints
ASTM E165	(2009) Standard Test Method for Liquid Penetrant Examination
ASTM E709	(2008) Standard Guide for Magnetic Particle Examination
ASTM F436	(2011) Hardened Steel Washers
ASTM F436M	(2011) Hardened Steel Washers (Metric)

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC S348	(2014) RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts
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1.2 SUBMITTALS

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SD-02 Shop Drawings

Quality Control Plan; G, DO  
Detail Drawings; G, DO  
Control Dimensions; G, DO



SD-03 Product Data

Welding of Structural Steel; G, DO  
Welding of Stainless Steel; G, DO  
Welding of Aluminum; G, DO  
Structural Steel Welding Repairs; G, DO  
Materials Orders  
Materials List  
Shipping Bill  
Tubular Welding Schedule; G, DO

SD-06 Test Reports

Tests, Inspections, and Verifications  
Fabrication Quality Control Reports

SD-07 Certificates

Qualification Of Structural Steel Fabricator; G, DO  
Qualification of Welders and Welding Operators  
Application Qualification for Steel Studs; G, DO  
Application Qualification for Stainless Steel Studs; G, DO  
Welding of Aluminum; G, DO  
Inspector Qualifications; G, DO  
NDT Equipment Calibration Records; G, DO

SD-08 Manufacturer's Instructions

Welding Procedure Specifications (WPS); G, DO  
NDT Written Practice; G, DO

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Welders and Welding Operators

Submit welder, welding operator and tack welder qualification certifications for each welder, welding operator or tack welder to the Contracting Officer for approval before fabrication begins. Welder and welding operator qualification test records shall be submitted on forms equivalent to the sample forms in [AWS D1.1/D1.1M](#). A CWI meeting the specified qualifications shall approve all welder qualifications. Welders, welding operators, and tack welders shall be limited to welding procedures for which they are certified. All welders shall be qualified according to [AWS D1.1/D1.1M](#) for structural welding [AWS D1.2/D1.2M](#) for structural aluminum welding, [AWS D1.3/D1.3M](#) for sheet steel welding and [AWS D1.6/D1.6M](#) for stainless steel welding. All qualifications shall be current prior to commencement of any work. Submit a continuity log for each welder showing that he/she is current in the process and procedures being proposed for this work. Before assigning any welder, welding operator or tack welder to work under this contract, submit the names of the welders, welding operators and tack welders to be employed, and certification that each individual is qualified as specified. The certification shall state the type of welding and positions for which the welder, welding operator or tack welder is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. The certification shall be kept current for the duration of the contract. Require the welder and welding operators to repeat the qualifying tests when, in the opinion of the Contracting Officer, the work indicates a reasonable doubt as to

proficiency. In such cases, the welder is required to repeat the qualification process in its entirety. The welder's qualification will be reestablished upon successful completion of the test. The welder will be disqualified until successfully passing a retest. The Contracting Officer or ACO is required to be present during requalification. All expenses in connection with qualification and requalification will be borne by the Contractor.

#### 1.3.2 Detail Drawings

Submit detail drawings for metalwork and machine work, prior to fabrication, include within the detail drawings catalog cuts, templates, fabrication and assembly details and type, grade and class of material as appropriate. Elements of fabricated items inadvertently omitted on contract drawings shall be detailed by the fabricator and indicated on the detail drawings.

#### 1.3.3 Prefabrication Conference

Schedule a prefabrication conference as soon as possible after Notice to Proceed and prior to any fabrication. The prefabrication conference shall include, at a minimum, the Contractor (prime), fabricator, the fabricator's primary QC representative, the Contracting Officer or ACO, the GQAR, and the Engineer of Record for the structure(s) being fabricated. The prefabrication conference shall occur either at the fabrication facility or a similar location as deemed appropriate. The format of the prefabrication conference shall include a review of the these specifications, discussion of the fabricator's QCP, identification of roles and responsibilities including roles and responsibilities of fabrication subcontractors. The Contractor shall prepare for this meeting by reviewing plans and specifications and code concerns prior to this meeting and be prepared to discuss any issues regarding the fabrication including Welding Procedure Specifications (WPS) qualification requirements and required witnessing of testing. Complicated connections that may require prototyping for both welding and inspection shall be identified and discussed. In addition, hold points/witness points shall be established during the prefabrication conference.

#### 1.3.4 QA Restriction

**AWS B2.1/B2.1M** shall not be permitted without Contracting Officer approval.

### 1.4 QUALITY CONTROL

#### 1.4.1 Inspector Qualifications

a. Quality control personnel can be assigned to more than one task, provided they are qualified and able to fully perform the duties of each position. Individual(s) responsible for quality assurance/quality control may not serve as or report to production management.

b. All welding inspectors are required to be currently certified by the American Welding Society (AWS) as a Certified Welding Inspector (CWI) or Senior Certified Welding Inspector (SCWI). Non-certified inspectors and Certified Associate Welding Inspectors (CAWI) are not qualified to be used for inspection under these specifications. Designate an individual inspector as the "lead" inspector to be the primary point of contact for quality control of welding and fabrication. Submit copies of certification documentation as provided

by AWS.

c. Qualify Non-Destructive Testing technicians in accordance with ANSI/ASNT CP-189 to level II or III for each applicable method. In the event that a level III be required to perform NDT, a level II practical examination (conducted within the last two years) will be required in addition to the level III qualifications. Level I technicians will be permitted to conduct testing under the direct supervision of an approved level II or III. Submit level II qualification/certification documentation in a format similar to Appendix C: Sample Certification Form ANSI/ASNT CP-189. Submit qualifying level III certification as provided by ASNT.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Materials Orders

Furnish six copies of purchase orders, mill orders, shop orders and work orders for all materials orders prior to the use of the materials in the work. Where mill tests are required, purchase orders include the test site address and the name of the testing agency.

#### 2.1.2 Materials List

Submit a list of the materials to be used in the fabrication of each item at the time of submittal of detail drawings.

#### 2.1.3 Shipping Bill

Submit a shipping bill or memorandum of each shipment of finished pieces or members to the project site giving the designation mark and weight of each item, the number of items, the total weight, and the car initial and number if shipped by rail in carload lots. Promptly mail duplicate copies of shipping bills to the Contracting Officer's Representative.

### 2.2 FABRICATION

#### 2.2.1 Structural Fabrication

Material shall be straight before being laid off or worked. Perform straightening, if necessary, by methods that will not impair the metal. Sharp kinks or bends will be cause for rejection of the material. Material with welds will not be accepted except where welding is definitely specified, indicated or otherwise approved. Make bends using approved dies, press brakes or bending rolls. Where heating is required, take precautions to avoid overheating the metal and allow it to cool in a manner that will not impair the original properties of the metal. Proposed flame cutting of material, other than structural steel, will be subject to approval and shall be indicated on detail drawings. Shearing shall be accurate and all portions of the work neatly finished. Corners shall be square and true unless otherwise shown. Re-entrant cuts shall be filleted to a minimum radius of 3/4 inch unless otherwise approved. Provide finished members free of twists, bends and open joints. Bolts, nuts and screws shall be tight.

#### 2.2.1.1 Dimensional Tolerances for Structural Work

Measure dimensions using an approved calibrated steel tape of approximately the same temperature as the material being measured. The overall dimensions of an assembled structural unit shall be within the tolerances indicated on the drawings or as specified in the particular section of these specifications for the item of work. Where tolerances are not specified in other sections of these specifications or shown, an allowable variation of  $1/32$  inch is permissible in the overall length of component members with both ends milled; component members without milled ends shall not deviate from the dimensions shown by more than  $1/16$  inch for members 30 feet or less in length, and by more than  $1/8$  inch for members over 30 feet in length.

#### 2.2.1.2 Structural Steel Fabrication

Structural steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Prepare surfaces and edges in accordance with AWS D1.1/D1.1M. Where structural steel is not to be welded, chipping or grinding will not be required except as necessary to remove slag and sharp edges of mechanically guided or hand-guided cuts not exposed to view. Chip, grind or machine to sound metal hand-guided cuts which are to be exposed or visible.

#### 2.2.1.3 Structural Aluminum Fabrication

Lay out and cut aluminum in accordance with the AA ADM, Section 6.

#### 2.2.2 Welding

##### 2.2.2.1 Welding of Structural Steel

a. Prepare and qualify each WPS in accordance with the applicable provisions of AWS D1.1/D1.1M. In case of conflict between this specification and AWS D1.1/D1.1M as applicable, this specification governs. A WPS is always required, even if the procedure is considered prequalified in accordance with AWS D1.1/D1.1M. Qualify all WPS by testing in the applicable process and position to be utilized. Qualify all combinations of required base metal by testing. Clearly identify each procedure as being either prequalified or qualified by tests. Individually identify WPS. Include in the WPS as a minimum the following: Indicate whether WPS is prequalified or qualified by testing, WPS ID number, revision number, date, name of company which created the WPS, supporting PQR number, joint design information (to include dimensional tolerances), base metal information, shielding information, preheat information, type of operation, position, electrical characteristics, technique, PWHT and joint sketch including all code required essential variables. Include filler metal data sheets with WPS and PQR. Submit all WPS with attached PQR and supporting test documentation on forms similar or equivalent to the sample forms in AWS D1.1/D1.1M.

b. Welding Process - Perform welding of structural steel by an electric arc welding process using a method which excludes the atmosphere from the molten metal and conforms to the applicable provisions of AWS D1.1/D1.1M. Minimize residual stresses, distortion and shrinkage from welding.

c. Welding Technique

(1) Filler Metal - The electrode, electrode-flux combination and grade of weld metal shall conform to the appropriate AWS specification for the base metal and welding process being used or be as shown where a specific choice of AWS specification allowables is required. Include the AWS designation of the electrodes to be used in the schedule of welding procedures. Use only low hydrogen electrodes for manual shielded metal-arc welding regardless of the thickness of the steel. Use a controlled temperature storage oven at the job site as prescribed by AWS D1.1/D1.1M, Subsection 3.5 to maintain low moisture of low hydrogen electrodes.

(2) Preheat and Interpass Temperature - Perform preheating as required by AWS D1.1/D1.1M, Subsection 3.5 or as otherwise specified.

(3) Stress-Relief Heat Treatment - Where stress relief heat treatment is specified or shown, perform in accordance with the requirements of AWS D1.1/D1.1M, Subsection 5.8 unless otherwise authorized or directed.

d. Workmanship - Perform welding workmanship in accordance with AWS D1.1/D1.1M, Section 3 and other applicable requirements of these specifications.

(1) Preparation of Base Metal - Prior to welding inspect surfaces to be welded to ensure compliance with AWS D1.1/D1.1M, Subsection 3.2.

(2) Temporary Welds - Make temporary welds, required for fabrication and erection, under the controlled conditions prescribed for permanent work. Make temporary welds using low-hydrogen welding electrodes and by welders qualified for permanent work as specified in these specifications. Conduct preheating for temporary welds as required by AWS D1.1/D1.1M for permanent welds except that the minimum temperature shall be 120 degrees F in any case. In making temporary welds, arcs shall not be struck in other than weld locations. Remove each temporary weld and grind flush with adjacent surfaces after serving its purpose.

(3) Tack Welds - Subject tack welds that are to be incorporated into the permanent work to the same quality requirements as the permanent welds; clean and thoroughly fuse them with permanent welds. Multiple-pass tack welds shall have cascaded ends. Remove defective tack welds before permanent welding.

(4) Surfaces on which weld metal is to be deposited shall be smooth, uniform, and free from fins, tears, cracks, and other discontinuities which would adversely affect the quality or strength of the weld. Surfaces to be welded and surfaces adjacent to a weld shall also be free from loose or thick scale, slag, rust, moisture, grease and other foreign material that would prevent proper welding or produce objectionable fumes.

(5) All temporary welds and/or tack welds not incorporated into the final weld shall be removed.

#### 2.2.2.2 Welding of Steel Castings

Remove unsound material from the surfaces of steel castings, to be incorporated into welded connections, by chipping, machining, air-arc gouging or grinding. Do not weld major connections designed for transfer of stresses if the temperature of the casting is lower than 100 degrees F. Castings containing over 0.35 percent carbon or over 0.75 percent manganese shall be preheated to a temperature not to exceed 450 degrees F and conduct welding while the castings are maintained at a temperature above 350 degrees F. Welding will not be permitted on castings containing carbon in excess of 0.45 percent except on written authorization. Castings requiring welding repairs after the first annealing and castings involving welding fabrication shall be stress-relieved annealed prior to receiving final machining unless otherwise permitted.

#### 2.2.2.3 Welding of Steel Studs

Conform to the requirements of AWS D1.1/D1.1M, Section 7, except as otherwise specified for the procedures for welding steel studs to structural steel, including mechanical, workmanship, technique, stud application qualification, production quality control and fabrication and verification inspection procedures.

- a. Application Qualification for Steel Studs - As a condition of approval of the stud application process, furnish certified test reports and certification that the studs conform to the requirements of AWS D1.1/D1.1M, Subsections 7.2 and 7.3, certified results of the stud manufacturer's stud base qualification test, and certified results of the stud application qualification test as required by AWS D1.1/D1.1M, Subsection 7.6, prior to commencing fabrication, except as otherwise specified.
- b. Production Quality Control - Conform to the requirements of AWS D1.1/D1.1M, Subsection 7.7, except as otherwise specified for quality control for production welding of studs. Studs on which pre-production testing is to be performed shall be welded in the same general position as required on production studs (flat, vertical, overhead or sloping). If the reduction of the length of studs becomes less than normal as they are welded, stop welding immediately and do not resume until the cause has been corrected.

#### 2.2.2.4 Welding of Stainless Steel

- a. Welding Procedures for Stainless Steel - Prequalify welding procedures for stainless steel as described in AWS D1.6/D1.6M, Subsection 3.0 or qualify by tests as prescribed in AWS D1.6/D1.6M, Section 4. Properly documented evidence of compliance with all requirements of these specifications for previous qualification tests shall establish a welding procedure as prequalified. For welding procedures qualified by tests, the test welding and specimen testing will be witnessed and the test report document signed by the Contracting Officer. Approval of any welding procedure will not relieve the Contractor of the responsibility for producing a finished structure meeting all requirements of these specifications. The Contractor will be directed or authorized to make any changes in previously approved welding procedures that are deemed necessary or desirable by the Contractor Officer. Submit a complete schedule of welding procedures for each stainless steel structure to be welded

prior to commencing fabrication. The schedule shall conform to the requirements specified in the provisions AWS D1.6/D1.6M, Sections 2, 3, 4, 6, and 7. Provide within the schedule detailed procedure specifications and tables or diagrams showing the procedures to be used for each required joint. Include in the welding procedures filler metal, preheat, interpass temperature and stress-relief heat treatment requirements. Each welding procedure shall be clearly identified as being prequalified or required to be qualified by tests. Welding procedures shall show types and locations of welds designated or in the specifications to receive nondestructive examination.

b. Welding Process - Perform welding of structural steel by an electric arc welding process using a method which excludes the atmosphere from the molten metal and conforms to the applicable provisions of AWS D1.6/D1.6M. Minimize residual stresses, distortion and shrinkage from welding.

c. Welding Technique

(1) Filler Metal - The electrode, electrode-flux combination and grade of weld metal shall conform to the appropriate AWS specification for the base metal and welding process being used or be as shown where a specific choice of AWS specification allowables is required. Include the AWS designation of the electrodes to be used in the schedule of welding procedures. Use a controlled temperature storage oven at the job site as prescribed by AWS D1.6/D1.6M, Subsection 3.10 to maintain low moisture of low hydrogen electrodes.

(2) Preheat and Interpass Temperature - Perform preheating as required by AWS D1.6/D1.6M, or as otherwise specified except that the temperature of the base metal shall be at least 70 degrees F. Slowly and uniformly preheat the weldments by approved means to the prescribed temperature, held at that temperature until the welding is completed and then permitted to cool slowly in still air.

d. Workmanship - Perform welding workmanship in accordance with AWS D1.6/D1.6M, Section 3 and other applicable requirements of these specifications.

(1) Preparation of Base Metal - Prior to welding inspect surfaces to be welded to ensure compliance with AWS D1.6/D1.6M.

(2) Temporary Welds - Make temporary welds, required for fabrication and erection, under the controlled conditions prescribed for permanent work. Make temporary welds by welders qualified for permanent work as specified in these specifications. Conduct preheating for temporary welds as required by AWS D1.6/D1.6M. In making temporary welds, arcs shall not be struck in other than weld locations. Remove each temporary weld and grind flush with adjacent surfaces after serving its purpose.

(3) Tack Welds - Subject tack welds that are to be incorporated into the permanent work to the same quality requirements as the permanent welds; clean and thoroughly fuse them with permanent welds. Multiple-pass tack welds shall have cascaded ends. Remove defective tack welds before permanent welding.

(4) Surfaces on which weld metal is to be deposited shall be smooth, uniform, and free from fins, tears, cracks, and other discontinuities which would adversely affect the quality or strength of the weld. Surfaces to be welded and surfaces adjacent to a weld shall also be free from loose or thick scale, slag, rust, moisture, grease and other foreign material that would prevent proper welding or produce objectionable fumes.

(5) All temporary welds and/or tack welds not incorporated into the final weld shall be removed.

#### 2.2.2.5 Welding of Stainless Steel Studs

Conform to the requirements of AWS D1.6/D1.6M, Section 7, except as otherwise specified for the procedures for welding stainless steel studs to structural stainless steel, including mechanical, workmanship, technique, stud application qualification, production quality control and fabrication and verification inspection procedures.

a. **Application Qualification for Stainless Steel Studs** - As a condition of approval of the stud application process, furnish certified test reports and certification that the studs conform to the requirements of AWS D1.6/D1.6M, Subsections 7.2 and 7.3, certified results of the stud manufacturer's stud base qualification test, and certified results of the stud application qualification test as required by AWS D1.6/D1.6M, Subsection 7.6, prior to commencing fabrication, except as otherwise specified.

b. **Production Quality Control** - Conform to the requirements of AWS D1.6/D1.6M, Subsection 7.7, except as otherwise specified for quality control for production welding of studs. Studs on which pre-production testing is to be performed shall be welded in the same general position as required on production studs (flat, vertical, overhead or sloping). If the reduction of the length of studs becomes less than normal as they are welded, stop welding immediately and do not resume until the cause has been corrected.

#### 2.2.3 Bolted Connections

##### 2.2.3.1 Bolted Structural Steel Connections

Provide bolts, nuts and washers of the type specified or indicated. Equip all nuts with washers except for high strength bolts. Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis. Where the use of high strength bolts is specified or indicated, the materials, workmanship and installation shall conform to the applicable provisions of ASTM A325 or ASTM A325M, ASTM A490 or ASTM A490M, and RCSC S348. Washers to be used with high strength bolts shall conform to ASTM F436 or ASTM F436M.

a. Bolt holes shall be accurately located, smooth, perpendicular to the member and cylindrical.

b. Holes for regular bolts shall be drilled or subdrilled and reamed in the shop and not be more than 1/16 inch larger than the diameter of the bolt.

c. Holes for fitted bolts shall be match-reamed or drilled in the



shop. Remove burrs resulting from reaming. Keep bolt threads entirely outside of the holes. The body diameter of bolts shall have tolerances as recommended by [ASME B4.1](#) for the class of fit specified. Place fitted bolts in reamed holes by selective assembly to provide an LN-2 fit.

d. Holes for high strength bolts shall not have diameters more than [1/16 inch](#) larger than bolt diameters. If the thickness of the material is not greater than the diameter of the bolts, the holes may be punched. If the thickness of the material is greater than the diameter of the bolts the holes may be drilled full size or subpunched or subdrilled at least [1/8 inch](#) smaller than the diameter of the bolts and then reamed to full size. Poor matching of holes will be cause for rejection. Drifting occurring during assembly shall not distort the metal or enlarge the holes. Reaming to a larger diameter of the next standard size bolt will be allowed for slight mismatching.

#### 2.2.3.2 Bolted Aluminum Connections

Conform to the requirements of [AA ADM](#), Section 6 for punching, drilling, reaming and bolting for bolted aluminum connections.

#### 2.2.4 Castings

Each casting and castings weighing more than [500 required pounds](#) shall bear cast or stamped heat numbers. Deviations from the dimensions of castings shown shall not exceed amounts that will impair the strength of castings by more than 10 percent as computed from the dimensions shown. Dimensions of castings shown on approved detail drawings are finished dimensions. Castings that are warped or otherwise distorted or that are oversize to an extent that will interfere with proper fit with other parts of the machinery or structure will be rejected. The structure of metal in castings shall be homogeneous and free from excessive nonmetallic inclusions. Excessive segregation of impurities or alloys at critical points in castings will be cause for rejection. Do not make repairs to castings prior to approval. Minor surface imperfections not affecting the strength of casting may be welded in the "green" if approved. Surface imperfections will be considered minor when the depth of the cavity prepared for welding is the lesser of 20 percent of the actual wall thickness or [1 inch](#). Defects other than minor surface imperfections may be welded only when specifically authorized in accordance with the following requirements:

a. The defects have been entirely removed and are judged not to affect the strength, use or machineability of the castings when properly welded and stress relieved.

b. The proposed welding procedure, stress relief and method of examination of the repair work have been submitted and approved.

#### 2.2.5 Machine Work

Tolerances, allowances and gauges for metal fits between plain, non-threaded, cylindrical parts shall conform to [ASME B4.1](#) for the class of fit shown or required unless otherwise shown on approved detail drawings. Where fits are not shown they will be suitable as approved. Tolerances for machine-finished surfaces designated by non-decimal dimensions shall be within [1/64 inch](#). Sufficient machining stock will be allowed on placing pads to ensure true surfaces of solid material. Provide finished contact

or bearing surfaces true and exact to secure full contact. Polish journal surfaces and finish all surfaces with sufficient smoothness and accuracy to ensure proper operation when assembled. Parts entering any machine shall be accurately machined and all like parts be interchangeable except that parts assembled together for drilling or reaming of holes or machining will not be required to be interchangeable with like parts. Accurately locate all drilled holes bolts.

#### 2.2.5.1 Finished Surfaces

Provide surface finishes, indicated or specified, in accordance with [ASME B46.1](#). Values of required roughness heights are arithmetical average deviations expressed in [microinches](#). These values are maximum. Lesser degrees will be satisfactory unless otherwise indicated. Compliance with surface requirements shall be determined by sense of feel and visual inspection of the work compared to Roughness Comparison Specimens in accordance with the provisions of [ASME B46.1](#). Values of roughness width and waviness height shall be consistent with the general type of finish specified by roughness height. Where the finish is not indicated or specified use that which is most suitable for the particular surface, provide the class of fit required and be indicated on the detail drawings by a symbol which conforms to [ASME B46.1](#) when machine finishing is provided. Flaws such as scratches, ridges, holes, peaks, cracks or checks which will make the part unsuitable for the intended use will be cause for rejection.

#### 2.2.5.2 Unfinished Surfaces

Lay out all work to secure proper matching of adjoining unfinished surfaces unless otherwise directed. Where there is a large discrepancy between adjoining unfinished surfaces chip and grind smooth or machine to secure proper alignment. Unfinished surfaces shall be true to the lines and dimensions shown and be chipped or ground free of all projections and rough spots. Fill in depressions or holes not affecting the strength or usefulness of the parts in an approved manner.

#### 2.2.5.3 Pin Holes

Pin holes are to be bored true to gauges, smooth, straight and at right angles to the axis of the member. The boring shall be done after the member is securely fastened in position.

#### 2.2.5.4 Gears

Provide gears that have machine cut teeth of a form conforming to applicable design requirements of [ANSI/AGMA 2005](#) and [ANSI/AGMA 6001](#) unless otherwise specified or shown.

#### 2.2.5.5 Shafting

Turn or grind shafting with hot-rolled or cold-rolled steel, as required, unless otherwise specified or authorized. Provide fillets where changes in section occur. Cold-finished shafting may be used where keyseating is the only machine work required.

## 2.2.6 Miscellaneous Provisions

### 2.2.6.1 Cleaning of Corrosion-Resisting Steel

Remove oil, paint and other foreign substances from corrosion-resisting steel surfaces after fabrication. Perform cleaning by vapor degreasing or by the use of cleaners of the alkaline, emulsion or solvent type. After the surfaces have been cleaned give a final rinsing with clean water followed by a 24 hour period during which the surfaces are intermittently wet with clean water and then allowed to dry for the purpose of inspecting the clean surfaces. Visually inspect the surfaces for evidence of paint, oil, grease, welding slag, heat treatment scale, iron rust or other forms of contamination. If evidence of foreign substance is found, clean again in accordance with the applicable provisions of [ASTM A380](#). Furnish the proposed method of treatment for approval. Visually reinspect after treatment. Use only stainless steel or nonmetallic bristle brushes to remove foreign substances. Any contamination occurring subsequent to the initial cleaning shall be removed by one or more of the methods indicated above.

### 2.2.6.2 Lubrication

The arrangement and details for lubrication shall be as shown. Thoroughly clean and lubricate, with an approved lubricant, all bearing surfaces before erection or assembly.

### 2.2.7 Shop Assembly

Assemble each machinery and structural unit furnished in the shop to determine the correctness of the fabrication and matching of the component parts unless otherwise specified. Do not exceed those tolerances shown. Closely check each unit assembled to ensure that all necessary clearances have been provided and that binding does not occur in any moving part. Assembly in the shop shall be in the same position as final installation in the field unless otherwise specified. Perform assembly and disassembly work in the presence of the Contracting Officer unless waived in writing. Immediately remedy errors or defects disclosed by the Contractor without cost to the Government. Before disassembly for shipment each piece of a machinery or structural unit shall be match-marked to facilitate erection in the field. Indicate the location of match-marks by circling with a ring of white paint after the shop coat of paint has been applied or as otherwise directed.

## 2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

Maintain an approved QC program and perform required inspections by approved quality control personnel. Conduct applicable inspections before, during and upon completion of welding as required. Inspect welding in order to determine conformance with the requirements set forth in this specification. Clean all completed welds and visually examine for rejectable indications to ensure compliance with the requirements of [AWS D1.1/D1.1M](#), [AWS D1.2/D1.2M](#), [AWS D1.3/D1.3M](#) or [AWS D1.6/D1.6M](#) whichever is applicable. In addition, the Government may choose to hire a third party inspector to perform verification of this work. The Government's third party inspection will occur at various times throughout the duration of fabrication. The Contractor will be advised when third party inspection must be coordinated with the Contracting Officer and the Contractor for all verification inspections selected by the Government. Fabrication cannot take place in locations with outstanding Department of State travel

warnings prior to approval from the Contracting Officer.

#### 2.3.1 Nondestructive Testing

When doubt exists as to the soundness of any material part, such part may be subjected to any form of nondestructive testing determined by the Contracting Officer. This may include ultrasonic, magnaflux, dye penetrant, radiography or any other test that will thoroughly investigate the part in question. The cost of such investigation will be borne by the Government. Any defects will be cause for rejection; replace and retest rejected parts at the Contractor's expense.

#### 2.3.2 Tests of Machinery and Structural Units

The details for tests of machinery and structural units shall conform to the requirements of the particular sections of these specifications covering these items. Assemble each complete machinery and structural unit and test them in the shop, in the presence of the Contracting Officer, unless otherwise directed. Waiving of tests will not relieve the Contractor of responsibility for any fault in operation, workmanship or material that occurs before the completion of the contract or guarantee. After being installed at the site, each complete machinery or structural unit shall be operated through a sufficient number of complete cycles to demonstrate to the satisfaction of the Contracting Officer that it meets the specified operational requirements in all respects.

#### 2.3.3 Inspection of Structural Steel Welding

##### 2.3.3.1 Visual Examination

Inspect 100 percent of all welds using a Government approved AWS Certified Welding Inspector (CWI) to ensure that the welds conform to the requirements of AWS D1.1/D1.1M for Structural Steel, AWS D1.2/D1.2M for Structural Aluminum, AWS D1.3/D1.3M for Sheet Steel, AWS D1.6/D1.6M for Stainless Steel and the approved welding procedure. Non-certified inspectors and certified associate weld inspectors (CAWI) must not be used for inspection under these specifications. An approved CWI will be present at all times during welding operations.

##### 2.3.3.2 Nondestructive Examination

Perform as designated or described in the sections of these specifications, the nondestructive examination of shop and field welds covering the particular items of work.

a. Testing Agency - Perform the nondestructive examination of welds and the evaluation of examination tests as to the acceptability of the welds by a testing agency adequately equipped and competent to perform such services or by the Contractor using suitable equipment and qualified personnel. In either case written approval of the examination procedures is required. Inform the Government prior to testing. The evaluation of examination tests is subject to the approval of, and all records become the property of, the Government. Only individuals qualified for NDT Level II or Level III may perform nondestructive testing. The Level III NDT inspector who supervises all NDT is required to possess a currently valid American Society for Nondestructive Testing (ASNT) Level III certificate for each of the processes for which they are qualified. Include copies of the certifications, including the ASNT certificate of Level III NDT

Technician that certified the Level II Technicians in the submittals. Perform all nondestructive testing in accordance with AWS D1.1/D1.1M for Structural Steel, AWS D1.2/D1.2M for Structural Aluminum, AWS D1.3/D1.3M for Sheet Steel, AWS D1.6/D1.6M for Stainless Steel.

b. Examination Procedures - Conform examination procedures to the following requirements.

(1) Ultrasonic Testing (UT) - Perform ultrasonic testing of welds to the provisions of AWS D1.1/D1.1M for Structural Steel, AWS D1.2/D1.2M for Structural Aluminum, AWS D1.3/D1.3M for Sheet Steel, AWS D1.6/D1.6M for Stainless Steel. Longitudinally scan base metal for laminations prior to shearwave examination. Longitudinal examinations conducted by the material producer are not considered acceptable for this testing. Sensitivity reference levels for shear wave examinations must be established on an iiw type block utilizing the .060 sensitivity hole. Any alternative method is required to be approved by the engineer. The ultrasonic equipment must be capable of making a permanent record of the test indications. Make a record of each weld tested. PAUT may be used in lue of conventional ultrasonics and radiography with government approval of PAUT procedures, scan plan and acceptance criteria.

(2) Radiographic Testing (RT) - Make, evaluate and report radiographic testing of welds in accrodance with the applicable requirements of AWS D1.1/D1.1M for Structural Steel, AWS D1.2/D1.2M for Structural Aluminum, AWS D1.3/D1.3M for Sheet Steel, AWS D1.6/D1.6M for Stainless Steel. Ensure that radiographic film provided is developed with a film density from 2.5 to 3.5. The Government will retain ownership of radiographic film provided by the fabricator. Only ASNT RT Level III's or individuals specifically certified in radiographic film interpretation are allowed to perform the interpretation and acceptance/rejection of radiographs. Submit qualifying documentation for Government approval. Only wire IQI's are permitted for use. The designated wire must be visible from end to end with no breaks. Phase Array Ultrasonic Testing may be used in place of RT with Government approval of technique and acceptance criteria.

(3) Magnetic Particle Inspection (MT) - Perform magnetic particle inspection of welds in accordance with the provisions of ASTM E709 and AWS D1.1/D1.1M for Structural Steel, AWS D1.2/D1.2M for Structural Aluminum, AWS D1.3/D1.3M for Sheet Steel, AWS D1.6/D1.6M for Stainless Steel. MT by the prod method is prohibited. Permanent magnets are prohibited. Unless specifically approved, do not use magnetic particle media suspended in a liquid solution for field applications. MT particle media must be of a contrasting color to the test material. Use field indicators to verify the correct field strength and direction.

(4) Dye Penetrant Inspection (PT) - Perform dye penetrant inspection of welds conforming to the applicable provisions of ASTM E165.

c. Acceptability of Welds - Welds will be unacceptable if shown to have defects prohibited by AWS D1.1/D1.1M for Structural Steel, AWS D1.2/D1.2M for Structural Aluminum, AWS D1.3/D1.3M for Sheet Steel, AWS D1.6/D1.6M for Stainless Steel. Welded connections that cannot be examined in conformance with the applicable AWS welding code are

required to be tested by an alternative procedure developed by the Contractor's level III NDT inspector and approved by the Government.

d. Welds to be Subject to Nondestructive Examination - 100 percent of all welds will be visually inspected and accepted prior to subsequent NDT. Complete Joint Penetration (CJP) welds: 100 percent examination by UT or RT, 25 percent examination by MT or PT. Partial Joint Penetration (PJP) welds: Ultrasonic examination required if noted on drawings, 25 percent examination by MT or PT. Fillet Welds: 25 percent examination by MT or PT. Magnetic Particle Testing (MT) and Liquid Penetrant Testing (PT) methods are interchangeable unless base metal is not conducive to magnetism. Radiographic testing will be restricted to butt joints only. NDT examinations specified to be conducted at a percentage less than 100 percent will be distributed at random locations throughout the components being fabricated.

#### 2.3.3.3 Test Coupons

The Government reserves the right to require the Contractor to remove coupons from completed work when doubt as to soundness cannot be resolved by nondestructive examination. Should tests of any two coupons cut from the work of any welder show strengths less than that specified for the base metal it will be considered evidence of negligence or incompetence and such welder will be removed from the work. When coupons are removed from any part of a structure, repair the members cut in a neat manner with joints of the proper type to develop the full strength of the members. Repaired joints shall be peened as approved or directed to relieve residual stress. The expense for removing and testing coupons, repairing cut members and the nondestructive examination of repairs shall be borne by the Government or the Contractor in accordance with the Contract Clauses INSPECTION AND ACCEPTANCE.

#### 2.3.4 Structural Steel Welding Repairs

Repair defective welds in the structural steel welding repairs in accordance with AWS D1.1/D1.1M, Subsection 3.7. Remove defective weld metal to sound metal by use of air carbon-arc or oxygen gouging. Do not use oxygen gouging on ASTM A514/A514M steel. Thoroughly clean surfaces before welding. Retest welds that have been repaired by the same methods used in the original inspection. Except for the repair of members cut to remove test coupons and found to have acceptable welds costs of repairs and retesting will be borne by the Contractor. Submit welding repair plans for steel, prior to making repairs.

#### 2.3.5 Inspection and Testing of Steel Stud Welding

Perform fabrication and verification inspection and testing of steel stud welding conforming to the requirements of AWS D1.1/D1.1M, Subsection 7.8 except as otherwise specified. The Contracting Officer or ACO will serve as the verification inspector. One stud in every 100 and studs that do not show a full 360 degree weld flash, have been repaired by welding or whose reduction in length due to welding is less than normal shall be bent or torque tested as required by AWS D1.1/D1.1M, Subsection 7.8. If any of these studs fail, bend or torque test two additional studs. If either of the two additional studs fails, all of the studs represented by the tests will be rejected. Studs that crack under testing in either the weld, base metal or shank will be rejected and replaced by the Contractor at no additional cost.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Thoroughly clean all parts to be installed. Remove packing compounds, rust, dirt, grit and other foreign matter. Clean holes and grooves for lubrication. Examine enclosed chambers or passages to make sure that they are free from damaging materials. Where units or items are shipped as assemblies they will be inspected prior to installation. Disassembly, cleaning and lubrication will not be required except where necessary to place the assembly in a clean and properly lubricated condition. Do not use pipe wrenches, cold chisels or other tools likely to cause damage to the surfaces of rods, nuts or other parts used for assembling and tightening parts. Tighten bolts and screws firmly and uniformly but take care not to overstress the threads. When a half nut is used for locking a full nut place the half nut first followed by the full nut. Lubricate threads of all bolts except high strength bolts, nuts and screws with an approved lubricant before assembly. Coat threads of corrosion-resisting steel bolts and nuts with an approved antigalling compound. Driving and drifting bolts or keys will not be permitted.

#### 3.1.1 Alignment and Setting

Accurately align each machinery or structural unit by the use of steel shims or other approved methods so that no binding in any moving parts or distortion of any member occurs before it is fastened in place. The alignment of all parts with respect to each other shall be true within the respective tolerances required. Set true machines to the elevations shown.

#### 3.1.2 Blocking and Wedges

Remove all blocking and wedges used during installation for the support of parts to be grouted in foundations before final grouting unless otherwise directed. Blocking and wedges left in the foundations with approval shall be of steel or iron.

Contractor shall coordinated with South Florida Operations Office (SFOO) through the Contracting Officer to have the existing emergency bulkheads delivered to the site for field fitting. Field fit the bulkhead slot frames and rails to emergency bulkhead before grouting.

#### 3.1.3 Field Fitting for Existing Bulkheads

The Contractor shall coordinate with South Florida Operations Office (SFOO) through the Contracting Officer to have the existing bulkheads delivered to the site for field fitting. Field fit the guides and frames to the existing bulkheads before grouting.

### 3.2 TESTS

#### 3.2.1 Workmanship

Workmanship must be of the highest grade and in accordance with the best modern practices to conform with the specifications for the item of work being furnished.

#### 3.2.2 Production Welding

Perform production welding conforming to the requirements of AWS D1.1/D1.1M,

AWS D1.2/D1.2M, AWS D1.3/D1.3M, or AWS D1.6/D1.6M, as applicable. Studs, on which pre-production testing is to be performed, shall be welded in the same general position as required on production items (flat, vertical, overhead or sloping). Test and production stud welding will be subjected to visual examination or inspection. If the reduction of the length of studs becomes less than normal as they are welded, stop welding immediately and do not resume until the cause has been corrected.

### 3.3 PROTECTION OF FINISHED WORK

#### 3.3.1 Machined Surfaces

Thoroughly clean foreign matter off machined surfaces. All finished surfaces shall be protected by suitable means. Oil and wrap unassembled pins and bolts with moisture resistant paper or protect them by other approved means. Wash finished surfaces of ferrous metals to be in bolted contact, with an approved rust inhibitor and coat them with an approved rust resisting compound for temporary protection during fabrication, shipping and storage periods.

#### 3.3.2 Lubrication After Assembly

After assembly fill all lubricating systems with the lubricant specified and apply additional lubricant at intervals as required to maintain the equipment in satisfactory condition until acceptance of the work.

#### 3.3.3 Aluminum

Protect aluminum that will be in contact with grout or concrete from galvanic or corrosive action, with a coat of zinc-chromate primer and a coat of aluminum paint. Protect aluminum in contact with structural steel against galvanic or corrosive action with a coat of zinc-chromate primer and a coat of aluminum paint. Provide aluminum paint consisting of a aluminum paste conforming to ASTM D962, spar varnish and thinner compatible with the varnish. Field mix the aluminum paint in proportion of 2 pounds of paste, not more than one gallon of spar varnish and not more than one pint of thinner.

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SECTION 05 50 15

CIVIL WORKS FABRICATIONS

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 INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303 (2010) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2012; Errata 2011) Structural Welding Code - Steel

AWS D1.2/D1.2M (2008) Structural Welding Code - Aluminum

AWS D1.6/D1.6M (2007) Structural Welding Code - Stainless Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2010) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2010) Standard for Square and Hex Nuts

ASME B18.21.1 (2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASME B18.3 (2003; R 2008) Socket Cap Shoulder and Set Screws, Hex and Spline Keys (Inch Series)

ASME B18.6.2 (1998; R 2010) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series

ASME B18.6.3 (2010) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A1 (2000; R 2010) Standard Specification for Carbon Steel Tee Rails

ASTM A123/A123M (2012) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A240/A240M	(2012a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A269	(2010) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A276	(2010) Standard Specification for Stainless Steel Bars and Shapes
ASTM A29/A29M	(2012) Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought General Requirements for
ASTM A307	(2012) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A312/A312M	(2012) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320/A320M	(2011a) Standard Specification for Alloy/Steel and Stainless Steel Bolting Materials for Low-Temperature Service
ASTM A322	(2007) Standard Specification Steel Bars, Alloy, Standard Grades
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A484/A484M	(2012) Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings
ASTM A490	(2012) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A493	(2009; R 2013) Standard Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging
ASTM A500/A500M	(2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A572/A572M	(2012) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A576	(1990b; R 2012) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A752	(2004; R 2010) Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Alloy Steel
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A786/A786M	(2005; R 2009) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B148	(1997; R 2009) Standard Specification for Aluminum-Bronze Sand Castings
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B211	(2012) Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B241/B241M	(2012) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B271	(2011) Standard Specification for Copper-Base Alloy Centrifugal Castings
ASTM B308/B308M	(2010) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B505/B505M	(2012a) Standard Specification for Copper-Base Alloy Continuous Castings
ASTM C955	(2011c) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and

Bracing or Bridging for Screw Application  
of Gypsum Panel Products and Metal Plaster  
Bases

ASTM D1187/D1187M

(1997; E 2011; R 2011) Asphalt-Base  
Emulsions for Use as Protective Coatings  
for Metal

ASTM F436

(2011) Hardened Steel Washers

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531

(2009) Metal Bar Grating Manual

NAAMM MBG 531S

(1989) Guide Specification for Stainless  
Steel Grating

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC S348

(2004) RCSC Specification for Structural  
Joints Using ASTM A325 or A490 Bolts

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J514

(2012) Hydraulic Tube Fittings

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20

(2002; E 2004) Zinc-Rich Primers (Type I,  
Inorganic, and Type II, Organic)

SSPC Paint 29

(2002; E 2004) Zinc Dust Sacrificial  
Primer, Performance-Based

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1

Safety and Health Requirements Manual

The most recent USACE EM 385-1-1 can be viewed at the web site indicated in  
Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410

(Rev G) Wire Rope and Strand

## 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. Submit the following in  
accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Quality Control Plan; G, DO  
Miscellaneous Metals & Standard Metal Articles; G, DO  
Shop Fabricated Metal Items; G, DO

Submit fabrication drawings showing layout(s), member sizing, description of connections to structural system, and anchoring details as specified in AISC 303. Drawings shall be signed and sealed by a qualified Licensed Professional Engineer registered in the state of Florida and experienced in the design of metal fabrications.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the culverts construction.

Control Dimensions; G, DO

#### SD-03 Product Data

Miscellaneous Metals & Standard Metal Articles; G, DO  
Shop Fabricated Metal Items; G, DO

Lists of materials and records which identify the disposition of approved material and fabricated items in the work. Also comply with Product Data as specified in Section 05 50 14 STRUCTURAL METAL FABRICATION.

#### SD-06 Test Reports

Miscellaneous Metals & Standard Metal Articles; G, DO  
Shop Fabricated Metal Items; G, DO

#### SD-07 Certificates

NDT Equipment Calibration Records; G, DO  
Welder Qualification Records; G, DO  
Inspector Qualifications; G, DO

#### SD-08 Manufacturer's Instructions

Welding Procedure Specifications; G, DO  
NDT Written Practice; G, DO

### 1.3 QUALITY ASSURANCE

Material shall be straight before being laid off or worked. If straightening is necessary, it shall be done by methods that will not impair the metal. Sharp kinks or bends will be cause for rejection of the material. Material with welds will not be accepted except where welding is definitely specified, indicated or otherwise approved. Bends shall be made by approved dies, press brakes or bending rolls. Where heating is required, precautions shall be taken to avoid overheating the metal and it shall be allowed to cool in a manner that will not impair the original properties of the metal. Shearing shall be accurate and all portions of the work shall be neatly finished. Corners shall be square and true unless otherwise shown. Re-entrant cuts shall be filleted round to a minimum radius in accordance with AWS D1.1/D1.1M unless otherwise indicated or approved. Members shall be free of twists, bends and deformation. Straighten material without shearing, fracturing, stressing, or damaging the bolts, welds, or base metal. Use heat straightening methods approved by the Engineer. Replace material damaged during straightening operations with new material at no additional cost to the Government. Do not heat

metal to temperatures greater than 1200 degrees F. The use of cutting heads for heating and straightening will not be permitted. After heating and straightening, allow the metal to slowly cool to ambient before inspecting for evidence of fracture or other damage. If the Engineer determines it is not possible to straighten a member as part of an assembly, remove the bent material from the assembly, straighten, and re-assemble or replace the component as required by the Engineer.

a. Diminsional Tolerances for Structural Work.

(1) The overall dimensions of an assembled structural unit shall be within the tolerances indicated on the drawings or as specified for the item of work. Where tolerances are not specified in other sections of these specifications or shown, a variation of 1/32 inch is permissible in the overall length of component members with both ends milled, and component members without milled ends shall not deviate from the dimensions shown by not more than 1/16 inch for members 30 feet or less in length and by not more than 1/8 inch for members over 30 feet in length.

(2) Structure dimensions indicated on the drawings are based on a structure temperature of 70 degrees F. The Contractor shall be responsible for any and all dimensional adjustments to compensate for actual temperature variations during construction. Measure tolerances of the final assembly with the structure in the orientation in which it will be used.

b. Structural Steel Fabrication. Structural steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Surfaces and edges must be prepared in accordance with AWS D1.1/D1.1M. Hand-guided cuts must be chipped, ground or machined to sound metal.

c. Seal Welding. See drawings for areas that require seal welding.

d. Qualify welders, perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M, AWS D1.2/D1.2M and AWS D1.6/D1.6M. GRIND ALL BUTT WELDS FLUSH IN THE FINISHED INSTALLATION. Use procedures, materials, and equipment of the type required for the work.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

PART 2 PRODUCTS

2.1 MISCELLANEOUS METALS & STANDARD METAL ARTICLES

Conform to the respective specifications and other designated requirements for miscellaneous metal materials and standard metal articles. Sizes shall be as specified or shown. Where material requirements are not specified, furnish materials suitable for the intended use and subject to approval.



2.1.1 Structural Steel

ASTM A572/A572M, Grade 50.

2.1.2 Steel Plates

2.1.2.1 Structural

ASTM A572/A572M, Grade 50.

2.1.3 Steel Pipes

2.1.3.1 Posts and Rails

ASTM A53/A53M, Type S, Grade B, or ASTM A500/A500M Grade C, seamless galvanized, nominal size and weight class or outside diameter and nominal wall thickness as shown, plain ends.

2.1.4 Stainless Steel

2.1.4.1 Plate, Sheet, and Strip

ASTM A240/A240M, UNS S30403 or S31603. Plate finish shall be hot-rolled and annealed or heat treated, and blast cleaned or pickled. Provide No. 1 sheet and strip finish.

2.1.4.2 Bars and Shapes

ASTM A276, UNS S30403 or S31603 with a maximum carbon content of 0.08 percent, Condition A, hot-finished or cold-finished, Class C.

2.1.4.3 Roller Axle, Shaft, Pins

ASTM A276, UNS S20910, Condition A, cold-finished or hot-rolled and machine-finished to the tolerances specified in ASTM A484/A484M for cold-finished round bars, Class C.

2.1.4.4 Grease Fittings

Heavy-duty, push type, with built-in flush ball check. The stainless steel fittings shall be straight or 90 degree angle style as required by the installation.

2.1.4.5 Tubing and Fittings

Tubing shall be stainless steel, Type 304 or 316, ASTM A269, full finished welded or seamless drawn, annealed and pickled. Tube fittings shall be of stainless steel type 304 and shall be of the flareless type with SAE straight threads and Buna N or Viton O-ring seals. The fittings shall conform with SAE J514. Allowable Working Pressure rating shall be 4000 psi, minimum.

2.1.4.6 Pipe

ASTM A312/A312M, seamless, UNS S30400, NPS and schedule number or outside diameter and nominal wall thickness as shown.

#### 2.1.4.7 Sleeves and Shaft Collars

Sleeves and shaft collars shall be stainless steel, Type 316L, [ASTM A276](#), Condition A, cold finished and machine finished as shown on the drawings.

#### 2.1.5 Steel Machinery

##### 2.1.5.1 Sleeves and Shaft Collars

[ASTM A29/A29M](#), [ASTM A576](#) UNS G 10400 with a minimum tensile strength of 87,000 psi, yield strength of 52,500, and Brinell Hardness of 180.

##### 2.1.5.2 Rods, Rocker, Arm, Cam

[ASTM A322](#), [ASTM A752](#) UNS G 4140 with a minimum tensile strength of 98,000 psi, yield strength of 61,000 psi, and Brinell Hardness of 197.

##### 2.1.5.3 Pickup Beam Rollers

[ASTM A322](#) UNS G 43400 with a minimum tensile strength of 106,000 psi, yield strength of 85,500 psi and Brinell Hardness of 217.

#### 2.1.6 Aluminum

##### 2.1.6.1 Sheets and Plates

[ASTM B209](#), Alloy 6061, Temper T6.

##### 2.1.6.2 Bars, Rods and Wire

[ASTM B211](#), Alloy 6061, Temper T6.

##### 2.1.6.3 Structural Shapes

[ASTM B308/B308M](#), Alloy 6061, Temper T6.

##### 2.1.6.4 Pipes and Tubes

[ASTM B241/B241M](#), Alloy 6063, Temper T6, size and schedule number or outside diameter and wall thickness as shown.

#### 2.1.7 Aluminum Bronze Rods, Bars, Shapes and Bushings

##### 2.1.7.1 Bushings

[ASTM B148](#), Copper Alloy UNS No. C95400. [ASTM B505/B505M](#)

##### 2.1.7.2 Sleeve (SAE 660)

[ASTM B505/B505M](#). [ASTM B271](#), Copper Alloy UNS C93200.

#### 2.1.8 Ductile Iron Casting

[ASTM A536](#) Grade 80-55-06.

#### 2.1.9 Bolts, Nuts, and Washers

Bolts, nuts, and washers shall be of the material, grade, type, class, style and finish indicated or best suited for intended use.

2.1.9.1 High-Strength Bolts, Nuts, and Washers

- a. [ASTM A325](#), Type 1, hot-dip galvanized or [ASTM A490](#), Type 1.
- b. Meet the requirements of [RCSC S348](#) for Slip Critical Connections. Conduct Rotational-capacity testing for all fastener assemblies. Test as an assembly each combination of bolt production lot, nut lot, and washer lot. Assign a rotational-capacity lot number to each combination of lots tested. Test bolts in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device.

2.1.9.2 Bolts, Nuts, and Washers (Other Than High-Strength)

- a. Bolts and Nuts - [ASTM A307](#), Grade A, hot-dip galvanized or [ASTM A320/A320M](#), Ferritic Steel, Grade L73 Austenitic Steel, Class 2.
- b. Bolts - [ASME B18.2.1](#).
- c. Nuts - [ASME B18.2.2](#).
- d. Washers
  - (1) Plain Washers - [ASME B18.21.1](#), Type B.
  - (2) Lock Washer - [ASME B18.21.1](#).
  - (3) Beveled Washers - [ASTM F436](#), Type 1, Beveled.

2.1.10 Screws

Provide screws of the material, grade, type, style, and finish indicated or best suited for use intended.

2.1.10.1 Cap Screws

[ASME B18.2.1](#), [ASME B18.3](#), or [ASME B18.6.2](#) as required.

2.1.10.2 Machine Screws

[ASME B18.6.3](#).

2.1.10.3 Set Screws

[ASME B18.6.2](#).

2.1.11 Expansion Anchors

Type 304 or 316 stainless steel.

2.1.12 Safety Treads

Provide slip-on skid resistant treads made from aluminum alloy as best suited for the intended location.

2.1.13 Wire Rope

[FS RR-W-410](#), Type I, Class 2, Construction IWRC, 0.50 inch diameter with a minimum breaking strength of 22,800 pounds.

#### 2.1.14 Steel Rails

ASTM A1, ASCE 60 pound, as shown.

#### 2.1.15 Gratings

NAAMM MBG 531 and NAAMM MBG 531S.

a. Description of grating: W-19-4 (2 x 3/16) stainless steel 304L or 316L.

b. Anchorage: Grating shall be anchored to the support frame with removable fasteners.

c. Finish: stainless steel.

#### 2.1.16 Steel Floor Plate

ASTM A786/A786M, Pattern No. 5.

#### 2.1.17 Submittals Requirements

This applies to SHOP FABRICATED METAL ITEMS also. Submit the following:

a. Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Include in the drawings catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: slide/flap gate and actuator, manatee screen, gate recess armor, thimble, and bulkhead seal plates.

b. Lists of materials, and records which identify the disposition of approved material and fabricated items in the work.

c. Certified test reports for materials tests and analyses.

#### 2.1.18 Stainless Steel Studs

Studs shall be made from cold drawn bar stock conforming to ASTM A493 or ASTM A276. The following 300-series alloys may be used; 304L and 316L or the low carbon version thereof. Other Type 300 series alloys may be used with the approval of the Contracting Officer; however, Type 303 shall not be used. Where studs are to be cyclically loaded, they shall be tested and furnished in the annealed condition.

### 2.2 SHOP FABRICATED METAL ITEMS

Conform shop fabricated metal items to the requirements and details as specified or shown and to the workmanship provisions and other applicable fabrication requirements as specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.2.1 Railings

Provide railings as type specified and show, furnish, and install complete with all fittings, brackets, fasteners, sleeves, anchors, and other appurtenances as shown and as required for proper installation. Design handrails to resist a minimum concentrated load of 200 lbf in any direction

at any point of the top of the rail or 50 lb/ft applied horizontally to top of the rail, whichever is more severe.

#### 2.2.1.1 Materials

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A53/A53M, Grade B, Schedule 80; or ASTM A500/A500M, Grade B, minimum 0.200 inch wall thickness. Provide steel railings with 1-1/2 inch nominal size. Railings shall be hot-dip galvanized. Pipe collars shall be hot-dip galvanized steel. Provide all fasteners of Series 300 stainless steel.

#### 2.2.1.2 Fabrication

Rigid joints in railings shall be of welded assembly and be flush-finished. Reinforce welded joints with tight-fitting interior sleeves assembled by welding rails and posts to flush-type fittings, or by mitering and welding joining rails and posts. Provide stainless steel fasteners for steel fittings. Expansion joints in railings shall be an inner-sleeved slip-joint, with one end of the sleeve secured to one rail and the ends of the adjoining rails separated a minimum of 1 inch in the installed position. Locate expansion joints in rails near the intersection of rails and posts. Make bends in railings in a manner that railings are not crushed and maintain their original cross-sectional shape. Ground welds smooth. Provide railings free of burrs, sharp corners, and sharp edges. For railings of other than welded assembly, manufacturer design calculations, showing that the installed railings are capable of withstanding a design working load of 200 lbf applied in any direction at any point on the top rail without permanent deformation, shall be submitted and approved prior to installation.

#### 2.2.2 Gratings and Cover Plates

Provide grating and cover plates of the material and size shown, and fabricated in sectional panels of the width and length shown, or as appropriate, to accurately fit within the supporting recess frames. Provide openings through panels as shown or as required.

##### 2.2.2.1 Grating

Gratings are as specified in previous paragraph titled GRATINGS. Band edges of gratings and openings through gratings which require the cutting of more than one bearing bar. Provide fasteners of the type recommended by the manufacturer and approved. Provide nonslip nosing on stair tread gratings.

##### 2.2.2.2 Cover Plates

Provide cover plates as specified in paragraph titled STEEL FLOOR PLATE. Provide cover plate panels with holes for insertion of removal tool as shown. Remove sharp edges and burrs from plates.

#### 2.2.3 Steel Stairs

Provide steel stairs complete with structural or formed channel stringers, grating treads, slip-resistant metallic treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Close exposed ends of stringers and continue around landings which they support. Conform to ASTM A36/A36M for structural steel. Stairs and accessories

shall be galvanized after fabrication. Integral nosings shall have braces extended into the concrete fill. Fabricate stair treads and landings of steel gratings of the type specified in paragraph GRATING. Provide grating treads with slip-resistant nosings. Provide bolts, nuts and other fastenings as shown and as required for proper installation. Use lock washers under all nuts. Anchor railings of the type specified above in paragraph RAILINGS to stairs as shown.

#### 2.2.4 Recess Frames

Fabricate recess frames of structural shapes of the type shown. Grind welded joints in frames smooth. Anchor frames to supports in the manner shown and not be continuous across contraction or expansion joints.

#### 2.2.5 Ladders

Provide fixed-rail metal ladders conforming to the requirements of [EM 385-1-1](#) and to details shown. Fabricate ladders of aluminum as shown. Fabrication of ladders shall consist of solid-section rod rungs fitted into holes in bar side rails and welded. Make splices in side rails using full penetration welds and provide a flush and smooth transition between connecting ends. Grind all welds smooth. Weld ladder rails to bent-bar supporting brackets anchored to supporting structure as shown. The Contractor shall install a rigid rail fall protection system as shown.

#### 2.2.6 Ladder Rungs, Grab Bars, Safety Fall Arrest Anchors

Fabricate Ladder rungs, grab bars, and safety fall arrest anchors from stainless steel rods in accordance with [ASTM C955](#), Grade 75, Alloy S31653 or S31803.

#### 2.2.7 Surface Finishes

##### 2.2.7.1 Galvanizing and Zinc Repair

Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanize in accordance with [ASTM A123/A123M](#), [ASTM A653/A653M](#), or [ASTM A924/A924M](#), as applicable. Regalvanize areas where zinc coatings are destroyed by cutting, welding or other causes. Coatings **2 ounces** or heavier shall be regalvanized with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating. Repair coatings less than **2 ounces** in accordance with [ASTM A780/A780M](#).

##### 2.2.7.2 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

##### 2.2.7.3 Aluminum Surfaces

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces. Unexposed sheet, plate and extrusions may have mill finish as fabricated. Unless otherwise specified, provide all other aluminum items with standard mill finish.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, generally match in color and finish, and harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather to exclude water. Items listed below require additional procedures.

### 3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

### 3.3 FINISHES

#### 3.3.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to [SSPC Paint 20](#) or [SSPC Paint 29](#) to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with [ASTM D1187/D1187M](#), asphalt-base emulsion.

#### 3.3.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

### 3.4 ATTACHMENT OF HANDRAILS

Install railings as specified and shown. Railing posts anchored to concrete surfaces perpendicular to the posts shall be as shown. Railing posts anchored to structural metal shall be rigidly secured to flange fittings to structural metal. Rigidly secure ends of rails anchored to concrete or masonry to flange fittings anchored to concrete or masonry with expansion anchors. Install toeboards and brackets where indicated. Splices, where required, shall be made at expansion joints. Install removable sections as indicated.

#### 3.4.1 Installation of Steel Handrails

Perform installation by means shown. Secure rail ends by steel pipe flanges anchored by expansion shields and bolts.

### 3.5 COVER PLATES AND FRAMES

Install the tops of cover plates and frames flush with floor.

### 3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to masonry or concrete with not less than two 1/2 inch diameter expansion bolts. Install intermediate clip angles not over 48 inches on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete.

### 3.7 STEEL STAIRS

Provide anchor bolts, grating fasteners, washers, and all parts or devices necessary for proper installation. Provide lock washers under nuts.

### 3.8 INSTALLATION OF GUARD POSTS (BOLLARDS/PIPE GUARDS)

Set pipe guards vertically in concrete piers. Piers shall be constructed as shown.

-- End of Section --



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SECTION 08 11 13

STEEL DOORS AND FRAMES

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 WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2012; Errata 2011) Structural Welding  
Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A879/A879M (2012) Standard Specification for Steel  
Sheet, zinc Coated by the Electrolytic  
Process for Applications Requiring  
Designation of the Coating Mass on Each  
Surface

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A115 (2006) (Complete Set - Spec dates Vary)  
Specifications for Door and Frame  
Preparation for Hardware (Incl A115.1  
(1990), A115.2 (1987), A115.4 (1994),  
A115.5 (1992), A115.6 (1993), A115.12  
(1994), A115.13 (1991), A115.14 (1994),  
A115.15 (1994), A115.16 (1990), A115.17  
(1994), A115.18 (1994))

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 862 (2003) Guide Specifications for Commercial  
Security Hollow Metal Doors and Frames

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 111 (2009) Recommended Selection and Usage  
Guide for Standard Steel Doors, Frames and  
Accessories

SDI/DOOR A250.11 (2001) Recommended Erection Instructions  
for Steel Frames

SDI/DOOR A250.3 (2007; R 2011) Test Procedure and  
Acceptance Criteria for Factory Applied  
Finish Painted Steel Surfaces for Steel  
Doors and Frames

SDI/DOOR A250.6

(2003; R2009) Recommended Practice for  
Hardware Reinforcing on Standard Steel  
Doors and Frames

SDI/DOOR A250.8

(2003; R2008) Recommended Specifications  
for Standard Steel Doors and Frames

## 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 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Doors; G|RO

Frames; G|RO

Accessories

Weatherstripping

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors; G|RO

Schedule of frames; G|RO

Submit door and frame locations.

### SD-03 Product Data

Doors; G|RO

Frames; G|RO

Accessories

Weatherstripping

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI/DOOR A250.8 requirements.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and

wipe affected surfaces dry. Replace damaged materials with new.

## PART 2 PRODUCTS

### 2.1 COMMERCIAL SECURITY HOLLOW METAL DOORS

Provide **NAAMM HMMA 862**, Bullet resistant, forced entry, swing type door, security rating 4, of the size and design indicated. Provide security rating 4 for the control building door.

### 2.2 STANDARD STEEL **FRAMES**

**SDI/DOOR A250.8**, Level 4, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, unless otherwise indicated.

#### 2.2.1 Welded Frames

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

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, **AWS D1.1/D1.1M** and in accordance with the practice specified by the producer of the metal being welded.

#### 2.2.2 Anchors

##### 2.2.2.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than **7.5 feet** in height, provide one additional anchor for each jamb for each additional **2.5 feet** or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or **3/16 inch** diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;
- c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with **SDI/DOOR 111**; and

##### 2.2.2.2 Floor Anchors

Provide floor anchors drilled for **3/8 inch** anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

### 2.3 **WEATHERSTRIPPING**

As specified in Section **08 71 00 DOOR HARDWARE**.

#### 2.3.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory

slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08 71 00 DOOR HARDWARE. Insert gasket in groove after frame is finish painted.

## 2.4 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to BHMA A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames to receive a minimum of two rubber or vinyl door silencers on lock side of doors. Set lock strikes out to provide clearance for silencers.

## 2.5 FINISHES

### 2.5.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8.

### 2.5.2 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A879/A879M, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI/DOOR A250.8.

### 2.5.3 Factory-Applied Enamel Finish

Coatings shall meet test procedures and acceptance criteria in accordance with SDI/DOOR A250.3. After factory priming, apply two coats of medium-gloss enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements shall be in accordance with the coating manufacturer's recommendations. Color(s) of finish coat shall match approved color sample(s).

## 2.6 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable.

### 2.6.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Frames

Set frames in accordance with [SDI/DOOR A250.11](#). Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. Coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

##### 3.1.2 Doors

Hang doors in accordance with clearances specified in [SDI/DOOR A250.8](#). After erection and glazing, clean and adjust hardware.

#### 3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

#### 3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

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SECTION 08 71 00

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PART 3 EXECUTION

3.1 INSTALLATION

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3.1.1.1 Stop-Applied Weather Stripping

3.1.2 Soundproofing Installation

3.1.3 Threshold Installation

3.2 EXIT DOORS

3.3 HARDWARE LOCATIONS

3.4 KEY CABINET AND CONTROL SYSTEM

3.5 FIELD QUALITY CONTROL

3.6 HARDWARE SETS (BHMA AND STANDARDS)

-- End of Section Table of Contents --



SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E283 (2004; R 2012) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM F883 (2009) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.1 (2006) Butts and Hinges

BHMA A156.13 (2005) Mortise Locks & Latches, Series 1000

BHMA A156.15 (2011) Release Devices Closer Holder, Electromagnetic and Electromechanical

BHMA A156.16 (2002) Auxiliary Hardware

BHMA A156.18 (2006) Materials and Finishes

BHMA A156.21 (2006) Thresholds

BHMA A156.22 (2012) Door Gasketing and Edge Seal Systems

BHMA A156.4 (2000) Door Controls - Closers

BHMA A156.5 (2001) Auxiliary Locks & Associated Products

BHMA A156.6 (2005) Architectural Door Trim

BHMA A156.7 (2003) Template Hinge Dimensions

BHMA A156.8 (2005) Door Controls - Overhead Stops and Holders

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA 862 (2003) Guide Specifications for Commercial Security Hollow Metal Doors and Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2012; Amendment 1 2012) Life Safety Code

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2003; R2008) Recommended Specifications  
for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2012) Building Materials Directory

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL  
PROCEDURES.

SD-02 Shop Drawings

Hardware schedule; G, RO

Keying system

SD-03 Product Data

Hardware items; G, RO

SD-07 Certificates

Certificates

The Contractor shall certify in writing that the commercial  
security door manufactures has been consulted for specific  
hardware sets needed for Security Level 4, and that the  
recommended hardware sets have been installed in accordance with  
the manufacturer's recommended procedures.

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule items, Data Package 1; G, RO

Submit data package in accordance with Section 01 78 23 OPERATION  
AND MAINTENANCE DATA.

1.3 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hard- ware Item	Quan- tity	Size	Reference Publi- cation Type No.	Finish	Mfr. Name and Catalog No.	Key Con- trol Symbols	UL Mark (If fire rated and listed)	BHMA Finish Designa- tion
-----	-----	-----	-----	-----	-----	-----	-----	-----

#### 1.4 KEY BITTING CHART REQUIREMENTS

The Government will provide key bitting charts to the Contractor. The Contractor shall use the key bitting charts to fabricate cores and keys to be used by the Government upon completion of work.

#### 1.5 QUALITY ASSURANCE

##### 1.5.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, pivots, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

##### 1.5.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware subcontractor, using Agency and Agency Locksmith shall meet to discuss key requirements for the facility.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown in hardware schedule. Deliver permanent keys to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

### PART 2 PRODUCTS

#### 2.1 TEMPLATE HARDWARE

Provide hardware to be applied to metal or to prefinished doors manufactured to template. Promptly furnish template information or templates to door and frame manufacturers. Conform to [BHMA A156.7](#) for template hinges. Coordinate hardware items to prevent interference with other hardware.

#### 2.2 HARDWARE FOR EXIT DOORS

Provide all hardware necessary to meet the requirements of [NFPA 101](#) for exit doors, and [NAAMM HMMA 862](#) for security grade 4, as well as to other requirements indicated, even if such hardware is not specifically mentioned under paragraph entitled "Hardware Schedule." Provide the label of Underwriters Laboratories, Inc. for such hardware listed in [UL Bld Mat Dir](#) or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

#### 2.3 [HARDWARE ITEMS](#)

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the identifying mark will be visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

##### 2.3.1 Hinges

[BHMA A156.1](#), 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct

loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Other antifriction bearing hinges may be provided in lieu of ball-bearing hinges. Cam-lift hinges to be provided with acoustic door.

#### 2.3.1.1 Protection Devices

Provide full height hand and finger protection device at the hinge-side area opening of doors and gates. Hinge-side protection device shall be provided on both sides of the doors and gates, covering hinges and space between door and frame when doors are in the open position. The installed device shall push hand and/or fingers out of the opening and away from a crushing hazard.

#### 2.3.2 Pivots

BHMA A156.4.

#### 2.3.3 Locks and Latches

##### 2.3.3.1 Mortise Locks and Latches

BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2 at interior doors, except at closet and bathroom, and Grade 4 at exterior doors. Provide mortise locks with escutcheons not less than 7 by 2-1/4 inch with a bushing at least 1/4 inch long. Cut escutcheons to suit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Install knobs and roses of mortise locks with screwless shanks and no exposed screws.

##### 2.3.4 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Provide cylinders and cores with six pin tumblers. Provide cylinders from products of one manufacturer, and provide cores from the products of one manufacturer.

Provide cylinders for new locks, including locks provided under other sections of this specification. Provide fully compatible cylinders with products of the Best Lock Corporation with interchangeable cores which are removable by a special control key. Factory set the cores with six pin tumblers using the A2 system and F keyway. Submit a core code sheet with the cores. Provide master keyed cores in one system for this project. Provide construction interchangeable cores.

##### 2.3.5 Keying System

Provide a construction master keying system. Provide key cabinet as specified. Notify the Contracting Officer 90 days prior to the required delivery of the cylinders. Provide temporary cores and keys for the Contractor's use during construction, and for testing the locksets.

##### 2.3.6 Lock Trim

Cast, forged, or heavy wrought construction and commercial plain design.

##### 2.3.6.1 Lever Handles

Provide lever handles in lieu of knobs where indicated in paragraph

entitled "Hardware Schedule". Conform to the minimum requirements of BHMA A156.13 for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in BHMA A156.13 is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

#### 2.3.7 Keys

Furnish 2 keys per cylinder and 1 control key. Stamp each key with appropriate key control symbol and "U.S. property - Do not duplicate". Do not place room number on keys.

#### 2.3.8 Closers

BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers, and other features necessary for the particular application. Size closers in accordance with manufacturer's recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

#### 2.3.9 Overhead Holders

BHMA A156.8.

#### 2.3.10 Closer Holder-Release Devices

BHMA A156.15.

#### 2.3.11 Door Protection Plates

BHMA A156.6.

##### 2.3.11.1 Sizes of Armor, Mop and Kick Plates

2 inch less than door width for single doors; one inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors. Provide 6 inch mop plates. Height of armor plates shall be not less than 36 inches for flush doors.

#### 2.3.12 Door Stops and Silencers

BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

#### 2.3.13 Padlocks

ASTM F883.

#### 2.3.14 Thresholds

BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise. Provide aluminum threshold by door manufacturer at sounded rated doors.

#### 2.3.15 Weather Stripping Gasketing

BHMA A156.22. Provide the type and function designation where specified in

paragraph entitled "Hardware Schedule". Provide a set to include head and jamb seals, and sweep strips. Air leakage of weather stripped doors not to exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283. Provide weather stripping with one of the following:

#### 2.3.15.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide clear (natural) anodized aluminum.

#### 2.3.15.2 Spring Tension Type

Spring bronze or stainless steel not less than 0.008 inch thick.

#### 2.3.16 Rain Drips

Extruded aluminum, not less than 0.08 inch thick, clear anodized. Set drips in sealant and fasten with stainless steel screws.

##### 2.3.16.1 Door Rain Drips

Approximately 1-1/2 inch high by 5/8 inch projection. Align bottom with bottom edge of door.

##### 2.3.16.2 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection, with length equal to overall width of door frame. Align bottom with door frame rabbet.

#### 2.3.17 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, required to service and adjust hardware items.

#### 2.3.18 Soundproofing Gasketing

Compression seal at perimeter and bottom to be provided as part of door assembly. Entire door and seal to be sound rated, as noted, on the schedule.

### 2.4 FASTENERS

Provide fasteners of proper type, quality, size, quantity, and finish with hardware. Provide stainless steel or nonferrous metal fasteners that are exposed to weather. Provide fasteners of type necessary to accomplish a permanent installation.

### 2.5 FINISHES

BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint finish for surface door closers. Provide hinges for exterior doors in stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to

the doors.

## 2.6 KEY CABINET AND CONTROL SYSTEM

**BHMA A156.5**, Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

#### 3.1.1 Weather Stripping Installation

Handle and install weather stripping to prevent damage. Provide full contact, weather-tight seals. Operate doors without binding.

##### 3.1.1.1 Stop-Applied Weather Stripping

Fasten in place with color-matched sheet metal screws not more than **9 inch** on center after doors and frames have been finish painted.

#### 3.1.2 Soundproofing Installation

Install as specified for stop-applied weather stripping.

#### 3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws.

## 3.2 EXIT DOORS

Install hardware in accordance with **NFPA 101** for exit doors.

## 3.3 HARDWARE LOCATIONS

**SDI/DOOR A250.8**, unless indicated or specified otherwise.

- a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.
- b. Mop Plates: Bottom flush with bottom of door.

## 3.4 KEY CABINET AND CONTROL SYSTEM

Tag one set of file keys and one set of duplicate keys. Coordinate keying system with the South Florida Operations Office of USACE. Furnish complete instructions for setup and use of key control system.

### 3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, as directed, errors in cutting and fitting and damage to adjoining work.

### 3.6 HARDWARE SETS (BHMA AND STANDARDS)

#### HW-1 (Control Buildings)

1-1/2 Pair Hinges	A5111 x 630 x NRP
1 Lockset	F05 (classroom)
1 Closer	C02021
1 Kick Plate	J102 x 630
1 Threshold	Type 26 x insert
1 Set Weather Stripping	

#### Notes.

1. Lockset and cylinders: Corbin Russwin Mortise Locksets ML 2000 series or approved equal.
2. Overhead Door - No hardware required in this section.
3. Provide wall stops on all doors, as required. Provide chain stop at access doors.

-- End of Section --



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SECTION 08 91 00

METAL WALL LOUVERS

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  - 2.2.2 Bird Screens, Insect Screens, and Frames
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- 2.3 FASTENERS AND ACCESSORIES
- 2.4 FINISHES
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    - 2.4.1.1 Anodic Coating

PART 3 EXECUTION

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  - 3.1.1 Wall Louvers
  - 3.1.2 Screens and Frames
- 3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS
  - 3.2.1 Aluminum

-- End of Section Table of Contents --

SECTION 08 91 00

METAL WALL LOUVERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D (2012) Laboratory Methods of Testing  
Dampers for Rating

AMCA 511 (1999; R 2004) Certified Ratings Program  
for Air Control Devices

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (2003) Designation System for Aluminum  
Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (1998; R 2004) Voluntary Specification for  
Anodized Architectural Aluminum

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS (ASHRAE)

ASHRAE 74 (1988) Method of Measuring Solar-Optical  
Properties of Materials

ASHRAE 90.1 - IP (2010; Errata 1-3 2011; INT 1-12 2011;  
Addenda A, B, C, G, H, J, K, O, P, S, Y,  
Z, BZ, CG, CI and DS 2012; Errata 4-8  
2012; INT 13-16 2012; Errata 9-10 2013)  
Energy Standard for Buildings Except  
Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A 167 (1999; R 2009) Standard Specification for  
Stainless and Heat-Resisting  
Chromium-Nickel Steel Plate, Sheet, and  
Strip

ASTM A 366/A 366M (1997e1) Standard Specification for  
Commercial Steel, Sheet, Carbon, (0.15  
Maximum Percent Cold-Rolled

ASTM B 209 (2007) Standard Specification for Aluminum  
and Aluminum-Alloy Sheet and Plate

ASTM B 221

(2008) Standard Specification for Aluminum  
and Aluminum-Alloy Extruded Bars, Rods,  
Wire, Profiles, and Tubes

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 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall louvers

SD-03 Product Data

Metal Wall Louvers

SD-06 Test Reports

Test Data; G|DO

Provide test data that the louvers meet requirements of the Florida Building Code, Test Protocols for High Velocity Hurricane Zones.

SD-07 Certificates

Certification; G|DO

Provide certification that the louvers meet the requirements of AMCA 511; Florida Building Code Testing Application Standard (TAS)100A, 201, 202, 203 and comply with the AMCA certified ratings program.

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum Sheet

ASTM B 209, alloy 3003 or 5005 with temper as required for forming.

#### 2.1.2 Extruded Aluminum

ASTM B 221, alloy 6063-T5 or -T52.

#### 2.1.3 Stainless Steel

ASTM A 167, Type 302 or 304, with 2B finish.

#### 2.1.4 Cold Rolled Steel Sheet

ASTM A 366/A 366M, Class 1, with matte finish. Use for interior louvers only.

### 2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and insect screens, that are made to withstand a wind load of not less than 62 pounds per square foot. The louvers shall meet Florida Building Code Testing Application Standards, TAS 101A, TAS 201, TAS 202 and TAS 203. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. Blades may be mounted vertically or horizontally but shall be oriented consistently for a building. Louvers shall include manual dampers.

#### 2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch.

#### 2.2.2 Bird Screens, Insect Screens, and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. Provide fiberglass insect screens with an 18 x 16 mesh count or better, in accordance with ASHRAE 74, and a yarn diameter between 0.008 and 0.0107 meters. Mount screens in removable, rewirable frames of same material and finish as the louvers.

#### 2.2.3 Dampers

Where outdoor air supply and exhaust air dampers are required they shall have a maximum leakage rate when tested in accordance with AMCA 500-D as required by ASHRAE 90.1 - IP. Maximum damper leakage: 4 cfm/SF of damper area at 1.0 inch w.g. and 8 cfm/SF at 4.0 inch w.g.. Damper shall be 6063T5 aluminum with 0.125-inch wall thickness and 0.070-inch blade thickness, minimum. Blades shall be airfoil type, extruded aluminum (maximum 6" depth) with integral structural reinforcing tube running the full length of each blade. Blade edge seals shall be extruded, double-edge design with inflatable pocket which enables air pressure from either direction to assist in blade to blade seal-off. Blade seals shall be mechanically locked in extruded blade slots, yet, shall be easily replaceable in the field. Adhesive or clip-on type blade seals are not acceptable.

### 2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers. Provide other accessories as required for complete and proper installation.

## 2.4 FINISHES

### 2.4.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an anodic coating. Color shall be clear. Louvers shall have the same finish.

#### 2.4.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF-45 and AAMA 611. Finish shall be:

Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-A41, clear (natural) anodized.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

#### 3.1.2 Screens and Frames

Attach frames to louvers by slide in channels or with brackets/screws/bolts.

### 3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

#### 3.2.1 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

-- End of Section --

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SECTION 13 34 23

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-- End of Section Table of Contents --

SECTION 13 34 23

PRECAST CONCRETE BUILDINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318 (2011; Errata 2011; Errata 2012) Building Code Requirements for Structural Concrete and Commentary

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M (2012) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Change 2010; Change 2011; Errata 2011; Change 2011) Minimum Design Loads for Buildings and Other Structures

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 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop and Erection Drawings; G|DO

Submit shop and erection drawings for modular precast concrete control structures.

SD-03 Product Data

Manufacturer's Catalog Data

Provide for air conditioner, steel doors and frames, door hardware (include hardware schedule), threshold, weatherstripping, sealants, paint, and equipment manufacturer's catalog information. Include door frame modifications proposed by the Concrete building system manufacturer because of reduced wall thickness.

## SD-07 Certificates

### Qualifications

Qualifications of the manufacturer and qualifications and experience of the building erector.

### Design Certification

A letter of certification signed and sealed by a registered professional engineer licensed in Florida stating that the building system and components satisfy the requirements of the Florida Building Code.

### Plant Certification

Certificate showing the precast concrete manufacturing plan is certified by the National Precast Concrete Association's Plant Certification Program, prior to start of production.

## 1.3 GENERAL REQUIREMENTS

The precast concrete building system covered under this specification shall be provided by a single manufacturer and shall include all components and assemblies that form a building.

### 1.3.1 Building Configuration

Reinforced concrete vertical walls, floor, and single slope roof. Building shall be a manufacturer's advertised product, except that dimensions shall be not less than those indicated.

### 1.3.2 Manufacture

Manufacture building with a mechanism for assembly under tension at the factory. Assemble, caulk, and test building for watertightness at the plant. Caulk joints with a material selected by the manufacturer to maintain a permanent seal under severe weather and handling conditions. Leakage within one year of installation shall constitute proof of noncompliance with this specification, and shall be repaired by the Contractor at no additional expense to the Government.

### 1.3.3 Qualifications

#### 1.3.3.1 Manufacturer

Precast concrete building shall be the product of a recognized concrete building systems manufacturer who has been manufacturing concrete buildings for a period of not less than 5 years. The manufacturer shall be chiefly engaged in the practice of designing and precasting concrete building systems.

#### 1.3.3.2 Installer

Erector shall have specialized experience in the erection of prefabricated concrete building systems for a period of at least 3 years.



## 1.4 DESIGN REQUIREMENTS

### 1.4.1 Design Loadings

Structures, components, and foundation shall be designed so that their design strength equals or exceeds the effects of the factored loads in the load combinations shown in the latest version of [ASCE 7](#), Minimum Design Loads for Buildings and Other Structures. Other applicable structural design loads not listed here are part of the general notes on the structural drawings (Drawing Number S-01).

#### 1.4.1.1 Dead Loads

Building dead loads comprise the weight of all permanent construction, including walls, floor, roof/ceiling, and fixed service equipment.

#### 1.4.1.2 Floor Load

The floor shall be designed for a floor live load of 100 psf.

#### 1.4.1.3 Wind Load

Control Buildings shall be designed per [ASCE 7](#), basic wind speed of 150 mph, basic 3-second gust wind load, Exposure Category D, Building Classification Category II, Enclosure Classification Enclosed, Kzt equal to 1.5.

#### 1.4.1.4 Roof Live Load

Roof live load of 50 psf.

### 1.4.2 Codes and Standards

[ACI 318](#) and [ASCE 7](#).

### 1.4.3 Wall Openings

Design for wall openings as indicated on drawings.

## PART 2 PRODUCTS

### 2.1 PRECAST CONCRETE BUILDING MATERIALS

Concrete, reinforcing steel, post-tensioning strands, fasteners, anchors, flashing, and other parts necessary for a complete building system shall be the manufacturer's standard.

### 2.2 REINFORCING STEEL

Deformed bars of all sizes shall conform to [ASTM A615/A615M](#), Grade 60.

### 2.3 PRECAST CONCRETE BUILDING

The building shall be constructed of steel reinforced 5,000 psi concrete. The building shall be designed to meet the requirements of the latest version of [ASCE 7](#), [ACI 318](#), the Florida Building Code and these specifications. All joints shall be caulked with sealant has specified herein to maintain a permanent seal under severe weather and handling conditions. The panels shall be securely fastened with welded steel plates

and tensioned to manufacturer's specifications. Cast junction boxes and conduits into wall panels for electrical devices indicated on the drawings, including future card readers for door access control system and CCTV. Roof joints shall be sealed with EPDM membrane roofing strips of a thickness and width selected by the manufacturer for the application, be cemented to the concrete with a compound designed for that purpose, and be sloped to drain. The building shall be entirely assembled by the manufacturer at his plant, sealed, caulked, waterproofed and tested for watertightness. All joints shall be caulked. Concrete finishes shall be as specified in Section 03 35 00 CONCRETE FINISHING.

## 2.4 STEEL DOORS AND FRAMES

See Section 08 11 13 STEEL DOORS AND FRAMES.

### 2.4.1 Hardware

See Section 08 71 00 DOOR HARDWARE.

## 2.5 LOUVERS

See Section 08 91 00 METAL WALL LOUVERS.

# PART 3 EXECUTION

## 3.1 PRECAST CONCRETE BUILDING INSTALLATION

a. Prior to installation of structures, construct and level granular base as indicated. Set building level and complete final touch-up if necessary.

b. The precast concrete enclosure shall be delivered to the site in one piece. The floor slab of the enclosure shall not vary from level or true plane more than 1/4 inch in 10 feet, nor more than 1/2 inch from the elevation shown on the drawings.

c. All penetrations through the walls shall be either cast-in-place by the manufacturer or core-drilled in the field. Non-uniform wall penetrations by use of impact devices are not acceptable. Provide sealant around finished penetrations.

d. Manufacturer's representative shall be present at building's delivery and unloading. Set building to conform to manufacturer's recommendations and as indicated by manufacturer's representative.

e. Furnish stainless steel sheet metal, 18 gauge Type 304, strips over all sealant joints between precast concrete sections on the exterior of the shelter. Strips shall be a minimum of 3 inches wide, and be attached with corrosion resistant fasteners.

f. Install all below grade conduits and piping, extending to above finished floor grade. Control installation of conduits and piping such that the installed facilities will conform to openings in the modular precast units.

g. Conduits and pipes shall be installed plumb and watertight.

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SECTION 13 51 00

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SECTION 13 51 00

INSTRUMENTATION

PART 1 GENERAL

1.1 DESCRIPTION

This section covers furnishing and installation of thermistors to monitor temperatures of cast-in-place structural concrete following placement. Place thermistors at the locations shown on the drawings. Route thermistors signal cables vertically through the monolith using plastic riser pipes at the locations shown on the drawings. Route all cables to a location that provides easy and convenient access to obtain readings.

1.1.1 Settlement Monitoring

This section also covers installation of survey markers for concrete, and monitoring settlement as indicated herein. One of each marker shall be placed at each headwall, wingwall, and culvert monolith. For the culvert monoliths, markers shall be placed on the interior, bottom slab. For the other project structural features, each marker shall be placed on the top of the wall footing, on the exterior side of the wall, at such point where it will not be covered by fill material, or at such location that if it is to be covered or backfill, the marker can be transferred to a point along the wall where it can be monitored throughout the life of the construction and until the project is accepted by the Government.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section 03 31 01 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS STRUCTURES.

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Survey Marker Placement and Settlement Monitoring Plan; G, DO

At least 21 calendar days prior to installation, submit a detailed plan (drawing) of all the numbered locations where concrete embedded survey markers for settlement monitoring will be installed along each construction monolith. Include type and size of markers. Submit form to be filled out for recording of measurements, as discussed under paragraph "DATA COLLECTION AND REPORTING".

SD-03 Product Data

Instrumentation Pre-Installation Form; G, RO

The pre-installation form shall contain the following:

- a. Gage type and model number;
- b. Project gage number;
- c. Manufacturer's serial number;
- d. Manufacturer's name;
- e. Date tested and calibrated by the manufacturer (with the manufacturer's test form and certification of test equipment attached);
- f. Date received at the project site;
- g. Person who received the gage;
- h. Verification of no apparent damage in shipping;
- i. Verification of proper lead wire type and length;
- j. Date of pre-installation testing;
- k. Measurements made during the pre-installation testing;
- l. As-Built gage location; and
- m. Signature of the person who performed the pre-installation testing.

Survey Markers; G, DO

Submit survey marker details at least 21 calendar days prior to installation. Survey markers shall be made of a corrosion resisting metal and be suited for concrete embedment. The marker shall embed at least 1 inch, and its top disk shall be from 1 inch to 1-1/4 inches in diameter.

SD-06 Test Reports

Instrumentation Installation Form; G, RO

Prepare and submit an installation form for each thermistor installation within two (2) calendar days after it is installed. The installation form shall include:

- a. Gage type and model number;
- b. Project gage number;
- c. Serial number of thermistors installed;
- d. Date and time of installation;
- e. Sketch identifying which monolith and location within monolith;
- f. Conditions encountered during the installation;
- g. Results of testing conducted during installation; and
- h. Signature of person in charge of installation and testing.

Settlement Monitoring Readings; G, DO

Submit these readings weekly as indicated in paragraph DATA COLLECTION AND REPORTING below.

Thermistor Data; G, DO

Submit readings weekly as (or 72 hours prior to placing concrete for an adjacent conduit monolith) as indicated in paragraph DATA COLLECTION AND REPORTING below.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals for all equipment (five copies each); G, DO

After all installations are complete and the instrumentation is in its final configuration, an operation and maintenance manual shall be submitted to the Government. This report shall document all operation and maintenance activities, including malfunctions, damages, replacements, etc. Manufacturer instructions and schedules shall be provided for the testing, maintenance, and monitoring of all sensors. The report shall be cumulative to include all records to date.

#### Manufacturer's Warranty

The Contractor shall provide to the Government the manufacturer's warranty for each instrument and readout unit within seven calendar days of receipt of the equipment.

#### SD-11 Closeout Submittals

##### As-Built Drawings; G, DO

Following installation of the instruments, submit As-Built Drawings showing the exact installed location, the instrument identification number, the instrument type, and the installation date and time. Include details of installed instruments, instrument calibrations, accessories, and protective measures including all dimensions and materials used. Amend project drawings during construction to reflect changes in instrumentation installations. A pre-installation and an installation form are required.

##### As-Built Drawings for Settlement Monitoring Survey Markers; G, DO

Following installation of the last survey marker, submit As-Built Drawings showing the exact installed location, the marker identification number, the marker type and details, and the installation date and time, and original and final installation location if bolt/anchor had to be relocated. As-Built Drawings shall include the first and last reading taken for each of the anchors or bolts.

#### 1.4 QUALITY ASSURANCE

a. Instrumentation equipment and computer interface systems are to be standard products of a manufacturer who has been regularly engaged in successful production of high quality equipment and systems of the types specified for at least 10 years. The instrumentation proposed to be furnished shall be equipment that has been a product of the manufacturer for at least two years of the ten-year period. The manufacturer shall have at least three similar system installations in successful operation for at least two years. The Government reserves the right to reject any manufacturer deemed to be insufficiently qualified.

b. The Contractor shall employ an Instrumentation Specialist for the duration of the contract. The Instrumentation Specialist shall be a registered professional engineer having at least 5 years of experience

in installing similar instrumentation systems and shall have at least three similar system installations in successful operation. Persons not meeting the registered professional engineer requirements will be considered on the basis of extensive experience and technical knowledge as demonstrated by resumes, personal interviews, and if that person is directly supervised by a professional engineer. The Government reserves the right to reject any Instrumentation Specialist deemed to be insufficiently qualified. The Instrumentation Specialist shall be onsite during all instrumentation work.

c. Following codes and standards apply for all aspects of the instrumentation:

- (1) IEEE - Institute of Electrical and Electronic Engineers
- (2) ISA - Instrument Society of American Standards
- (3) ANSI - American National Standards Institute
- (4) AWWA - American Water Works Association Standards
- (5) OSHA - Occupational Safety and Health Act
- (6) NEC - National Electric Code
- (7) UL - Underwriters Laboratories
- (8) EM 1110-2-4300 - Instrumentation for Concrete Structures

## PART 2 PRODUCTS

### 2.1 MATERIALS

Materials shall conform to the requirements indicated on the Drawings or referred to herein, and, when not covered thereby, materials and equipment of commercial grade quality suited to the intended use and as approved by the Government shall be furnished.

### 2.2 EQUIPMENT

a. Where model numbers are given in this section, they shall be understood to represent models selected on the basis of past factory specifications and project experience demonstrating that the equipment, including stipulations herein, will meet the performance objectives of this Work. Verify with any selected manufacturer that the designated model, or the updated version, meets the design performance outlined by these drawings and specifications.

b. The term "or equivalent" in this section shall be understood to indicate that the "equivalent" product is the same or better than the product named in this section in function, performance, reliability, quality, and general configuration. Whenever any product is indicated or specified by proprietary name, by name of manufacturer, or by catalog number, such specification shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the product required. The Contractor may submit complete comparative data to the Contracting Officer for consideration of another product that shall be substantially equal in every respect to that so indicated or specified. Alternative products shall not be used unless approved by the Contracting Officer in writing. The Contracting Officer will be the sole judge of the alternative product.

c. All gradations shall be U.S. Customary Units (e.g. feet, inches, pounds, pounds per square inch, and degrees Fahrenheit).

d. The Contractor shall furnish all installation tools, materials, and

miscellaneous instrumentation components required to accomplish the work except where noted within these Specifications.

e. Thermistors - Thermistors shall have a standard range of -50 to 150 degree C (-58 to 302 degree F) with a sensitivity of 0.1 degree C and accuracy of +/- 0.2 degree C as manufactured by Geokon (Model No. 3800-1-2, 3800-2-2, or equivalent). For equivalent product, salient features include temperature range and accuracy. Furnish signal cables recommended by thermistors manufacturer and order cable that is factory-connected to the thermistors in one continuous length. All signal cable shall be marked and properly identified at 20-foot intervals.

f. A barometer and thermometer shall be furnished and installed at each culvert site, at a location to be determined by the Contracting Officer, for the entire duration that thermistors readings are taken. The barometer shall be a Met One of Grants Pass, Oregon, Model 092, or equal. The barometer shall be contained in weatherproof enclosure and equal product shall meet the following salient features: Range 17.72 to 32.48 inch/hg, resolution 0.1 hPa, temperature operating and compensation ranges -40 degrees F to 131 degrees F, accuracy to +/-0.35 hPa @ 68 degrees F and +/- 1.0 hPa over full range or +/- 0.5 hPa over any 200 hPa range. The thermometer shall be a Met One of Grants Pass, Oregon, Model 060A-2, or equal. Equal product shall be a general purpose thermometer for ambient air temperature measurement with the following salient features: Temperature range of -58 degrees F to 122 degrees F and an accuracy of +/-0.18 degrees F.

## 2.3 FABRICATION

Factory-calibration curves are required for each thermistors, including individual gage factor, temperature correction factor, and barometric pressure at time of calibration.

## 2.4 MAINTENANCE

a. For the duration of concreting operation, until the last concrete placement has reached design strength and concrete has cooled to ambient temperature, maintain all instrumentation installations in progress and all completed instrumentation installations. Protect all instruments from lightning induced surges during construction. Immediately repair or replace any major damage to installations in progress, or installations completed.

b. Maintain all electronic instrumentation equipment and materials prior to installation within weather tight, ventilated structures.

## PART 3 EXECUTION

### 3.1 EXAMINATION

When instruments are received at the site, the Contractor shall perform the following quality control checks:

- a. Examine and verify completeness of factory calibration curves and tabulated data;
- b. Examine manufacturer's final quality control inspection checklist;



- c. Check cable length;
- d. Check tag numbers and serial numbers on instrument and cable;
- e. Check, by comparing with procurement document, that model, dimensions, materials, etc., are correct;
- f. Verify that all components fit together in the correct configuration;
- g. Check all components for signs of damage in transit; and
- h. Check that quantities received correspond to quantities ordered.

An instrument that fails the specified pre-installation test shall be repaired such that it passes a subsequent pre-installation test, or shall be replaced by an identical instrument.

### 3.2 PREPARATION

#### 3.2.1 Protection

Protect existing structures and facilities during the installation process.

#### 3.2.2 Verification

Verify that all thermistors have been located properly and are in operating condition before concrete placement. Similarly, verify that all settlement monitoring survey markers have been properly located.

### 3.3 INSTALLATION

The Contractor shall be responsible for providing the thermistors, cables, and manual readout devices. The thermistors shall be installed as shown on the drawings. Protect all thermistors from lightning-induced surges during installation. Protect all thermistors during concrete placement and consolidation. Operation and field calibration checks of all instruments shall be performed. Install thermistors following the manufacturer's recommended procedures. The Contractor shall also be responsible for providing all settlement monitoring survey markers and tools necessary for their installation.

### 3.4 DATA COLLECTION AND REPORTING

#### 3.4.1 Thermistors

Manual readings - Readings shall be taken twice daily for the duration of concreting operations, until the last concrete placement has reached design strength and concrete has cooled to ambient temperature. Readings should be taken during the coolest part of the workday and the hottest part of the workday. Data collected manually shall include the following:

- a. Instrument ID (Gage number);
- b. Instrument type;
- c. Date and time;
- d. Observer;
- e. Readout unit number;
- f. Readings;
- g. Remarks;

- h. Visual Observations, if any; and
- i. Pertinent data, including weather, ambient temperature, humidity, barometric pressure, and construction activities.

The Contractor shall reduce, process, plot, and report data. A data report, as specified herein shall be provided to the Contracting Officer. The data report shall be bound, indexed, and shall include:

- a. A section for each monolith.
- b. A brief description of the changes in readings.
- c. A brief description of the cumulative changes in instrument readings.
- d. Raw and reduced data collected during the week.

Plots of data (concrete temperature and ambient temperature) versus time. All events that could influence changes in the data shall be indicated.

The Contractor shall evaluate the data. Evaluation shall include making correlations between instrumentation data and specific events. Instrumentation data shall be evaluated to determine whether the instrumentation response to events is reasonable.

#### 3.4.2 Settlement Monitoring

Readings shall be taken once a week. For the headwalls and wingwall monoliths, readings shall be taken beginning once the forms are stripped and forming of the vertical components of the walls has commenced. Readings shall be taken until such time when the cofferdams have been removed. For the culvert monoliths, readings shall be taken beginning once the walls have been cast, but culvert roof or top slab has not yet been poured. Readings shall be taken until such time when water flow within the culvert has reinstated or access to the culvert's interior is no longer available.

Report all readings on a weekly basis, within 48 hours after taken, depicting the last and all previous readings in tabular or spreadsheet form. In addition, for each monolith or marker, present data in graphical form, showing elevation readings on the y-axis and date on the x-axis. The weekly report shall also show diagram(s) of survey marker locations. Readings shall include elevation measurements, to the closest 1/100th of a foot, of both top of markers at each of the monoliths, as well as the fill placed, and shall be certified by a registered Professional Surveyor. Data collected manually shall include the following:

- a. Instrument ID;
- b. Instrument type;
- c. Date and time;
- d. Observer;
- e. Readings. In the case of the walls, report the height of fill behind (retained by) the walls. In the case of the culvert, report the height of embankment fill above the top of the culvert;
- f. Remarks. Include remarks developments in monoliths immediately adjacent to the one in question, elevations before and after relocation, if such is done, etc.;
- g. Visual observations, if any; and
- h. Pertinent data, including weather, ambient temperature, humidity, barometric pressure, and construction activities, if not already described under remarks.

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SECTION 25 31 01

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SECTION 25 31 01

STRUCTURE REMOTE TERMINAL UNIT (RTU), SUTRON

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

This section specifies requirements for a remote terminal unit (RTU), Sutron, used for monitoring of a gated structure. The RTU panel is modular in design and includes power supply, battery, processor, I/O cards, relays, surge arrestors, ethernet switch, fiber optic converters, ethernet radios, satellite transmitter, and other components as shown on the drawings and as specified herein. The Contractor shall be responsible for functionally testing the RTU cabinet as detailed herein.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

UNDERWRITERS LABORATORIES (UL)

UL 508

(1999; Reprint Apr 2010) Industrial  
Control Equipment

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Layout and Shop Drawings; G, DO

Prior to installation, submit layout and shop drawings including the following:

- a. RTU cabinet layout, including fully dimensioned and detailed views and internal layout.
- b. Electrical schematics, including, but not limited to block diagrams, ladder diagrams, DC panel wiring and instrument wiring, and surge suppression devices.
- c. Layout of relays, breakers, switches and instrumentation provided, and applicable single line and wiring diagrams.

SD-03 Product Data

Catalog Data; G, DO

Prior to installation, submit manufacturer's standard catalog data, including a description and depiction of all control devices and instruments in sufficient detail to demonstrate complete specification compliance. If standard catalog data does not contain sufficient detail to verify compliance, then the Contractor shall submit supplementary documentation to verify compliance.

#### Spare Equipment and Parts Data

Submit spare equipment and parts data with each item to be furnished as indicated in paragraph SPARE EQUIPMENT AND PARTS below.

#### SD-07 Certificates

##### Manufacturer's Representative Qualifications; G, DO

Submit qualifications as indicated in paragraph INSTRUMENT CONTRACTOR PANEL BUILDER QUALIFICATIONS below.

#### SD-10 Operation and Maintenance Data

##### Operating Manuals; G, DO

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

#### 1.4 FABRICATOR QUALIFICATIONS

Panel fabrications shall be by a manufacturer or particular division of a manufacturing firm specializing in control panel construction. Fabricator shall have a UL certified shop, and all panels shall be built according to UL 508.

#### 1.5 SPARE EQUIPMENT AND PARTS

Furnish the following spare equipment and parts, tagged and boxed:

- a. One of each type of camera.
- b. One of the network security devices.
- c. One of the broadband routers.
- d. One network radio.
- e. One antenna.
- f. One RTU.

#### PART 2 PRODUCTS

##### 2.1 RTU CABINET

The RTU as detailed on the drawings and as described herein shall consist of devices and instrumentation to provide monitoring of a gated structure. The Contractor shall construct the Remote Terminal Unit and cabinet as shown and as detailed on the drawings. The Project I/O List shown on the drawings shall summarize the digital inputs, digital outputs, and analog inputs for the RTU. Prior to procurement, the Contractor shall submit any deviation from the specified components and Project I/O List for approval by the Government.

## 2.2 RTU PROGRAMMING

The Contractor shall be responsible to furnish and install standard manufacturer programs into the new RTU to functionally test each input and output as detailed in paragraph FIELD TESTS below. Following the successful initial functional test of the RTU's I/O, the Contractor shall schedule with the Contracting Officer a second functional test witnessed by the Contracting Officer.

## 2.3 INCLINOMETER

The inclinometer shall be Applied Geomechanics, Model number A906-ST-B, or approved equal. The inclinometer shall be used for determining whether the flap gates are out of vertical axis and for monitoring gate positioning. Inclinometer shall be compatible with the Sutron RTU. The inclinometer shall have reverse polarity protected power of +8 to +24 VDC and shall have an operation range of no less than +/- 30 degrees. The inclinometer shall be capable of operating in a humid environment with a temperature range of 0 degrees to +150 degrees F. The inclinometer shall be capable of being submersed to 72 psi. See drawings for inclinometer installation.

## 2.4 CABLE REEL ENCLOSURE

The cable reel enclosure assembly shall comprise a NEMA 4X, 20-inch by 20-inch by 8-inch enclosure and a spring driven cable reel with bottom wind direction and a constant tension device. The enclosure shall be provided without a latch pawl. The spring driven cable reel shall be capable of holding thirty feet of 3/8 inch flexible conduit.

## 2.5 CAMERAS

### 2.5.1 Stationary

Stationary cameras shall be weatherproof IP network cameras with a minimum of three megapixel resolution in color mode. The cameras shall include two telephoto lenses with a color or black-and-white sensor for use around the clock. Depending on the lighting conditions, the camera automatically switches between the color sensor with the daylight lens and the more light-sensitive black-and-white lens. The cameras shall be capable of alarm notification via email or ftp, internal DVR capable, include internal microphone and speaker, live recording capable, include web interface for viewing, virtual PTZ, capable of motion detection alarming via ftp, email and visual LEDs located on the cameras, and multilevel password protection. All configuration and remote viewing software shall be included. The cameras shall be Mobotix Allaround Dual M15 or approved equal. The cameras shall be installed on camera poles using manufacturer's recommended mounting hardware, and adjusted to cover the entire upstream and downstream areas for gate operations. The cameras shall include all necessary accessories as described on the drawings.

### 2.5.2 Movable

Movable camera shall be IP network pan/tilt/zoom (PTZ) camera that shall include autofocus, high-resolution integrated camera/optics packages. The camera shall include day/night, minimum 540 TVL, motion detection with image enhancement, and shall be weatherproof, with web interface for viewing and configuration, multilevel password protection, and contain onscreen compass and tilt display. The camera shall be Pelco Spectra model

IV SE or approved equal. The camera shall be installed below the stationary camera on the lakeside pole using manufacturer's recommended arm mount with protective cage facing the structure area. The camera shall include all necessary accessories as described on the drawings.

## 2.6 NETWORK SECURITY DEVICE

Provide a secure Unified Threat Management (UTM) firewall. The unit shall provide effective anti-malware, intrusion prevention, and content/URL filtering along with mobile platform support. The unit shall be network capable with a built-in web configuration tool backup network. The unit shall be a Dell Sonicwall TZ 215 or approved equal.

## 2.7 BROADBAND ROUTER

The unit shall provide wired Ethernet and 3G/4G wireless WAN connectivity. The unit shall be capable of being connected to an AT&T 3G/4G air card and shall include (or be capable of including) a minimum of eight ports. The router shall be capable of day-in, day-out 24/7 internet connectivity. LAN connections shall be protected with advanced WiFi encryption, LAN segmentation, and VLAN capabilities. Office access and POS transactions shall be protected by VPN capability and other security features to ensure the network stays secure. The broadband router shall be CradlePoint MBR 1400 or approved equal.

# PART 3 EXECUTION

## 3.1 GENERAL

The Contractor shall furnish and install all cable, wiring, and conduit as required and as specified in the drawings and herein to power and monitor the RTU installation.

## 3.2 FIELD TESTS

Upon the completion of the RTU cabinet installation, the Contractor shall procure the services of an authorized RTU Manufacturers Representative to functionally test the RTU cabinet and Sutron.

### 3.2.1 RTU Cabinet Site Validation Testing

As a minimum, RTU testing shall include the following:

- a. Using manufacturer's standard program, simulate each discrete input and each analog input from the signal device back to the RTU cabinet. With the RTU energized, show to the Contracting Officer that the RTU's processor received the input signal.
- b. Using manufacturer's program, simulate each discrete output from the RTU to the end device.

The Contractor shall develop a Validation Report Checklist for each site and use it to record the test results.

### 3.2.2 Standing Wave Ratio Testing

The standing wave ratio (SWR) of the radio antenna systems shall be tested using the following procedure:



- a. Purpose. The purpose of this procedure is to describe how to properly measure the transmitter power output of the radio and subsequently, the reflected power back to the radio. The following steps are based on the use of a Bird Electronic Corp. model 43 Wattmeter with the appropriate Thruline elements of "slugs".
- b. Items Needed. The items needed for implementing this procedure are a Bird 43 Wattmeter and slugs with a power range and frequency range suitable for each antenna.
- c. Typical Procedure:
  - (1) Connect the Wattmeter in series with the radio and the PolyPhaser. The Contractor may need assorted RF Connectors and Patch Cable to connect Wattmeter in series.
  - (2) Power Output - Forward Power. On the Wattmeter, turn the slug so that the arrow is pointed away from the radio and toward the antenna. Key the RTU radio. Record the value in the SIM Site Worksheet 2. If the power output is out of specification, replace with a new/tested Radio, then go to Reflected Power.
  - (3) Reflected Power. Turn the slug in the opposite direction. It should be facing toward the radio to measure reflected power from the antenna. Key the RTU radio and read the Wattmeter. Record the value in the Validation Report Checklist. STOP if reflected power is out of specification, Troubleshoot RF Transmission Line, PolyPhaser, Antenna, and Connectors for any possible defect. Reflected power should ideally be 0 Watts reflected or less than 10% of transmitter power output.

### 3.2.3 RTU Radio Communications Validation Testing

As a minimum, RTU radio communications testing shall include the following:

- a. Using radio service utility program, verify that the radio has been programmed with the correct technical/operational parameters and radio frequencies.
- b. Working with the USACE technical personnel, perform RF signal level optimization for the radios and install RF attenuators if instructed by USACE personnel.
- c. Verify that the RTU is communicating to the District SCADA network.

The Contractor shall develop a Radio Validation Report Checklist for each radio and use it to record the test results.

### 3.2.4 Camera Testing

The operation of the cameras shall be demonstrated under both daylight and nighttime conditions. The Contractor shall make any necessary adjustments to the cameras to provide the camera views necessary for the safe operation of the structure. The Contractor shall provide any equipment necessary to demonstrate the proper operation of the cameras.

### 3.3 INSTRUMENT CONTRACTOR PANEL BUILDER QUALIFICATIONS

The RTU Instrument Contractor Panel Builder shall be knowledgeable on all

aspects of the RTU system, including the initial testing, startup, programming, and integration of the system. The Contractor shall supply the services of a qualified Manufacturer's Representative, and shall submit their qualifications for Government review.

#### 3.4 INSTRUMENT CONTRACT PANEL BUILDER AVAILABILITY

In addition to the time required by the RTU Instrument Contractor Panel Builder for the specified checkout and startup of the RTU installation, furnish his services for minimum of two site visits with a total of 20 on site man-hours to assist the Government with the programming and the integration of the RTU systems and/or conducting on site training. The Government's use of the RTU Instrument Contractor Panel Builder shall be at the discretion of the Contracting Officer upon 48 hours prior notification to the Contractor. The Instrument Contractor Panel Builder shall be furnished at no additional cost to the Government including travel time, plane ticket costs, room and board, overtime premium, and other costs.

#### 3.5 WARRANTY

The RTU Panel and all panel devices supplied under this section shall be warranted for a period of one (1) year by the equipment manufacturer. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit restored within 72 hours at no expense to the Government. The warranty shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment. The warranty period shall commence on the Contractor's final completion date. Manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

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SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

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 C12.7 (2005) Requirements for Watthour Meter  
Sockets

ASTM INTERNATIONAL (ASTM)

ASTM B1 (2012) Standard Specification for  
Hard-Drawn Copper Wire

ASTM B8 (2011) Standard Specification for  
Concentric-Lay-Stranded Copper Conductors,  
Hard, Medium-Hard, or Soft

ASTM D709 (2001; R 2007) Laminated Thermosetting  
Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2012; Errata 2012; INT 1-4 2012) National  
Electrical Safety Code

IEEE Std 100 (2000) The Authoritative Dictionary of  
IEEE Standards Terms

IEEE Std 81 (1983) Guide for Measuring Earth  
Resistivity, Ground Impedance, and Earth  
Surface Potentials of a Ground System  
(Part 1) Normal Measurements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment  
(1000 Volts Maximum)

NEMA C80.1 (2005) Standard for Electrical Rigid Steel  
Conduit (ERSC)

NEMA FU 1 (2002; R 2007) Low Voltage Cartridge Fuses

NEMA ICS 1 (2000; R 2008; E 2010) Standard for  
Industrial Control and Systems: General  
Requirements

NEMA ICS 2	(2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2010) Terminal Blocks
NEMA ICS 6	(1993; R 2011) Enclosures
NEMA KS 1	(2001; R 2006) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA MG 1	(2011; Errata 2012) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA RN 1	(2005) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2004) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA WD 1	(1999; R 2005; R 2010) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2002; R 2008) Wiring Devices Dimensions Specifications
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2014) National Electrical Code
NFPA 70E	(2015) Standard for Electrical Safety in the Workplace
TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)	
TIA J-STD-607-A	(2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)
UNDERWRITERS LABORATORIES (UL)	
UL 1063	(2006; Reprint Jul 2012) Machine-Tool Wires and Cables

UL 1449	(2006; Reprint Jul 2012) Surge Protective Devices
UL 1660	(2004; Reprint Apr 2008) Liquid-Tight Flexible Nonmetallic Conduit
UL 198M	(2003; Reprint Feb 2013) Standard for Mine-Duty Fuses
UL 20	(2010; Reprint Feb 2012) General-Use Snap Switches
UL 360	(2013) Liquid-Tight Flexible Steel Conduit
UL 44	(2010) Thermoset-Insulated Wires and Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2013) Wire Connectors
UL 486C	(2013) Splicing Wire Connectors
UL 489	(2013) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(2012; Reprint Nov 2012) Attachment Plugs and Receptacles
UL 50	(2007; Reprint Apr 2012) Enclosures for Electrical Equipment, Non-environmental Considerations
UL 508	(1999; Reprint Apr 2010) Industrial Control Equipment
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 512	(1993; R 1993 thru 2008) Standard for Fuseholders
UL 514A	(2013) Metallic Outlet Boxes
UL 514B	(2012) Conduit, Tubing and Cable Fittings
UL 514C	(1996; Reprint May 2011) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 651	(2011; Reprint Mar 2012) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings



UL 67	(2009; Reprint Jan 2013) Standard for Panelboards
UL 83	(2008) Thermoplastic-Insulated Wires and Cables
UL 869A	(2006) Reference Standard for Service Equipment
UL 870	(2008; Reprint Feb 2013) Standard for Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2006; Reprint Jun 2012) Ground-Fault Circuit-Interrupters
UL 984	(1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors

## 1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

## 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 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

#### Panelboards; G|DO

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

#### Wireways; G|DO

#### Marking Strips; G|DO

### SD-03 Product Data

#### Receptacles; G|DO

#### Circuit breakers; G|DO

#### Switches; G|DO

Motor controllers; G|DO

Meter base only; G|DO

Surge protective devices; G|DO

Submittals shall include performance and characteristic curves.

#### SD-06 Test Reports

Grounding system test; G|DO

Ground-fault receptacle test; G|DO

#### SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5; G|DO

Submit operation and maintenance data in accordance with Section  
01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein.

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

#### 1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

#### 1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

### 1.5 MAINTENANCE

#### 1.5.1 Electrical Systems

Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. This shall include:

- a. Single line diagram of the "as-built" building electrical system.
- b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).
- c. Manufacturers' operating and maintenance manuals on active electrical equipment.

### 1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

### 2.2 CONDUIT AND FITTINGS

Shall conform to the following:

#### 2.2.1 Rigid Metallic Conduit

##### 2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

NEMA C80.1, UL 6.

##### 2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2, UL 651.

##### 2.2.3 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

##### 2.2.4 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

## 2.2.5 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

### 2.2.5.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

## 2.2.6 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

## 2.2.7 Liquid-Tight Flexible Nonmetallic Conduit

UL 1660.

## 2.3 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

## 2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

## 2.5 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

### 2.5.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and capacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

#### 2.5.1.1 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

#### 2.5.1.2 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a

circuit, including junctions.

#### 2.5.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

- a. 208/120 volt, three-phase
  - (1) Phase A - black
  - (2) Phase B - red
  - (3) Phase C - blue
- b. 480/277 volt, three-phase
  - (1) Phase A - brown
  - (2) Phase B - orange
  - (3) Phase C - yellow
- c. 120/240 volt, single phase: Black and red

#### 2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type XHHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

#### 2.5.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

#### 2.6 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

#### 2.7 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Plates on finished walls shall be satin finish stainless steel or brushed-finish aluminum, minimum 0.03 inch thick. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

## 2.8 SWITCHES

### 2.8.1 Toggle Switches

**NEMA WD 1, UL 20**, single pole and double pole totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Handles shall be ivory thermoplastic. Wiring terminals shall be screw-type, side-wired or of the solderless pressure type having suitable conductor-release arrangement. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

### 2.8.2 Disconnect Switches

**NEMA KS 1**. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 1 or 4x, enclosure as indicated per **NEMA ICS 6**.

## 2.9 FUSES

**NEMA FU 1**. Provide complete set of fuses for each fusible switch. Time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

### 2.9.1 Fuseholders

Provide in accordance with **UL 512**.

### 2.9.2 Cartridge Fuses, Current Limiting Type (Class T)

**UL 198M**, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

## 2.10 RECEPTACLES

**UL 498**, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of ivory as per **NEMA WD 1**. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per **NEMA WD 6**. Provide screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement. Connect grounding pole to mounting strap. The receptacle shall contain triple-wipe power contacts and double or triple-wipe ground contacts.

### 2.10.1 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Receptacle shall be UL listed for use in "wet locations with plug in use."

## 2.10.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFCI devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

## 2.11 PANELBOARDS

UL 67 and UL 50. Panelboards for use as service disconnecting means shall additionally conform to UL 869A. Panelboards shall be circuit breaker-equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for future installation of breaker sized as indicated. Directories shall indicate load served by each circuit of panelboard. Directories shall also indicate source of service (upstream panel, switchboard, motor control center, etc.) to panelboard. Type directories and mount in holder behind transparent protective covering. Panelboard shall have nameplates in accordance with paragraph FIELD FABRICATED NAMEPLATES.

### 2.11.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than No. 10 gauge if flush-mounted or mounted outdoors, and not less than No. 12 gauge if surface-mounted indoors, with full seam-welded box ends. Cabinets mounted outdoors or flush-mounted shall be hot-dipped galvanized after fabrication. Cabinets shall be painted in accordance with paragraph PAINTING. Outdoor cabinets shall be of NEMA 3R raintight with conduit hubs welded to the cabinet. Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 1/8 inch. Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface. Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 24 inches long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets.

### 2.11.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

### 2.11.3 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the

circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

#### 2.11.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

#### 2.12 ENCLOSED CIRCUIT BREAKERS

**UL 489**. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral.

#### 2.13 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs); shall conform to **UL 508** and **UL 489** and shall be provided as shown. MSCPs shall consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. MSCPs shall be rated in accordance with the requirements of **NFPA 70**.

#### 2.14 MOTORS

**NEMA MG 1**; hermetic-type sealed motor compressors shall also comply with **UL 984**. Provide the size in terms of **HP**, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating. Unless otherwise indicated, motors rated **1 HP** and above shall be continuous duty type.

Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

##### 2.14.1 Premium Efficiency Polyphase Motors

Polyphase motors shall be selected based on high efficiency characteristics relative to typical characteristics and applications as listed in **NEMA MG 10**. In addition, continuous rated, polyphase squirrel-cage medium induction motors shall meet the requirement for premium efficiency electric motors in accordance with **NEMA MG 1**, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

##### 2.14.2 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified



capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

#### 2.14.3 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment, and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to equipment as specified herein. Power wiring and conduit shall conform to the requirements specified herein. Control wiring shall be provided under, and conform to the requirements of the section specifying the associated equipment.

#### 2.15 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. Selector switch shall have means for locking in any position. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

##### 2.15.1 Control Wiring

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW

meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Power wiring for 480-volt circuits and below shall be of the same type as control wiring and the minimum size shall be No. 12 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

## 2.15.2 Control Circuit Terminal Blocks

NEMA ICS 4. Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four (4) spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. The Contractor shall submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

### 2.15.2.1 Types of Terminal Blocks

- a. Short-Circuiting Type: Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and shall have provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.
- b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

### 2.15.3 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from a separate control source. Provide terminals and terminal boards. Provide separate control disconnect switch within controller. One secondary lead shall be fused; other shall be grounded.

#### 2.15.4 Enclosures for Motor Controllers

NEMA ICS 6.

#### 2.15.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers shall have compelling relays and shall be multiple-button, station-type with pilot lights for each speed.

#### 2.15.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

#### 2.15.7 Pilot and Indicating Lights

Provide LED cluster lamps.

#### 2.16 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 23, "Mechanical."

#### 2.17 GROUNDING AND BONDING EQUIPMENT

##### 2.17.1 Ground Rods

UL 467. Ground rods shall be sectional type, copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

##### 2.17.2 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated.

#### 2.18 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### 2.19 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Provide red laminated plastic label with white center core where indicated. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

## 2.20 WIREWAYS

UL 870. Material shall be steel epoxy painted 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with hinged-cover NEMA 1 enclosure per NEMA ICS 6.

## 2.21 METER BASE ONLY

ANSI C12.7. Provide NEMA Type 3R, box-mounted socket, ringless, having jaws compatible with requirements of a class: 200 and Form: 2S self contained watthour meter. Provide gray plastic closing cover and bypass links. Provide manufacturers standard enclosure color unless otherwise indicated.

## 2.22 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices which comply with UL 1449 at the service entrance panelboards. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-

Each phase to neutral ( L-N )

Neutral to ground ( N-G )

Phase to ground ( L-G )

Surge protective devices at the service entrance shall have a minimum surge current rating of 80,000 amperes per mode minimum and downstream protectors shall be rated 40,000 amperes per mode minimum. The maximum line to neutral (L-N) Suppressed Voltage Rating (SVR) shall be:

500V for 208Y/120V, three-phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating shall be:

300/150V for 208Y/120V, three-phase system

EMI/RFI filtering shall be provided for each mode with the capability to attenuate high frequency noise. Minimum attenuation shall be 20db.

## 2.23 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray, and equipment located outdoors shall be ANSI Light Gray. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

#### 3.1.1 Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

#### 3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

##### 3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

#### 3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches.

##### 3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

#### 3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits under floor slab as if exposed.

#### 3.1.4.1 Restrictions Applicable to Nonmetallic Conduit

##### a. PVC Schedule 40 and PVC Schedule 80

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

#### 3.1.4.2 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS.

#### 3.1.4.3 Service Entrance Conduit, Underground

Underground portion shall be encased in minimum of 3 inches of concrete and shall be installed minimum 18 inches below slab or grade.

#### 3.1.4.4 Underground Conduit Other Than Service Entrance

Convert nonmetallic conduit to galvanized rigid steel conduit before rising through floor slab.

#### 3.1.4.5 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

#### 3.1.4.6 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

#### 3.1.4.7 Conduit Installed in Concrete Floor Slabs

PVC, Type EPC-80, unless indicated otherwise. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab. Increase slab thickness as necessary to provide minimum one inch cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings shall allow horizontal and vertical movement of raceway. Conduit larger than one inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab. Where nonmetallic conduit is used, raceway shall be converted to plastic coated rigid steel or plastic coated steel IMC before rising above floor, unless specifically indicated.

#### 3.1.4.8 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in

rigid galvanized steel pvc coated conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

#### 3.1.4.9 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

#### 3.1.4.10 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

#### 3.1.4.11 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

#### 3.1.4.12 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement

or motors. Provide separate ground conductor across flexible connections.

### 3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when surface mounted on interior walls exposed up to 7 feet above floors and walkways, and when specifically indicated. Boxes in other locations shall be sheet steel. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

#### 3.1.5.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets shall be a minimum of 4 inches square by 2 1/8 inches deep. Mount outlet boxes flush in finished walls.

#### 3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, and compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

#### 3.1.5.3 Extension Rings

Extension rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.



### 3.1.6 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets to center of device or outlet.

### 3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with manufacturer's recommendations.

#### 3.1.7.1 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

### 3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

### 3.1.9 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

### 3.1.10 Grounding and Bonding

Provide In accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, grounding conductor of nonmetallic sheathed cables, and neutral conductor of wiring systems. Make ground connection to driven ground rods on exterior of building. Interconnect all grounding media in or on the structure to provide a common ground potential. This shall include lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA J-STD-607-A. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

#### 3.1.10.1 Ground Rods

Provide cone pointed ground rods. The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 5 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 6 feet on centers, or if sectional type rods are used, additional sections may be coupled and driven with the first rod. If the resultant resistance exceeds 5 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

#### 3.1.10.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

#### 3.1.10.3 Ground Bus

A copper ground bus shall be provided in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Connections and splices shall be of the brazed, welded, bolted, or pressure-connector type, except that pressure connectors or bolted connections shall be used for connections to removable equipment.

#### 3.1.10.4 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

#### 3.1.11 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

#### 3.1.12 Government-Furnished Equipment

Contractor shall rough-in for Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

#### 3.1.13 Repair of Existing Work

Repair of existing work shall be performed as follows:

##### 3.1.13.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

##### 3.1.13.2 Existing Concealed Wiring to be Removed

Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

#### 3.1.14 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible.

### 3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

### 3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

### 3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces

or to meet the indicated or specified safety criteria. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

### 3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

#### 3.5.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

#### 3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

#### 3.5.3 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

#### 3.5.4 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

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SECTION 26 29 10

ELECTRIC MOTOR ACTUATOR FOR LIFT GATES

PART 1 GENERAL

1.1 SCOPE

- a. This Section includes slide gate electric motor actuators and accessories.
- b. Actuators shall be supplied for the slide gates shown on the drawings. See Section 35 20 16 VERTICAL LIFT SLIDE GATES for slide gate specifications.
- c. Related Work Specified Elsewhere:
  - (1) Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.
  - (2) Section 35 20 16 VERTICAL LIFT SLIDE GATES.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

- |                 |   |
|-----------------|---|
| ASTM A123/A123M | (2012) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A153/A153M | (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware             |

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- |           |   |
|-----------|---|
| AWWA C513 | (2005) Open Channel, Fabricated-Metal Slide Gates and Open Channel, Fabricated-Metal Weir Gates |
| AWWA C542 | (2009) Electric Motor Actuators for Valves and Slide Gates                                      |
| AWWA C560 | (2000; Er 2002) Cast Iron Slide Gates   |
| AWWA C561 | (2004) Fabricated Stainless Steel Slide Gates   |

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- |              |  |
|--------------|--|
| IEEE Std 112 | (2004) Standard Test Procedure for Polyphase Induction Motors and Generators |
|--------------|--|

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (2000; R 2005; Errata 2008) Standard for  
Controllers, Contactors, and Overload  
Relays Rated 600 V

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014) National Electrical Code

NFPA 70E (2015) Standard for Electrical Safety in  
the Workplace

1.3 CORROSION PREVENTION AND FINISH PAINTING

All equipment furnished under these specifications will be subjected to severe moisture conditions, shall operate over a temperature range of 20 degrees F to 150 degrees F, and shall be designed to render it resistant to corrosion. The general requirements to be followed are specified below; any additional special treatment or requirement considered necessary for any individual item is specified under the respective item.

1.3.1 Fastenings and Fittings

Where practicable, all screws, bolts, nuts, pins, studs, springs, washers, and such other miscellaneous fastenings and fittings shall be of an approved corrosion-resisting material or shall be treated in an approved manner to render them resistant to corrosion.

1.3.2 Corrosion-Resisting Materials

Corrosion-resisting steel, copper, brass, bronze, copper-nickel, and nickel-copper alloys are acceptable corrosion-resisting materials. However, contact between dissimilar metals should be avoided as much as practicable, except where one of the dissimilar metals is steel or in the case of wiring and connections.

1.3.3 Corrosion-Resisting Treatments

Hot-dip galvanizing shall be in accordance with ASTM A123/A123M or ASTM A153/A153M as applicable. Other corrosion-resisting treatments may be used if approved by the Contracting Officer.

1.3.4 Frames, Enclosing Cases, and Housings

All surfaces of the enclosing cases or housings of controllers, limit switches, control stations, and other similar equipment, if other than plastic or stainless steel construction, shall be cleaned of rust, grease, mill scale, and dirt and then treated with an approved iron and zinc phosphate solution followed by rinsing with a chromic acid solution, bonderizing, or equivalent process. Immediately after rinsing and drying, the inside and outside surfaces shall be given one coat of a zinc molybdate primer and cured as required. For items of cast construction, the iron and zinc phosphate treatment may be omitted.

1.3.5 Finish Painting

A minimum of two coats of paint shall be applied to all equipment in accordance with the manufacturer's standard process for the conditions



specified.

#### 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

###### Controller, Terminal Leads, Terminal Blocks

Methods of identifying conductors, terminal leads, and terminal blocks.

###### Motor Nameplates, Equipment and Door Nameplates

###### Controller; G|DO

Copies of a description of the operation scheme, if other than herein specified or shown on the drawings, a dimensioned outline drawings showing specific relationships and clearances between equipment and their component parts.

###### Limit Switch; G|DO

Copies of dimensioned outline drawing of the limit switch and "Interrupter" drive. Drawings shall show specific relationships and clearances between equipment and their component parts.

###### Electric Motor Actuator; G|DO Control Stations; G|DO Enclosing Case; G|DO

Copies of dimensioned outline drawings showing specific relationships and clearances between equipment and their component parts.

##### SD-03 Product Data

###### Electric Motor Actuator; G|DO

Copies of catalog information/data providing technical information on the actuator assembly and its components, including all components used in a dual stem gate lifting mechanism (shaft, gearbox, etc.). Provide a parts breakdown of the actuator assembly with a description of all parts/components. Provide calculations that support the actuator selection showing, at a minimum, design heads, gate and stem weight, actuator loading, horsepower and torque requirements, stem characteristics, gate travel distance/stroke, and gate travel speed.

###### Actuator Motor; G|DO

Copies of motor characteristics, curves or tabulated data (tested or calculated), indicating the speed, power factor, efficiency, current and kilowatt input, all plotted or tabulated

against torque or percent of rated motor load.

Copies of calculations to determine the required horsepower rating of each motor.

Copies of detailed descriptive specifications of the motor, with necessary cuts, photographs, and drawings to clearly indicate the construction of the machine. Special emphasis shall be given to describing and illustrating features of "Insulated Windings," "Winding Heaters," "Bearings and Lubrication," and "Terminal Leads."

#### Limit Switch; G|DO

Copies of all limit switch computations used to determine the selection of gear ratios and calibration for gate travel.

Copies of complete descriptive data covering the limit switch with necessary cuts, photographs, and drawings to indicate clearly the construction, materials used in the parts, rating, accuracy of tripping and reset, method of adjustment, and safeguards.

#### Overload Relays; G|DO

Copies of curves showing the overload relay tripping time versus current characteristics of the overload relays for the controller.

#### Controller

Copies of detailed descriptive data covering all component parts of the controller.

#### Control Stations; G|DO

Copies of detailed descriptive data covering the control station(s).

#### Wiring; G|DO

Copies of data sufficient to demonstrate that the proposed wire and cable conform to these specifications.

#### Spare Parts List

Copies of the spare parts list.

#### Protective Coating List

Copies of the protective coating system.

### SD-09 Manufacturer's Field Reports

#### Tests

Certified copies of the reports of all complete and routine tests, including complete test data.

Certified copies of the results of a complete test for duplicate equipment will be accepted in lieu of the requirement of the

complete test specified. Reports shall include analysis and interpretation of test results and shall be properly identified with the test systems and materials. The contractor shall provide test reports for "complete tests" on the motor, and controller. Performance curves indicating the results of the motor tests shall be furnished as follows:

- a. Excitation Tests. Volts or percent of rated voltage as abscissa vs. amperes and watts as ordinates.
- b. Impedance Tests. Volts or percent of rated voltage as abscissa vs. amperes and watts as ordinates.
- c. Performance Test. Torque or percent of rated horsepower output as abscissa vs. efficiency, power factor, amperes watts, and rpm or percent slip as ordinates.
- d. Speed-Torque Test. Torque in foot-pounds as abscissa vs. speed in rpm or percent of synchronous speed as ordinates.
- e. Temperature Test. Time in minutes as abscissa vs. temperature rise in degrees C as ordinate.
- f. Insulation Resistance Test. Test result values shall be plotted on semilogarithmic graphs, the insulation resistance values as logarithmic ordinates, and the temperature values as uniform abscissa.

Routine test reports shall include analysis and interpretation of test results and shall be properly identified with the test systems and materials. No substitute will be accepted for the routine test. The contractor shall provide test reports for "routine tests" on the motor, controller, limit switch, (interrupter,) and wiring.

#### SD-10 Operation and Maintenance Data

##### Operation and Maintenance Data; G|DO

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, Data Package 3. Submit O&M Manuals for the entire actuator and all of its parts, components and accessories.

#### 1.5 QUALITY ASSURANCE

Manufacturers shall be experienced in the design and manufacture of equipment and accessories for a minimum period of 10 years.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

##### 1.6.1 Shipment Preparation

Prepare equipment and materials for shipment in a manner to facilitate unloading and handling, and to protect against damage or unnecessary exposure in transit and storage. Include the following:

- a. Crates or other suitable packaging materials.

- b. Covers and other means to prevent corrosion, moisture damage, mechanical injury and accumulation of dirt in motors, electrical equipment and machine.
- c. Suitable rust-preventive compound on exposed machined surfaces and unpainted iron and steel
- d. Grease packing or oil lubrication in all bearings and similar items.

#### 1.6.2 Marking

- a. Tag or mark each item of equipment or material as identified in the delivery schedule or on Submittals and include complete packing lists and bills of material with each shipment. Each piece of every item need not be marked separately provided that all pieces of each item are packed or bundled together and the packages or bundles are properly tagged and marked.
- b. Mark partial deliveries of component parts of equipment to identify the equipment, to permit easy accumulation of parts, and to facilitate assembly.

#### 1.7 SPARE PARTS AND EQUIPMENT

Submit spare parts data for each different (size, type, model, etc.) actuator supplied under this contract, after approval of detail drawings. Include in the data a complete list of parts and supplies, with current unit prices and source of supply, recommended spare parts, and a list of the parts recommended by the manufacturer to be replaced on a routine basis. Provide a complete spare electric motor actuator for each different (size, type, model, etc.) electric motor actuator supplied under this contract.

#### 1.8 WARRANTY

The installed electric motor actuators shall be guaranteed to provide trouble free service for a period of not less than two years. During the warranty period, and by the direction of the Customer (Government), any defects in material, workmanship and/or design shall be corrected within 36 hours of notification at no additional cost to the Customer.

### PART 2 PRODUCTS

#### 2.1 BASIC ACTUATOR

There shall be one electric motor actuator installed per gate. See structural drawings. The electric actuator shall include the motor, reversible motor starter, actuator unit gearing, limit switch gearing, position limit switches, torque switches, position potentiometer, stem nut, declutch lever, and handwheel as a self-contained unit. The reversible motor starter shall be furnished by the actuator supplier or the gate supplier. The slide gate and actuator combination must be self locking. The actuator shall be a proper selection and a compatible match for the gate assembly. Design water levels shall be as shown on the drawings. See Section 35 20 16 VERTICAL LIFT SLIDE GATES and Section 35 20 18 VERTICAL LIFT DUAL LEAF GATES for sizing information. The actuator shall conform to AWWA C542. The actuator shall operate the gate at a speed of 6 inches per minute (plus or minus 10 percent). The actuator shall, also, have a second

input shaft extension with a 1 inch hex head for emergency manual operation.

## 2.2 ENCLOSURE

a. The actuator and motor enclosure shall be NEMA 4 (watertight) for outdoor service.

b. The actuator shall be furnished with power and control terminal strips, limit switches, torque switches, all housed in a control compartment meeting NEMA 4 (weatherproof). The enclosure shall have a bonded o-ring seal and a hinged cover. Cover bolting shall be captive stainless steel hex head screws.

## 2.3 CONTROL SYSTEM

The gates shall be controllable from the structure's local control station, located in a hardened vandal proof lockable box, on the structure walkway. No controls shall be located in the individual gate actuators.

## 2.4 MOTOR

The actuator shall have an electric motor sized for the torque and loading requirements. The motor horsepower (HP) shall be calculated and rated no more than the HP as specified on the drawings. The motor shall be totally enclosed construction and specifically designed for gate actuator service. The electric motor shall have a minimum service factor of 1.15 and be continuous duty. The actuator motor shall be in compliance with NFPA 70 (NEC), Article 430. Motor insulation shall be a minimum NEMA Class F, with a maximum continuous temperature rating of 190 degrees F (rise plus ambient) for the duty cycle specified. The motor shall be of sufficient size to open or close the gate at the maximum stated torque and the specified speed of 6 inches per minute (plus or minus 10 percent). The motor shall be capable of operating at plus or minus 10 percent of specified voltage. The motor duty rating shall be 15 minutes for single phase motors and 30 minutes for 3 phase motors, minimum, without exceeding its temperature rating. Motor bearings shall be of the anti-friction type, and permanently lubricated. The motor shall be an independent sub-assembly, to allow for motor or gear changes dictated by system operation requirements. The motor shall be equipped with 120 volt AC heaters.

## 2.5 POWER GEARING

The actuator shall be a multiple reduction unit with power gearing consisting of spur, helical, or bevel gears, and worm gearing. The spur, helical, or bevel gearing and worm shall be of hardened alloy steel, and the worm gear shall be alloy bronze. All gearing shall be accurately cut. Non-metallic, aluminum, or cast gearing shall not be allowed. Anti-friction bearings shall be used throughout.

## 2.6 LUBRICATION

All rotating power train components shall be immersed in grease with provisions for inspection and relubrication without disassembly. Lubricants shall be suitable for ambient conditions of minus 20 degrees F to 150 degrees F. Adequate seals shall be provided on all shafting.

## 2.7 SELF-LOCKING FEATURE

Actuator gearing and/or stem threading shall be self-locking.

## 2.8 LOST MOTION DEVICE

A hammerblow feature is required and the mechanical advantage may either be distributed through the drive sleeve components or via the motor/worm connection. If via the motor/worm connection, then the actuator shall permit a "GATE JAMMED ENTRY" to occur at least one time should the electronics detect a "jammed gate".

## 2.9 MANUAL OPERATION

An aluminum hand wheel shall be provided for manual operation with an arrow to indicate "open" rotation. The hand wheel shall not rotate during motor operation. An inoperative motor shall not prevent manual operation. When in the manual operating mode, the actuator will remain in this mode until the motor is energized, at which time the actuator will automatically return to electric operation. Movement from motor operation to hand wheel operation shall be accomplished by a positive padlockable declutch levers which mechanically disengages the motor and related gearing. It shall be impossible for simultaneous manual and motor operation to occur. Friction type declutch mechanism is not acceptable.

## 2.10 STEM NUT

The gate actuator shall have a removable stem nut or drive bushing of high tensile bronze or other material compatible with the valve stem material.

## 2.11 POSITION LIMIT SWITCHES

Position limit switches and the associated gearing shall be integral part of the gate actuator. Limit switch gearing shall be of the intermittent type, made of bronze or stainless steel, grease lubricated, and totally enclosed to prevent dirt and foreign matter from entering the gear train. Switches shall be adjustable, allowing for trip points from fully open to fully closed positions of gate travel. They shall not be subject to breakage or slippage due to over-travel. Limit switch contacts shall be heavy-duty, silver-plated with wiping action. The actuators shall have 16 contacts, 4 contacts/4 rotor type, all of the same basic design. Contacts shall be convertible from N/O, to N/C or reverse. Switch design shall permit visual verification of switch position without disassembly.

## 2.12 TORQUE SWITCH

Each gate actuator shall be equipped with a switch, that will interrupt the control circuit in both the opening and closing directions when gate torque overload occurs or when gates require torque seating in the closed or open position. In addition, spare normally open contacts that operate with an over torque condition in the open direction or in the close direction shall be provided for remote signaling by others. Contacts shall be silver-plated. The torque switch shall have graduated dials for both open and close directions of travel and each shall be independently adjustable, with a positive means to limit the adjustability so as not to exceed the actuator output torque capability. Switch design shall permit visible verification of switch position without disassembly.

## 2.13 SWITCH CONTACT RATINGS

The position limit switch and torque switch shall be rated 600 volts per **NEMA ICS 2-125**, heavy-duty.

## 2.14 STEM LUBRICATION

Lubrication of the stem shall be by grease. Grease shall be stored/packed in a grease reservoir at the electric motor actuator for the stem. The packed grease shall allow for constant grease tracking onto the stem. The grease reservoir shall incorporate a grease fitting to allow for repacking of the grease reservoir. Grease shall be as recommended by the equipment manufacturers.

## 2.15 BOTTOM STEM COVER

Provide a flexible protective cover, properly sized, for the stem section between the top of the gate and the bottom of the operator pedestal. Cover material shall be rated for outdoor use including UV protection. Use stainless steel mounting hardware. Provide a standard sewn circular screw cover, as manufactured by Gortite of A and A Manufacturing Company, New Berlin, Wisconsin, or an approved equal.

## 2.16 TOP STEM COVER

Provide a rigid protective cover for the stem section above the operator. The cover shall be made of clear butyrate plastic that will not discolor or become opaque for at least five years after installation. The cover shall be of sufficient diameter and length to permit full-travel of the threaded stem without obstruction. The top of the stem cover shall be closed. The bottom end of the stem cover shall be vented and drained to avoid condensation, and mounted in a housing or adapter plate for easy field-mounting installation. Provide graduation marks on the cover for gate position indication.

## 2.17 POSITION INDICATION

The electric motor actuator shall be provided with a dial window indicator. The indicator shall be located on the limit switch compartment cover and labeled 0 to 100 percent open, and graduated in 10 percent increments, as a minimum. Also, provide a 1000 ohm potentiometer for remote position indication. The potentiometer shall move in step with valve position at all times, whether operation is electrical or manual. The potentiometer shall operate at all times, including when the motor is not energized.

## 2.18 TESTS

Each item of equipment furnished, one of each rating and type and selected at random by the Contracting Officer, shall be given a complete test. The remaining items of equipment shall be given a routine test. All complete tests required herein shall be witnessed by the Contracting Officer, unless waived in writing, and no equipment shall be shipped until it has been approved for shipment by the Contracting Officer. The Contractor shall notify the Contracting Officer sufficiently in advance of the date of the tests, so that arrangements can be made for the Contracting Officer to be present at the tests. The test equipment and the test methods used shall conform to the applicable requirements of ANSI, IEEE, and NEMA standards and shall be subject to the approval of the Contracting Officer. Certified

copies of "Complete Tests" on duplicate equipment may be accepted with the approval of the Contracting Officer. No substitute will be accepted for the routine test. The cost of performing all tests shall be borne by the Contractor and shall be included in the price bid. Operational tests shall be made on equipment after it is installed.

#### 2.18.1 Motor Tests

All tests shall be performed in accordance with the requirements of **IEEE Std 112** for single-phase induction motors.

##### 2.18.1.1 Routine Motor Tests

The routine tests shall include the following:

- a. Excitation test: (One point - no load, volts, amperes, and watts.)
- b. Impedance test: (One point - half-voltage amperes and watts.)
- c. General operation.
- d. Insulation resistance - temperature test (one point).
- e. Resistance measurements.
- f. Dielectric.
- g. Motor winding heater test.
  - (1) Successful operation.
  - (2) Dielectric.

#### 2.18.2 Controller Tests

##### 2.18.2.1 Routine Controller Tests

The routine tests shall include the following:

- a. Adjustment, fit, and material.
- b. Successful operation.
- c. Resistance.
- d. Dielectric.
- e. Insulation Resistance.
- f. Enclosure space heater test.
  - (1) Successful operation.
  - (2) Dielectric.

#### 2.18.3 Limit-Switch Tests

Each drive shall be tested in the manufacturers shop by suitable means, simulating service conditions, to ascertain that it will transmit the



correct information for the control sequence specified. In addition, the routine tests shall include the following:

- a. Adjustment, fit, and material.
- b. Accuracy of trip and reset.
- c. Successful operation.
- d. Dielectric.
- e. Insulation resistance.

#### 2.18.4 Wiring Tests

All wiring shall be given a dielectric test following installation by applying, for no more than five (5) seconds, a voltage test of 1,000 volts to each circuit and ground and between each conductor and all other conductors in the same conduit.

#### 2.18.5 Actuator Functional Test

After the electric motor actuators are installed, all shall be operated to raise and lower their respective gates in a proper and acceptable manner in the presence of the Contracting Officer. The gates shall be operated through two cycles per [AWWA C542](#). The success of this test is subject to approval by the Contracting Officer.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- a. Comply with provisions of [AWWA C513](#), [AWWA C542](#), [AWWA C560](#), [AWWA C561](#), [NFPA 70](#), and [NFPA 70E](#), where applicable, and as specified.
- b. Provide manufacturer's field services if required during and after installation.
- c. Perform equipment tests during and after start-up to determine if equipment is performing as specified.
- d. Lubricate all bearings and gears before placing gates in operation.

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- 2.3 BATTERIES
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SECTION 26 31 00

SOLAR PHOTOVOLTAIC (PV) COMPONENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Errata 2011; Supp 1 2013) Minimum  
Design Loads for Buildings and Other  
Structures

ASTM INTERNATIONAL (ASTM)

ASTM E772 (2015) Standard Terminology of Solar  
Energy Conversion

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1013 (2007) Recommended Practice for Sizing  
Lead-Acid Batteries for Photovoltaic (PV)  
Systems

IEEE 928 (1986; R 1991) Recommended Criteria for  
Terrestrial Photovoltaic Power Systems

IEEE 937 (2007) IEEE Recommended Practice for  
Installation and Maintenance of Lead-Acid  
Batteries for Photovoltaic (PV) Systems

IEEE Stds Dictionary (2009) IEEE Standards Dictionary: Glossary  
of Terms & Definitions

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2012) International Building Code

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 61215 (2005; ED 2.0) Crystalline Silicon  
Terrestrial Photovoltaic (PV) Modules -  
Design Qualification and Type Approval

IEC 61853-1 (2011; ED 1.0) Photovoltaic (Pv) Module  
Performance Testing and Energy Rating -  
Part 1: Irradiance and Temperature  
Performance Measurements and Power Rating

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001 (2008; Corr 1 2009) Quality Management  
Systems- Requirements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1 (2002) Molded-Case Circuit Breakers,  
Molded Case Switches, and Circuit-Breaker  
Enclosures

NEMA FU 1 (2002; R 2007) Low Voltage Cartridge Fuses

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2015) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1703 (2002; Reprint Nov 2014) UL Standard for  
Safety Flat-Plate Photovoltaic Modules and  
Panels

UL 2703 (2015) UL Standard for Safety Mounting  
Systems, Mounting Devices,  
Clamping/Retention Devices, And Ground  
Lugs For Use With Flat-Plate Photovoltaic  
Modules And Panels

UL 50 (2007; Reprint Apr 2012) Enclosures for  
Electrical Equipment, Non-environmental  
Considerations

UL Electrical Constructn (2012) Electrical Construction Equipment  
Directory

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM apply to this section with  
additions and modifications specified herein.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics  
terms used in these specifications, and on the drawings, are as defined  
in the IEEE Stds Dictionary.
- b. Unless otherwise specified or indicated, solar energy conversion terms  
used in these specifications, and on the drawings, are as defined in  
ASTM E772.

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. Submit the following in  
accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Schematic Diagrams; G, DO

Interconnection Diagrams; G, DO

Installation Drawings; G, DO

SD-03 Product Data

Roof Mounting Structure for Modules (Racking); G, DO

Photovoltaic Modules; G, DO

SD-05 Design Data

System Operation; G, DO

SD-06 Test Reports

Field Test Plan; G, DO

Submit a detailed description of the Contractor's proposed procedure for onsite test 20 calendar days prior to testing the installed system. No final field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including test to be performed, test equipment and tolerance limits.

Field Test Reports; G, DO

Provide the information described below. Include a separate section for tests on each solar-powered system.

- a. A list of equipment used.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

SD-07 Certificates

Installer; G, DO

Materials; G, DO

Warranty; G, DO

SD-08 Manufacturer's Instructions

Installation Instructions; G, DO

SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5; G, DO

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

Comply with requirements specified in Section 01 78 02 CLOSEOUT SUBMITTALS.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officers. Provide equipment, materials, installation, and workmanship in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

### 1.6.2 Installation Drawings

In addition to requirements in Section 01 33 00 SUBMITTAL PROCEDURES, include the following:

- a. Submit drawings for government approval prior to equipment construction or integration.
- b. Shop drawings may include legible copies of manufacturer's product literature, with selected items and specifications highlighted thereon.

### 1.6.3 System Operation

Provide a complete description of the function of each component including PV modules, DC wiring, combiner boxes, inverters, AC wiring, AC and DC disconnect switches, and monitoring system. Provide a discussion of the overall system operation.

### 1.6.4 Installer

Submit NABCEP (North American Board of Certified Energy Practitioners) PV Installation Professional certification, and a resume with references that details least four successful projects that, in aggregate, equal or exceed the size of the proposed project.

### 1.6.5 Materials

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Submit proof of compliance with requirements of UL, where material or equipment is specified to comply. The label of or listing in UL Electrical Constructn Directory will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing laboratory (NRTL) equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted.

#### 1.6.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if the manufacturer has been regularly engaged in the design and production

of solar photovoltaic products for a minimum of 5-years. Similar photovoltaic products must have been in satisfactory commercial or industrial use for 5-years prior to bid opening and must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 5-year period.

#### 1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1-year prior to date of delivery to site must not be used, unless specified otherwise.

#### 1.6.6 Operation and Maintenance Data

Submit Solar Photovoltaic Systems data package for the following items in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

- a. Troubleshooting guide.
- b. Warranty.
- c. Operation instructions.
- d. Preventive maintenance and inspection data, including a schedule for system operators.

##### 1.6.6.1 Electrical Systems

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. In addition to requirements of Data Package 5, include the following for the actual solar photovoltaic (PV) system provided:

- a. Service and maintenance information including preventive maintenance, assembly, and disassembly procedures.
- b. Complete operation, repair, and maintenance information, detailed to the smallest replaceable unit.
- c. Adjustment, trouble-shooting, configuration, tuning, and system calibration instructions.
- d. An instruction manual with pertinent items and information highlighted.
- e. A layout drawing showing locations as well as views of equipment; front, top, and side views.
- f. A one-line drawing showing all components and interfaces to the electrical system.
- g. Date of purchase.

#### 1.6.7 Bill of Materials

Submit a Bill of Materials listing each product being incorporated into the system. Bill of Materials includes a general description of the product, quantity, and exact manufacturer's model number. Where the manufacturer's model number does not fully identify the product, list options, accessories, or custom features by additional descriptions.



#### 1.6.8 Spare Parts

Spare parts shall be furnished as specified below. All spare parts shall be of the same material and workmanship, shall meet the same requirements, and shall be interchangeable with the corresponding original parts.

- a. 5 - Fuses of each type and size.
- b. 2 - Circuit breakers of each type and size.
- c. 1 - Solar controller of each type and size.
- d. 1 - Solar module of each type and size.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- a. Store solar PV modules in their original packaging according to the manufacturer's guidance, and do not remove from packaging until day of installation.
- b. If a solar PV module is removed from its packaging, store it according to the manufacturer's guidance.
- c. Do not store solar PV modules on-site for more than 12 months.

#### 1.8 WARRANTY

The equipment items must be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

##### 1.8.1 Solar Photovoltaic Modules

Furnish the solar photovoltaic module manufacturer's warranty. The warranty must be a 25-year linear 80 percent (minimum) power warranty (at the end of the 25th year after purchase an actual minimum power output of 80 percent based on the nameplate rating must be achieved) and not less than 10-years for workmanship material and manufacturing defects from the date of manufacture.

The warranty must state that the malfunctioning solar photovoltaic module must be exchanged by the manufacturer and promptly shipped to the using Government facility. The replacement solar module must be identical to, or an improvement upon, the original design of the malfunctioning solar module.

##### 1.8.2 Solar Controllers

Furnish the controller manufacturer's warranty.

##### 1.8.3 Batteries

Furnish the manufacturer's warranty for the batteries.

## PART 2 PRODUCTS

### 2.1 PHOTOVOLTAIC MODULES

- a. PV modules must be IEC 61215 compliant and listed to UL 1703, and manufactured in an ISO 9001 certified facility.
- b. PV modules must be of monocrystalline or polycrystalline technology and

for rack mounting.

- c. PV module efficiency must be greater than 15 percent for crystalline technology.
- d. PV modules must be of the same manufacturer and model number and consistent sub-components.
- e. Submit on cutsheets PV module performance data from the manufacturer that must include a flash test data in accordance with IEC 61853-1, and temperature coefficients at: STC, nominal operating cell temperature (NOCT), low irradiance conditions (LIC), high temperature conditions (HTC), and low temperature conditions (LTC).
- e. PV module bypass diodes must be inside the solar PV module's single conductor cable junction box.
- f. Photovoltaic wire, wiring methods, and utilization of locking-type connectors must comply with the requirements of NFPA 70. Provide USE-2 or RHH or RHW-2 wire, and sunlight-resistant wire when exposed to sunlight.

## 2.2 SOLAR CONTROLLERS

The solar controllers shall operate on 12Vdc and shall be rated for the amperage required for each system indicated. The charger shall be voltage regulated and temperature compensated and shall be appropriated for recharging VRLA batteries without causing overcharge. The controllers shall be fully and continuously rated at 70 degrees C. They shall be pulse width modulated with three stage charging: Bulk, PWM regulation and float. The controllers shall be fully protected against reverse polarity, short circuit, overcurrent, lightning and transient surges, high temperature and reverse current. Construction shall be 100 percent solid state, epoxy encapsulated and rated for outdoor use. LEDs shall indicated mode. Grounding for the solar power system shall be in conformance with NFPA 70, the drawings and the specifications herein. Conform to NEMA AB 1, NEMA FU 1, UL 50 and IEEE 928

### 2.2.1 Solar Controller Enclosure

Enclosures shall be NEMA Type 3R, vented enclosure of white fiberglass reinforced polyester or powder-coated white aluminum, with hinged door, padlock hasp and screw-type door clamps. The interior-mounting panel shall be 12-gage steel. It shall be sized to house the equipment indicated and be of wall-mounted design. Fittings shall be watertight for all conduits entering the enclosure. It shall be sized to allow airflow around the components.

### 2.2.2 Electrical System

#### 2.2.2.1 Wiring

The wiring shall be NEC type, THHN/THWN wire, rated to 90 degrees C at 600V.

#### 2.2.2.2 Wire Markers

Wire markers shall be hot-stamped tube-type, Brady Ty-grip, Electrovert slip-on Type Z, or Floy Tag FT200C sized for snug fit for wire size. Identify both ends with the same unique wire number. Assign wire numbers

where specific designations are not indicated.

### 2.2.3 Solar Enclosure Components

#### 2.2.3.1 Terminal Blocks

Terminal Blocks shall be 125V, section type of nylon or polyamide blocks with tubular clamp contacts. Provide a minimum of 10 percent spare terminals.

#### 2.2.3.2 Switch Action Fuse Blocks

Pull switch shall interrupt circuit before fuse can be removed or installed. Fuse blocks shall be rated 30V, 30A and be sectional type nylon or polyamide blocks with tubular clamp contacts.

#### 2.2.3.3 Circuit Breakers

Use Heineman Series CF, Curve 3 breakers for devices or systems requiring 24Vdc power or less. Trip rating shall be as recommended by the manufacturer of equipment being protected. Provide necessary space on the panel for a minimum of three future circuit breakers. Mount inside control panel in a readily accessible location.

### 2.3 BATTERIES

The batteries shall be sealed, valve-regulated, deep cycle, lead acid batteries. The case material shall be polypropylene. The batteries shall be rated non-spillable by DOT, ICAO and IATA. Battery capacity shall include 5 days backup in Amp/Hours for equipment being charged. Conform to [IEEE 937](#) and [IEEE 1013](#). The batteries shall be absorbed glass mat (AGM) type batteries and shall power a 12V system. Provide batteries with 50 amp-hours rating.

### 2.4 ROOF MOUNTING STRUCTURE FOR MODULES (RACKING)

- a. Provide racking for array as indicated on the drawings. Provide racking compliant with [UL 2703](#).
- b. Racking and PV array, including modules, hardware, and attachments, must withstand wind loads as required by [ASCE 7](#) and [ICC IBC](#).

#### 2.4.1 Mounting System Base Supports

Fabricate with fastening points integral to the mounting structure. Mounting system supports must be permanently affixed stanchions that are anchored to the building structure. Coordinate height with thickness of roof insulation.

#### 2.4.2 Flashing Boot

Fabricate for precision fit over base support. Coordinate height with base supports.

#### 2.4.3 Base Cap

Fabricate to overlap base support and flashing boot a minimum of [2 inches](#).

#### 2.4.4 Base Cap Gasket

EPDM with self-adhesive closed cell foam or other gasketing material compatible with the roofing material.

#### 2.4.5 Framing

Provide with wall thickness as determined by structural calculations.

#### 2.4.6 Hardware

Bolts, nuts, washers, and screws must be 18-8 stainless steel.

### 2.5 MANUFACTURER'S NAMEPLATE

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable. For PV modules, a label on the back of the module is acceptable.

### 2.6 GROUNDING AND BONDING

- a. Provide properly sized equipment grounding conductors.
- b. Provide bonding fittings on concentric/eccentric knockouts with metal conduits for circuits over 250 volts in accordance with NFPA 70.
- c. Provide bonding fittings for ferrous metal conduits enclosing grounding electrode conductors in accordance with NFPA 70.
- d. Provide grounding lugs for aluminum PV solar module frames of either stainless steel or tin-coated copper.

## PART 3 EXECUTION

### 3.1 INSTALLATION

After delivery of equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the solar equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

#### 3.1.1 Solar Array

The solar array shall be installed at a 30-degree tilt angle with orientation to the south. Each solar module shall be removable for maintenance repair or replacement.

#### 3.1.2 Array Support Frame

The array support frame shall be installed in accordance with the recommendations of the solar array manufacturer. Structural members requiring welding shall be welded in accordance with Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

### 3.1.3 Solar Controller Components

The solar controller, fuses, circuit breakers, and disconnecting means shall be installed in an enclosure in accordance with the manufacturer's instructions. Wiring shall be installed in liquidtight flex conduit between the array and the array junction box, and in conduit between the array junction box and the batteries. See Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

## 3.2 INSPECTION AND TESTING

### 3.2.1 Acceptance Testing and Final Inspection

After acceptance of the field test plan, the Contractor shall notify the Contracting Officer 7 calendar days prior to the performance and acceptance tests are to be conducted. Tests shall be performed in the presence of the Contracting Officer or ACO. The Contractor shall furnish all instruments and personnel required for the tests. Field test reports of the results of all acceptance tests shall be maintained and submitted in booklet form. Final acceptance of the solar system will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

## 3.3 FIELD TRAINING

A field training course for the solar power system shall be provided for operation and maintenance staff members. Training shall be provided by the solar equipment manufacturer's representative for a minimum period of 4 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. The training shall include discussion of the system design and layout, and demonstration of routine operation and maintenance procedures. At a minimum, this training shall include solar module inspection, cleaning and replacement, trouble shooting for the controller, battery inspection, replacement and battery wiring. Notify the Contracting Officer in writing prior to scheduling instructions.

-- End of Section --

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SECTION 26 41 01

LIGHTNING PROTECTION SYSTEM

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.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- |          |   |
|----------|---|
| NFPA 70  | (2014) National Electrical Code   |
| NFPA 780 | (2014) Standard for the Installation of<br>Lightning Protection Systems |

UNDERWRITERS LABORATORIES (UL)

- |                          |  |
|--------------------------|--|
| UL 467                   | (2007) Grounding and Bonding Equipment   |
| UL 96                    | (2005; Reprint Oct 2010) Standard for<br>Lightning Protection Components                               |
| UL 96A                   | (2007; Reprint Jul 2012) Standard for<br>Installation Requirements for Lightning<br>Protection Systems |
| UL Electrical Constructn | (2012) Electrical Construction Equipment<br>Directory  |

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings of Each Major Component; G, DO

SD-07 Certificates

Materials

Proof of compliance with requirements of UL, where material or equipment is specified to comply. The label of or listing in UL Electrical Constructn will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform

to the requirements and testing methods of Underwriters Laboratories may be submitted. Submit a letter of findings certifying UL inspection of lightning protection systems provided on the control building.

### 1.3 QUALITY ASSURANCE

Submit detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

## PART 2 PRODUCTS

### 2.1 STANDARD PRODUCTS

Provide a system consisting of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and which is the manufacturer's latest UL approved design. The lightning protection system shall conform to NFPA 70 and NFPA 780, UL 96 and UL 96A, except where requirements in excess thereof are specified herein.

### 2.2 MATERIALS

#### 2.2.1 General Requirements

Do not use any combination of materials that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture, unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist, which would cause corrosion of conductors, use conductors with protective coatings or oversize conductors. Where a mechanical hazard is involved, increase the conductor size to compensate for the hazard or protect the conductors by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

#### 2.2.2 Main and Secondary Conductors

Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.

##### 2.2.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than 375 pounds/thousand feet, and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

##### 2.2.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal. Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and



cross-sectional area of a No. 4 AWG aluminum wire. When perforated strips are provided, strips that are much wider than solid strips shall be. A strip width that is at least twice that of the diameter of the perforations shall be used. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least 1-1/2 inch wide.

#### 2.2.3 Air Terminals

Terminals shall be in accordance with UL 96 and NFPA 780. Air terminals on the roof of the control building shall be 3/8 inch in diameter and 18 inches in length. Air terminals on the pole as specified shall be 3/8 inch in diameter and 36 inches in length. Air terminals more than 24 inch in length shall be supported by a suitable brace, with guides not less than one-half the height of the terminal.

#### 2.2.4 Ground Rods

Rods made of copper-clad steel shall conform to UL 467. Ground rods shall be not less than 3/4 inch in diameter and 10 feet in length.

#### 2.2.5 Connectors

Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable, and, Class 2, style and size as required for the installation.

#### 2.2.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to UL 96, classes as applicable.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

#### 3.2 INTEGRAL SYSTEM

##### 3.2.1 General Requirements

Provide a lightning protection system consisting of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

##### 3.2.1.1 Air Terminals

Air terminal design and support shall be in accordance with NFPA 780. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of

T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inch for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 780, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed with air terminals mounted thereon, the air terminal shall not be more than 24 inch away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement. Where metal ventilators are installed with air terminals mounted adjacent, the air terminal shall not be more than 24 inches away from the farther edge or corner. If the air terminal is farther than this distance, an additional air terminal shall be added in order to meet this requirement.

#### 3.2.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inch. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 3 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

#### 3.2.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more than 110 feet long, there shall be at least one additional down conductor for each additional 50 feet of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding 250 feet in perimeter, there shall be at least one additional down conductor for each 100 feet of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each

wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 100 feet. On structures exceeding 50 feet in height, there shall be at least one additional down conductor for each additional 60 feet of height or fraction thereof, except that this application shall not cause down conductors to be placed about the perimeter of the structure at intervals of less than 50 feet. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than 16 feet in length and maintains a horizontal or downward coursing. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected by placing in rigid steel conduit for a minimum distance of 72 inch above finished grade level. If the conduit is metal, the down conductor shall be bonded at the top and bottom of the conduit.

#### 3.2.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

#### 3.2.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

#### 3.2.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 3 feet, nor more than 8 feet, from the structures foundation. The complete installation shall have a total resistance to ground of not more than 10 ohms. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 24 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 10 ohms, the Contracting Officer shall be notified immediately. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 3 feet nor more than 8 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where

so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors are then buried in the trenches.

### 3.3 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. Metal bodies of conductance having an area of 400 square inch or greater or a volume of 1000 cubic inch or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 3 square inch. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds 5 feet in any dimension, that is situated wholly within a building, and that does not at any point come within 6 feet of a lightning conductor or metal connected thereto shall be independently grounded.

### 3.4 FENCES

Except as indicated below, metal fences that are electrically continuous with metal posts extending at least 2 feet into the ground require no additional grounding. Other fences shall be grounded on each side of every gate. Fences shall be grounded by means of ground rods every 1000 to 1500 feet of length when fences are located in isolated places, and every 500 to 750 feet when in proximity (100 feet or less) to public roads, highways, and buildings. Where the fence consists of wooden posts and horizontal metal strands only, down conductors consisting of No. 8 copper wire or equivalent shall be run from the ground rod the full height of the fence and fastened to each wire, so as to be electrically continuous. The connection to ground shall be made from the post where it is of metal and is electrically continuous with the fencing. All metal fences shall be grounded at or near points crossed by overhead lines in excess of 600 volts and at distances not exceeding 150 feet on each side of line crossings.

### 3.5 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

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SECTION 26 51 00

INTERIOR LIGHTING

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.

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9 (2000; Errata 2004; Errata 2005; Errata 2006) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE C2 (2012; Errata 2012; INT 1-4 2012) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2014) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1598 (2008; Reprint Oct 2012) Luminaires

1.2 RELATED REQUIREMENTS

Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

- b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.
- c. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

#### 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 01 33 00 SUBMITTAL PROCEDURES:

Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IESNA HB-9, as applicable, for the lighting system specified.

##### SD-03 Product Data

Luminaires; G|DO

Lamps; G|DO

##### SD-10 Operation and Maintenance Data

Operational Service; G|DO

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

#### 1.5 QUALITY ASSURANCE

##### 1.5.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

##### 1.5.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the

products of the same manufacturer unless stated in this section.

#### 1.5.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

#### 1.5.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

#### 1.5.2.3 Energy Efficiency

Comply with National Energy Policy Act and **Energy Star** requirements for lighting products. Submit data indicating lumens per watt efficiency and color rendition index of light source with all submittals under SD-03 Product Data in paragraph SUBMITTALS above.

### 1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

## PART 2 PRODUCTS

### 2.1 LUMINAIRES

**UL 1598**. Provide LED luminaires as indicated. Provide luminaires complete with lamps of number, type, and wattage indicated. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

### 2.2 TOGGLE SWITCHES

Provide toggle switches as specified in Section **26 20 00** INTERIOR DISTRIBUTION SYSTEM.

### 2.3 EQUIPMENT IDENTIFICATION

#### 2.3.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### 2.3.2 Labels

Provide labeled luminaires in accordance with **UL 1598** requirements. All luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. All markings related to lamp type



shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

#### 2.4 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of **NEMA 250** corrosion-resistance test.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Electrical installations shall conform to **IEEE C2**, **NFPA 70**, and to the requirements specified herein.

##### 3.1.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15 percent of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. Provide 10 percent spare lamps of each type from the original manufacturer.

##### 3.1.2 Lighting Fixtures

Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of **NFPA 70**. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.

#### 3.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be per manufacturer's recommendations.

#### 3.3 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section.

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SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO LTS-5 (2009; Errata 2009; Amendment 1 2010; Amendment 2 2011) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2012) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM B108/B108M (2012; E 2012) Standard Specification for Aluminum-Alloy Permanent Mold Castings

ASTM C1089 (2013) Standard Specification for Spun Cast Prestressed Concrete Poles

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9 (2000; Errata 2004; Errata 2005; Errata 2006) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE C2 (2012; Errata 2012; INT 1-4 2012) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.13 (2004; R 2009) American National Standard for Roadway Lighting Equipment, Metal Brackets for Wood Poles

ANSI C136.21 (2004; R 2009) American National Standard

for Roadway and Area Lighting Equipment -  
Vertical Tenons Used with Post-Top-Mounted  
Luminaires

ANSI C136.3

(2005; R 2009) American National Standard  
for Roadway and Area Lighting Equipment  
Luminaire Attachments

NEMA 250

(2008) Enclosures for Electrical Equipment  
(1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2014) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star

(1992; R 2006) Energy Star Energy  
Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1598

(2008; Reprint Oct 2012) Luminaires

UL 773

(1995; Reprint Mar 2002) Standard for  
Plug-In, Locking Type Photocontrols for  
Use with Area Lighting

UL 773A

(2006; Reprint Mar 2011) Standard for  
Nonindustrial Photoelectric Switches for  
Lighting Control

## 1.2 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.
- c. Groundline section is that portion between one foot above and 2 feet below the groundline.

## 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 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire Drawings; G, DO

Poles; G, DO

SD-03 Product Data

Luminaires; G, DO

Lamps; G, DO

Photocell switch; G, DO

Concrete poles; G, DO

Aluminum poles; G, DO

Steel poles; G, DO

Brackets

Anchorage system; G, DO

SD-05 Design Data

Design Data for Luminaires; G, DO

SD-06 Test Reports

Operating Test

SD-08 Manufacturer's Instructions

Poles

Submit instructions prior to installation.

Foundation Requirements  
Mounting Details

Submit instructions prior to installation.

SD-10 Operation and Maintenance Data

Operational Service; G|DO

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

1.4 QUALITY ASSURANCE

1.4.1 Drawing Requirements

1.4.1.1 Luminaires

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and candlepower distribution data shall accompany shop drawings.

#### 1.4.1.2 Poles

Include dimensions, wind load determined in accordance with AASHTO LTS-5, pole deflection, pole class, and other applicable information. For concrete poles, include: section and details to indicate quantities and position of prestressing steel, spiral steel, inserts, and through holes; initial prestressing steel tension; and concrete strengths at release and at 28 days.

#### 1.4.2 Design Data for Luminaires

Include distribution data according to IESNA classification type as defined in IESNA HB-9.

#### 1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### 1.5.1 Concrete Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation.

### 1.5.2 Aluminum or Steel Poles

Do not store poles on ground. Support poles so they are at least **one foot** above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

## 1.6 SUSTAINABLE DESIGN REQUIREMENTS

### 1.6.1 Energy Efficiency

Comply with National Energy Policy Act and **Energy Star** requirements for lighting products. Submit data indicating lumens per watt efficiency and color rendition index of light source.

## 1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

## PART 2 PRODUCTS

### 2.1 PRODUCT COORDINATION

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section **26 20 00** INTERIOR DISTRIBUTION SYSTEM.

### 2.2 LUMINAIRES

**UL 1598**. Provide LED luminaires as indicated. Provide luminaires complete with lamps of number, type, and wattage indicated. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

### 2.3 PHOTOCCELL SWITCH

**UL 773** or **UL 773A**, hermetically sealed cadmium-sulfide or silicon diode type cell rated 120 volts ac, 60 Hz with single-throw contacts designed to fail to the ON position. Switch shall turn on at or below **3 footcandles** and off at **4 to 10 footcandles**. A time delay shall prevent accidental switching from transient light sources. Provide switch integral to the luminaire, rated 1000 VA, minimum.

### 2.4 POLES

Provide poles designed for wind loading of 155 miles per hour determined in accordance with **AASHTO LTS-5** while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall have oval-shaped handhole having a minimum clear opening of **2.5 by 5 inches**. Handhole cover shall be secured by stainless steel captive screws. Metal poles shall have an internal grounding connection accessible from the handhole near the bottom of each pole. Scratched, stained, chipped, or dented poles shall not be



installed.

#### 2.4.1 Concrete Poles

Provide concrete poles conforming to ASTM C1089. Cross-sectional shape shall be multi-sided.

##### 2.4.1.1 Steel Reinforcing

Prestressed concrete pole shafts shall be reinforced with steel prestressing members. Design shall provide internal longitudinal loading by either pretensioning or post tensioning of longitudinal reinforcing members.

##### 2.4.1.2 Tensioned Reinforcing

Primary reinforcement steel used for a prestressed concrete pole shaft shall be tensioned between 60 to 70 percent of its ultimate strength. The amount of reinforcement shall be such that when reinforcement is tensioned to 70 percent of its ultimate strength, the total resultant tensile force does not exceed the minimum section compressive strength of the concrete.

##### 2.4.1.3 Coating and Sleeves for Reinforcing Members

Where minimum internal coverage cannot be maintained next to required core openings, such as handhole and wiring inlet, reinforcing shall be protected with a vaporproof noncorrosive sleeve over the length without the 1/2 inch concrete coverage. Each steel reinforcing member which is to be post-tensioned shall have a nonmigrating slipper coating applied prior to the addition of concrete to ensure uniformity of stress throughout the length of such member.

##### 2.4.1.4 Strength Requirement

As an exception to the requirements of ASTM C1089, poles shall be naturally cured to achieve a 28-day compressive strength of 7000 psi. Poles shall not be subjected to severe temperature changes during the curing period.

##### 2.4.1.5 Shaft Preparation

Completed prestressed concrete pole shaft shall have a hard, smooth, nonporous surface that is resistant to soil acids, road salts, and attacks of water and frost, and shall be clean, smooth, and free of surface voids and internal honeycombing. Poles shall not be installed for at least 15 days after manufacture.

#### 2.4.2 Aluminum Poles

Provide aluminum poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-5 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3,5) for cast alloys. Poles shall be seamless extruded or spun seamless type with minimum 0.188 inch wall thickness. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Tops of shafts shall be fitted with a round or tapered cover. Base shall be anchor bolt mounted, made of cast 356-T6 aluminum alloy in accordance with ASTM B108/B108M and shall be machined to receive the lower end of shaft. Joint between shaft and base shall be welded. Base cover shall be cast 356-T6 aluminum alloy in accordance with ASTM B108/B108M. Hardware, except anchor bolts, shall be either 2024-T4

anodized aluminum alloy or stainless steel. Aluminum poles and brackets for area lighting shall have a uniform dark anodic bronze finish to match fixtures and shall not be painted. Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

#### 2.4.3 Steel Poles

**AASHTO LTS-5.** Provide steel poles having minimum 11-gage steel with minimum yield/strength of 48,000 psi and hot-dipped galvanized in accordance with **ASTM A123/A123M** factory finish. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Pole shall be anchor bolt mounted type. Poles shall have tapered tubular members, either round in cross section or polygonal. Pole shafts shall be one piece. Poles shall be welded construction with no bolts, rivets, or other means of fastening except as specifically approved. Pole markings shall be approximately 3 to 4 feet above grade and shall include manufacturer, year of manufacture, top and bottom diameters, and length. Base covers for steel poles shall be structural quality hot-rolled carbon steel plate having a minimum yield of 36,000 psi.

#### 2.5 BRACKETS AND SUPPORTS

**ANSI C136.3**, **ANSI C136.13**, and **ANSI C136.21**, as applicable. Pole brackets shall be not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

#### 2.6 POLE FOUNDATIONS

Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with **ASTM A153/A153M**. Concrete shall be as specified in the drawings.

#### 2.7 EQUIPMENT IDENTIFICATION

##### 2.7.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

##### 2.7.2 Labels

Provide labeled luminaires in accordance with **UL 1598** requirements. Luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. Markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

## 2.8 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

#### 3.1.1 Concrete Poles

Install according to pole manufacturer's instructions.

##### 3.1.1.1 Pole Setting

Depth shall be as indicated. Poles in straight runs shall be in a straight line. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6 inch maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

#### 3.1.2 Aluminum or Steel Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

##### 3.1.2.1 Pole Setting

Pole setting shall be as indicated on the drawings.

#### 3.1.3 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

#### 3.1.4 Grounding

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

#### 3.1.5 Field Applied Painting

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be

per manufacturer's recommendations.

### 3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an [operating test](#) to show that the equipment operates in accordance with the requirements of this section.

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SECTION 31 05 19

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SECTION 31 05 19

GEOTEXTILE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4354	(2012) Sampling of Geosynthetics for Testing
ASTM D4355	(2007) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491	(1999a; R 2009) Water Permeability of Geotextiles by Permittivity
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2012) Determining Apparent Opening Size of a Geotextile
ASTM D4759	(2011) Determining the Specification Conformance of Geosynthetics
ASTM D4873	(2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D6241	(2004; R 2009) Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	Safety and Health Requirements Manual
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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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-03 Product Data

#### Thread; G, RO

A minimum of 30 days prior to scheduled use, proposed thread type for sewn seams along with data sheets showing the physical properties of the thread.

#### Manufacturing Quality Assurance Sampling and Testing; G, RO

A minimum of 30 days prior to scheduled use, manufacturer's quality assurance manual.

### SD-04 Samples

#### Quality Control Samples and Tests; G, RO

Samples for quality control testing; assign 30 days in the schedule, plus 30 days prior to scheduled, to allow for testing.

### SD-07 Certificates

#### Geotextile; G, RO

A minimum of 30 days prior to scheduled use, manufacturer's certificate of compliance stating that the geotextile meets the requirements of this section. For needle punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors and does not contain any needles which could damage other geosynthetic layers. The certificate of compliance shall be attested to by a person having legal authority to bind the geotextile manufacturer.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle geotextile in accordance with [ASTM D4873](#).

### 1.3.1 Delivery

Notify the Contracting Officer a minimum of 24 hours prior to delivery and unloading of geotextile rolls packaged in an opaque, waterproof, protective plastic wrapping. The plastic wrapping shall not be removed until deployment. If quality assurance samples are collected, immediately rewrap rolls with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Label each roll with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

### 1.3.2 Storage

Protect rolls of geotextile from construction equipment, UV radiation, chemicals, sparks and flames, temperatures in excess of [160 degrees F](#), or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, either elevate rolls off the ground or place them on a sacrificial sheet of plastic in an area where water will not accumulate.

### 1.3.3 Handling

Handle and unload geotextile rolls with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

## PART 2 PRODUCTS

### 2.1 RAW MATERIALS

#### 2.1.1 Geotextile

Provide geotextile that is a nonwoven needle-punched 12 ounce/square yard pervious sheet of polymeric material consisting of long-chain synthetic polymers, and composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Add stabilizers and/or inhibitors to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material shall not be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in the following table. Where applicable, the property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent required average roll values.

MINIMUM PHYSICAL REQUIREMENTS FOR GEOTEXTILE			
PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	LBS	300	ASTM D4632
PUNCTURE	LBS	825	ASTM D6241
TRAPEZOID TEAR	LBS	115	ASTM D4533
APPARENT OPENING SIZE	U.S. SIEVE	100	ASTM D4751
PERMITTIVITY	SEC -1	0.8	ASTM D4491
ULTRAVIOLET DEGRADATION	PERCENT	50 AT 500 HRS	ASTM D4355

#### 2.1.2 Thread

Construct sewn seams with high-strength polyester, nylon, or other approved thread type. Thread shall have ultraviolet light stability equivalent to the geotextile and the color shall contrast with the geotextile.

### 2.2 MANUFACTURING QUALITY ASSURANCE SAMPLING AND TESTING

The Manufacturer is responsible for establishing and maintaining a quality assurance program to assure compliance with the requirements of the specification. Documentation describing the quality assurance program



shall be made available upon request. Perform manufacturing quality assurance sampling and testing in accordance with the manufacturer's approved quality assurance manual. As a minimum, geotextiles shall be randomly sampled for testing in accordance with [ASTM D4354](#), Procedure A. Acceptance of geotextile shall be in accordance with [ASTM D4759](#). Tests not meeting the specified requirements will result in the rejection of applicable rolls.

### PART 3 EXECUTION

#### 3.1 QUALITY CONTROL SAMPLES AND TESTS

##### 3.1.1 Quality Control Samples

Collect quality control samples upon delivery to the site for quality control testing in the presence of the Contracting Officer's Representative at a frequency of one per [50,000 square feet](#) with a minimum of 4 tests for the project. Identify samples with a waterproof marker by manufacturer's name, product identification, lot number, roll number, and machine direction. The date and a unique sample number shall also be noted on the sample. Discard the outer layer of the geotextile roll prior to sampling a roll. Samples shall then be collected by cutting the full-width of the geotextile sheet a minimum of [3 feet](#) long in the machine direction. Rolls which are sampled shall be immediately resealed in their protective covering.

##### 3.1.2 Quality Control Tests

The Contractor shall provide quality control samples to an Independent Laboratory. Samples will be tested to verify that geotextile meets the requirements specified in Table 1. Test method [ASTM D4355](#) shall not be performed on the collected samples. Geotextile product acceptance shall be based on [ASTM D4759](#). Test results shall be supplied to the Contracting Officer. Tests not meeting the specified requirements will result in the rejection of applicable rolls.

#### 3.2 INSTALLATION

##### 3.2.1 Subgrade Preparation

The surface underlying the geotextile shall be smooth and free of ruts or protrusions which could damage the geotextile. Subgrade materials and compaction requirements shall be in accordance with Section [35 41 00](#) EMBANKMENT CONSTRUCTION.

##### 3.2.2 Surface Preparation

The receiving slope shall be graded to a smooth plane surface to ensure that intimate contact is achieved between the receiving slope and the geotextile. All slope deformities, ruts, rills and gullies resulting from traffic, precipitation runoff, groundwater seepage, or any other cause shall be corrected prior to installation of the geotextile. No holes, "pockmarks", slope board teeth marks, footprints, or other voids greater than 0.5 inches in depth normal to the receiving face shall be permitted. No grooves or depressions greater than 0.5 inches in depth normal to the local slope face with a dimension exceeding 12 inches in any direction shall be permitted. Where such areas are evident, they shall be brought to grade by placing the proper embankment fill as per the drawings for each location. For instances where the geotextile is to be placed underwater,

the use of divers may be required to ensure the surface preparation is performed as described above. If divers are required, the Contractor shall submit a Dive Operations Plan as required in EM 385-1-1, and as part of the Accident Prevention Plan (APP). The Activity Hazard Analysis (AHA) shall also include diving operations. Both APP and AHA are required in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

### 3.2.3 Placement

Notify the Contracting Officer a minimum of 24 hours prior to installation of geotextile. Geotextile rolls which are damaged or contain imperfections shall be repaired or replaced as directed. The geotextile shall be laid flat and smooth so that it is in direct contact with the subgrade. The geotextile shall also be free of tensile stresses, folds, and wrinkles. On slopes steeper than 10 horizontal on 1 vertical, lay the geotextile with the machine direction of the fabric parallel to the slope direction. If geotextile is placed underwater, the Contractor can stake the edges of the geotextile in lieu of keying it in.

### 3.3 OVERLAP SEAMS

Continuously overlap geotextile panels a minimum of 24 inches at all transverse joints and 36 inches at all longitudinal joints. All geotextile placed in the wet shall have a minimum overlap of 36 inches. Where seams must be oriented horizontally across the slope, lap the upper panel over the lower panel. Direction of adjacent section overlap shall be in same direction of channel flow (i.e., overlapping section shall be located upstream from underlying section). If approved, sewn seams may be used instead of overlapped seams.

### 3.4 PROTECTION

Protect the geotextile during installation from clogging, tears, and other damage. Damaged geotextile shall be repaired or replaced as directed. Use adequate ballast (e.g. bedding stone) to prevent uplift by wind. The geotextile shall not be left uncovered for more than 14 days after installation or as specified by the manufacturer, whichever is more restrictive.

### 3.5 REPAIRS

Repair torn or damaged geotextile. Clogged areas of geotextile shall be removed. Perform repairs by placing a patch of the same type of geotextile over the damaged area. The patch shall extend a minimum of 24 inches beyond the edge of the damaged area. Patches shall be continuously fastened using approved methods. The machine direction of the patch shall be aligned with the machine direction of the geotextile being repaired. Remove and replace geotextile rolls which cannot be repaired. Repairs shall be performed at no additional cost to the Government

### 3.6 PENETRATIONS

Construct engineered penetrations of the geotextile by methods recommended by the geotextile manufacturer.

### 3.7 COVERING

Do not cover geotextile prior to inspection and approval by the Contracting Officer. Place bedding stone in a manner that prevents material from

entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves. On side slopes, bedding stone shall be placed from the bottom of the slope upward. The bedding stone material shall not be dropped onto the geotextile from a height greater than 1 foot. No equipment shall be operated directly on top of the geotextile. Use equipment with ground pressures less than 7 psi to place the first lift over the geotextile. The thickness of the bedding stone is shown on the drawings, and shall be placed over the geotextile and prior to placement of riprap stone. Equipment placing bedding stone or riprap shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 5 mph.

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SECTION 31 23 24

CONTROLLED LOW STRENGTH MATERIAL (CLSM, FLOWABLE FILL)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C91/C91M	(2012) Standard Specification for Masonry Cement
ASTM C94/C94M	(2013) Standard Specification for Ready-Mixed Concrete
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C143/C143M	(2012) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2012) Standard Specification for Portland Cement
ASTM C220	(1991; R 2009) Standard Specification for Flat Asbestos-Cement Sheets
ASTM C618	(2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C940	(2010a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM D4832	(2010) Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.2 SYSTEM DESCRIPTION

In order to abandon the existing IP-3 culvert pipes in-place, the Contractor shall pump controlled low strength mortar (CLSM), also called flowable fill, into the pipe barrel until full. Each end of the pipe shall be capped, and grout shall be pumped into the pipe. The grout shall be pumped at low pressures to avoid damage to the existing pipe walls.

### 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

##### Work Plan

Submit a work plan detailing the equipment, setup, procedures, sequencing, plan for handling waste, method for communication, Contractor Quality Control plan, and method for sealing and bulk heading the upstream and downstream ends of the conduit. As part of the Work Plan, describe the proposed methods that will be used to ensure that no voids exist at the conduit crown. As a minimum, a two stage CLSM grouting operation maybe required to if voids exist.

#### SD-05 Design Data

##### CLSM Grout Mix Design; G, DO

Submit a mix design for the CLSM grout at least 14 calendar days prior to commencement of work.

#### SD-07 Certificates

##### Receipts

Submit copies of receipts or delivery tickets for all materials used in the CLSM mix to the Contracting Officer upon delivery to the site.

### 1.4 MATERIALS DELIVERY, STORAGE AND HANDLING

#### 1.4.1 Materials

As required by the approved mix design, sufficient quantities of cement, pozzolans (Fly Ash), sand, and fluidifier shall be stored at or near the site of the work to ensure that grouting operations will not be delayed due to shortage of materials. In the event the materials for the approved mix are found to contain lumps or foreign matter of a nature and in amounts which, in the opinion of the Contracting Officer, may be deleterious to the grout, screening through a standard 100 mesh screen or other measures may be required. No separate payment will be made for screening. Copies of receipts or delivery tickets for all materials delivered to the job site shall be provided to the Contracting Officer.

### 1.5 PERFORMANCE REQUIREMENTS

Non-shrink, low bleed CLSM grout shall completely fill the space inside the IP-3 barrel. CLSM shall be in place at least ten days prior to embankment fill placement above the CLSM grouted pipe.

## PART 2 PRODUCTS

### 2.1 CLSM MATERIAL

CLSM Grout shall consist of 100 pounds or less of Portland cement per cubic yard; pozzolan (fly ash); sand; water; and fluidifier. The various materials to be furnished by the Contractor shall conform to the specifications listed in paragraphs below.

#### 2.1.1 Water

The water used in the grout shall be furnished by the Contractor. It shall be fresh, clean and free from injurious amounts of sewage, oil, acid, sugar, alkali, salts, or organic matter or any impurities that affect the performance of the fill grout.

#### 2.1.2 Cement

Cement used in grout shall conform to the requirements of [ASTM C91/C91M](#) and [ASTM C150/C150M](#), Type I.

#### 2.1.3 Pozzolans

Pozzolans, if required in the approve mix design, shall be fly ash or other raw or calcined natural pozzolans conforming to [ASTM C618](#), Class F. Pozzolans may be furnished in paper sacks or in bulk, It shall be transported, handled, and stored so as to avoid damage, waste, or absorption of moisture.

#### 2.1.4 Admixtures

Admixtures shall be added to the grout immediately before or during its mixing and will consist of accelerators, retarders, water reducers, aluminum powder, and fluidifiers as required.

#### 2.1.5 Fluidifier

The fluidifier shall be a compound possessing characteristics which will increase the flowability of the mixture, assist in dispersal of the cement grains, and neutralize the setting shrinkage of the grout.

Fluidifier shall give the fill the following salient characteristics; (a) must have less than 1 percent bleed water in accordance with [ASTM C940](#), (b) have an initial set time of more than 5 hours in accordance with [ASTM C220](#) modified by using a Ferioli apparatus, (c) have a flowability expressed as a slump of more than 8 inches in accordance with [ASTM C143/C143M](#) (slump prior to adding admixtures shall be 1 inch or less), and (e) maintain a homogeneous mixture during pumping. See the following criteria:

- a. Quantity of admixture(s) required in the mixture proportion is governed by the salient characteristics specified.
- b. The fluidifier or other approved admixtures shall be added as directed by the manufacturer. In most cases it is added to the fill at the job site and mixed for a minimum of 5 minutes at mixing speed.

#### 2.1.6 Sand

Sand shall be approved by the Contracting Officer and shall be clean and

consist of hard, tough, durable, uncoated particles. The sand shall be well graded from fine to coarse in accordance with ASTM C33/C33M with gradational characteristics accordance with ASTM C136.

### PART 3 EXECUTION

#### 3.1 EQUIPMENT

All equipment used shall be of a type, capacity and mechanical condition suitable for performing the work as approved by the Contracting Officer. The power and equipment and the layout thereof shall meet all applicable requirements of local, State, and Federal regulations and codes, both safety and otherwise.

#### 3.2 DEFINITIONS AND PROCEDURES FOR CLSM

##### 3.2.1 CLSM Placement

All CLSM placement operations shall be performed in the presence of the Contracting Officer or his representative, and shall be in accordance with the following general procedures.

##### 3.2.1.1 CLSM Mix Design

Unless otherwise shown on the plans, the Contractor shall furnish an acceptable mix meeting the following requirements:

- a. Strength. The compressive strength range shall be determined in accordance with ASTM D4832, shall be between 100 psi to 300 psi at 56 days; with a maximum strength of 1200 psi at 365 days. Samples for testing shall be cured in accordance with ASTM D4832. Variations of the specified strength will be allowed as approved by the Contracting Officer.
- b. Consistency. The mix shall be designed to be placed without consolidation and shall fill all intended voids. The mix shall have a slump greater than 8" when tested in accordance with ASTM C143/C143M. The mix shall be designed such that no segregation occurs. The Contractor shall have the option of using specialty type admixtures to enhance the flowability, reduce shrinkage, and reduce segregation by maintaining solids in suspension. All admixtures shall be proportioned in accordance with the manufacturer's recommendations. The CLSM shall be mixed by central-mixed concrete plant, ready-mix concrete truck, pugmill, or other method approved by the Contracting Officer.
- c. Design Mix Proportions. The mixture proportions shall be reported in accordance with ASTM C94/C94M. The Contractor shall submit the CLSM mix design that meets the above requirements. The mix fill design shall be submitted for Government approval. CLSM Mix changes shall require Contracting Officer approval.

##### 3.2.2 Contractor Quality Control

In accordance with Section 01 45 04 CONTRACTOR QUALITY CONTROL, quality control shall be established and maintained which shall specifically include, but not be limited by, inspections to assure that:

- a. The specified qualification requirements are met.



- b. CLSM is placed in the presence of a Contracting Officer's representative.
- c. A minimum of four CLSM sample cubes shall be obtained and tested for compressive strength, on accordance with [ASTM D4832](#).
- d. Accurate cement grout mixture proportions are maintained as recommended by the manufacturer or supplier.
- e. Materials are properly protected from moisture and contamination after delivery and transportation to the site.
- f. Only approved materials are used.
- g. A test program to ensure that no voids exist at the conduit crown.

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SECTION 31 41 16

METAL SHEET PILING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A328/A328M	(2007; R 2012) Standard Specification for Steel Sheet Piling
ASTM A572/A572M	(2012) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A6/A6M	(2012) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates

1.2 SYSTEM DESCRIPTION

Submit to the Contracting Officer for approval descriptions of pile driving equipment to be employed in the work . Descriptive information includes manufacturer's name, model numbers, capacity, rated energy, hammer details, cushion material, helmet, and templates.

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal Sheet Piling; G, DO

Detail drawings for sheet piling, including fabricated sections, showing complete piling dimensions and details, driving sequence and location of installed piling. Include in the drawings details of top protection, special reinforcing tips, tip protection, lagging, fabricated additions to plain piles, cut-off method, corrosion protection, and dimensions of templates and other temporary guide structures for installing piling. Provide details of the method for handling piling to prevent permanent deflection,

distortion or damage to piling interlocks. Provide a work plan for achieving design tip elevation for piles through hard and/or resistant layers including limestone, cemented strata or other very dense strata.

#### SD-03 Product Data

##### Driving; G, DO

Records of the completed sheet piling driving operations, including a system of identification which shows the disposition of approved piling in the work, driving equipment performance data, piling penetration rate data, piling dimensions and top and bottom elevations of installed piling. The Contractor's format for driving records shall be submitted for approval.

##### Pile Driving Equipment; G, DO

Complete descriptions of sheet piling driving equipment including hammers, extractors, protection caps and other installation appurtenances, prior to commencement of work.

##### Pulling and Redriving; G, DO

The proposed method of pulling sheet piling, prior to pulling any piling.

#### SD-06 Test Reports

##### Materials Tests; G, RO

Certified materials tests reports showing that sheet piling and appurtenant metal materials meet the specified requirements, for each shipment and identified with specific lots prior to installing materials. Material test reports shall meet the requirements of ASTM A6/A6M.

#### SD-11 Closeout Submittals

##### Pile Driving Record

Record for each sheet pile driven, as specified.

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Material Certificates

For each shipment, submit certificates identified with specific lots prior to installing piling. Include in the identification data piling type, dimensions, chemical composition, mechanical properties, section properties, heat number, and mill identification mark.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Materials delivered to the site designated for permanent installation shall be new and undamaged and shall be accompanied by certified test reports. Materials delivered to the site designated for the temporary cofferdam shall be undamaged, inspected and approved for use, and accompanied by certified test reports. The utilization of previously used piles shall be

approved on a case-by-case basis, and shall require Government inspection. Contractor shall be liable for any unforeseen complications or delays caused by reuse of piles. Provide the manufacturer's logo and mill identification mark on the sheet piling as required by the referenced specifications. Store and handle sheet piling in the manner recommended by the manufacturer to prevent permanent deflection, distortion or damage to the interlocks; as a minimum, support on level blocks or racks spaced not more than 10 feet apart and not more than 2 feet from the ends. Storage of sheet piling should also facilitate required inspection activities and prevent damage to coatings and corrosion prior to installation. Handle sheet piling over 80 feet in length using a minimum of two pickup points.

## PART 2 PRODUCTS

### 2.1 METAL SHEET PILING

#### 2.1.1 Scour Cutoff Wall Piling

Metal sheet piling shall be hot-rolled steel sections conforming to ASTM A328/A328M, Grade 36.

#### 2.1.2 Temporary Cofferdam

Metal sheet piling wall shall be hot-rolled steel sections conforming to ASTM A572/A572M, Grade 50.

#### 2.1.3 Interlocks

The interlocks of sheet piling shall be free-sliding, provide a swing angle suitable for the intended installation but not less than 5 degrees when interlocked, and maintain continuous interlocking when installed. Interlocks for the Scour Cutoff Wall Piling shall be Larssen double hook, Ball and Socket, or Thumb and Finger with three point contact. Joint sealants shall be applied before driving to reduce interlock leakage. The sealants may include, but not be limited to, bituminous and hydrophilic sealants and shall be applied at the mill or as recommended by the manufacturer to guarantee effectiveness. Alternatively, cold-formed steel sheets may be used if the interlocks are such that a cavity (that can be cleaned, inspected and grouted) is created.

#### 2.1.4 General Requirements

Sheet piling including special fabricated sections shall be full-length sections of the dimensions shown. Provide fabricated sections conforming to the requirement and the piling manufacturer's recommendations for fabricated sections. Fabricated tees, wyes and cross pieces shall be fabricated of piling sections with a minimum web thickness of 0.525 inch. Provide sheet piling with standard pulling holes. Metalwork fabrication for sheet piling shall be as specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

### 2.2 APPURTENANT METAL MATERIALS

Provide metal plates, shapes, bolts, nuts, rivets and other appurtenant fabrication and installation materials conforming to manufacturer's standards and to the requirements specified in the respective sheet piling standards and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

## 2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

Requirements for material tests, workmanship and other measures for quality assurance shall be as specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

### 2.3.1 Materials Tests

Perform materials tests conforming to the following requirements. Sheet piling and appurtenant materials shall be tested and certified by the manufacturer to meet the specified chemical, mechanical and section property requirements prior to delivery to the site. Testing of sheet piling for mechanical properties shall be performed after the completion of all rolling and forming operations. Testing of sheet piling shall meet the requirements of ASTM A6/A6M.

## PART 3 EXECUTION

### 3.1 EARTHWORK

Perform in accordance with Section 35 41 00 EMBANKMENT CONSTRUCTION. Pre-excavation will not be permitted. Backfill as indicated.

### 3.2 INSTALLATION

#### 3.2.1 Pile Driving Equipment

Provide pile driving equipment conforming to the following requirements.

##### 3.2.1.1 Driving Hammers

Hammers shall be steam, air, or diesel drop, single-acting, double-acting, differential-acting, or vibratory type. The driving energy of the hammers shall be as recommended by the manufacturer for the piling weights and subsurface materials to be encountered. Repair damage to piling caused by use of a pile hammer with excess delivered force or energy.

##### 3.2.1.2 Jetting Equipment

Jetting will not be permitted.

##### 3.2.1.3 Pre-augering

Pre-augering of piles may be used at no additional cost to the Government. Discontinue pre-augering once penetration through the dense layer has been achieved. See geotechnical report for approximate location of dense layers. The Contractor shall withdraw the auger by reverse-augering to minimize removal of subsurface materials. Pre-auger holes shall not be performed overlapping or tangentially. The auger bit and flighting used shall be narrower than the width of the pile wall, so that disturbance is kept within the wall profile and to not have an adverse effect on the pile wall design and wall integrity. See subparagraph "Driving" below.

#### 3.2.2 Placing and Driving

##### 3.2.2.1 Placing

Any excavation required within the area where sheet pilings are to be installed shall be completed prior to placing sheet pilings. Pilings

properly placed and driven shall be interlocked throughout their length with adjacent pilings to form a continuous diaphragm throughout the length or run of piling wall.

- a. Pilings to be placed in cofferdams shall be picked up and completely threaded to demonstrate that they slide freely in interlock.
- b. Pilings shall be carefully located as shown. Pilings shall be placed plumb with out-of-plumbness not exceeding  $\frac{1}{8}$  inch per foot of length and true to line. Place the pile so the face will not be more than 6 inches from vertical alignment at any point. Top of pile at elevation of cut-off shall be within  $\frac{1}{2}$  inch horizontally and 2 inches vertically of the location indicated. Manipulation of piles to force them into position will not be permitted. Check all piles for heave. Redrive all heaved piles to the required tip elevation.
- c. Provide temporary wales, templates, master pilings, or guide structures to ensure that the pilings are placed and driven to the correct alignment. Use a system of structural framing sufficiently rigid to resist lateral and driving forces and to adequately support the sheet piling until design tip elevation is achieved. Use two templates, at least, when placing each piling not less than 20 feet apart. Templates shall not move when supporting sheet piling. Fit templates with wood blocking to bear against the web of each alternate sheet pile and hold the sheet pile at the design location alignment. Provide outer template straps or other restraints as necessary to prevent the sheets from warping or wandering from the alignment. Mark template for the location of the leading edge of each alternate sheet pile. If in view, also mark the second level to assure that the piles are vertical and in position. If two guide marks cannot be seen, other means shall be used to keep the sheet pile vertical along its leading edge.
- d. Master pilings shall be used to maintain plumbness and proper configuration in placing cofferdam cells over 90 feet in height in water flowing at a velocity of more than 4 feet per second.

#### 3.2.2.2 Driving

Prior to driving pilings, paint a horizontal line on both sides of each piling at a fixed distance from the bottom so that it will be visible after installation. This line shall indicate the profile of the bottom elevation of installed pilings and potential problem areas can be identified by abrupt changes in its elevation. Drive pilings with the proper size hammer and by approved methods so as not to subject the pilings to damage and to ensure proper interlocking throughout their lengths. Limestone and sandstone rock materials are expected to be encountered as described in Section 00 31 32 GEOTECHNICAL DATA REPORT. Pre-splitting of limestone or cemented strata may be required to achieve the design tip elevations. Refer to subitem f. below for allowable penetration methods for obstructions or rock.

- a. Maintain driving hammers in proper alignment during driving operations by use of leads or guides attached to the hammer. Caution shall be taken in the sustained use of vibratory hammers when a hard driving condition is encountered to avoid interlock-melt or damages. Discontinue the use of vibratory hammers and instead use impact hammers when the penetration rate due to vibratory loading is one foot or less per minute. Refusal for impact hammers shall be defined as 10 blows per inch.

- b. Employ a protecting cap in driving when using impact hammers to prevent damage to the tops of pilings. Use cast steel shoe to prevent damage to the tip of the sheet piling. Remove and replace pilings damaged during driving or driven out of interlock at the Contractor's expense.
- c. Drive pilings without the aid of a water jet.
- d. Take adequate precautions to ensure that pilings are driven plumb. Where possible, drive Z-pile with the ball end leading. If an open socket is leading, a bolt or similar object placed in the bottom of the interlock will minimize packing material into it and ease driving for the next sheet. If at any time the forward or leading edge of the piling wall is found to be out-of-plumb in the plane of the wall the piling being driven shall be driven to the required depth and tapered pilings shall be provided and driven to interlock with the out-of-plumb leading edge or other approved corrective measures shall be taken to ensure the plumbness of succeeding pilings. The maximum permissible taper for any tapered piling shall be  $\frac{1}{8}$  inch per foot of length.
- e. Pilings in each run or continuous length of piling wall shall be driven alternately in increments of depth to the required depth or elevation. No piling shall be driven to a lower elevation than those behind it in the same run except when the pilings behind it cannot be driven deeper. Incrementally sequence driving of individual piles such that the tip of any sheet pile shall not be more than 4 feet below that of any adjacent sheet pile. When the penetration resistance exceeds five blows per inch, the tip of any sheet pile shall not be more than 2 feet below any adjacent sheet pile. If the piling next to the one being driven tends to follow below final elevation it may be pinned to the next adjacent piling.
- f. If obstructions, rock, cemented layers or dense soils restrict driving a piling to the specified penetration, interfering material shall be penetrated with a chisel beam, or through pre-auguring. If pre-auguring or pre-drilling is performed, the auger shall be reversed out of the hole so that the in-situ soils are loosened in-place but not removed from the ground. Installation of the cofferdam sheet piles to the design tip elevation is required for this project. Pilings shall be driven to depths shown and shall extend up to the elevation indicated for the top of pilings. Pilings shall not be driven within 100 feet of concrete less than 7 days old.
- g. Any sheet piles installed may have limited embedment depth and/or unbalanced loads during construction. The Contractor shall anticipate specialized construction methods, limited excavation lengths, and/or temporary bracing to maintain verticality of the sheets until cofferdam is completed.

### 3.2.3 Cutting-Off and Splicing

Pilings driven below the required top elevation and pilings damaged by driving and cut off to permit further driving shall be extended as required to reach the top elevation by splicing when directed at no additional cost to the Government.

- a. Piles shall not be spliced, except as indicated above.
- b. The tops of pilings excessively battered during driving shall be



trimmed when directed, at no cost to the Government. Piling cut-offs shall become the property of the Contractor and shall be removed from the site.

- c. Cut holes in pilings for bolts, rods, drains or utilities in a neat and workmanlike manner, as shown or as directed. Use a straight edge in cuts made by burning to avoid abrupt nicks. Bolt holes in steel piling shall be drilled or may be burned and reamed by approved methods which will not damage the surrounding metal. Holes other than bolt holes shall be reasonably smooth and the proper size for rods and other items to be inserted. All holes in steel pilings on the wet side of cofferdams shall be made watertight by welding steel plates over the holes after the piling installation is completed. Do not use explosives for cutting.

#### 3.2.4 Inspection of Driven Piling

Perform continuous inspection during pile driving. Inspect all piles for compliance with tolerance requirements. Bring any unusual problems which may occur to the attention of the Contracting Officer. Inspect the interlocked joints of driven pilings extending above ground. Pilings found to be out of interlock shall be removed and replaced at the Contractor's expense. Use divers to inspect underwater interlocked joints of cofferdam sheet piling. Government divers may also inspect the interlocked joints. The inspection of cofferdams shall be performed after driving is completed, prior to dewatering the work area.

#### 3.2.5 Pulling and Redriving

At no additional cost to the Government, pull, as directed, selected pilings after driving to determine the condition of the underground portions of pilings. Any piling so pulled and found to be damaged, to the extent that its usefulness in the structure is impaired, shall be removed and replaced at the Contractor's expense. Pilings pulled and found to be in satisfactory condition shall be redriven when directed.

Immediately upon extraction of the steel sheet pile wall or segment thereof, for the areas above the water level in the after bay or discharge canal, the Contractor shall excavate a trench at least 5 feet in depth (or no deeper than one foot after encountering phreatic surface) and at least as wide as the thickness of the cofferdam. The trench shall follow the alignment of the recently extracted wall. The excavation shall be backfilled with a 6 to 9-inch slotted or perforated pipe and ASTM C33/C33M sand. The pipe shall be wrapped in a geotextile fabric capable of retaining the ASTM C33/C33M sand, while having a hydraulic permeability of at least 5 times that of the ASTM C33/C33M sand. The pipe shall be placed 6 to 12 inches above the invert of the excavation, and shall be inclined such that it discharges, by gravity, at a point in the landside canal or after bay equal to the normal or operational water level in said canal. For the areas below the water level in the landside canal or after bay, ASTM C33/C33M sand shall be placed (by push method) and vibrated into the anticipated cavity created during the extraction of the sheets. A concrete vibrator/compactor with at least a 4-foot depth range or reach shall be used.

### 3.3 REMOVAL

The removal of sheet pilings shall consist of pulling, sorting, cleaning the interlocks, inventorying and storing previously installed sheet pilings

as shown and directed.

### 3.3.1 Pulling

The method of pulling piling shall be approved. Provide pulling holes in pilings, as required. Extractors shall be of suitable type and size. Care shall be exercised during pulling of pilings to avoid damaging piling interlocks and adjacent construction. If the Contracting Officer determines that adjacent permanent construction has been damaged during pulling, the Contractor will be required to repair this construction at no cost to the Government. Pull pilings one sheet at a time. Pilings fused together shall be separated prior to pulling, unless the Contractor demonstrates, to the satisfaction of the Contracting Officer, that the pilings cannot be separated. The Contractor will not be paid for the removal of pilings damaged beyond structural use due to proper care not being exercised during pulling.

### 3.3.2 Sorting, Cleaning, Inventorying and Storing

Pulled pilings shall be sorted, cleaned, inventoried and stored by type into groups as:

- a. Piling usable without reconditioning.
- b. Piling requiring reconditioning.
- c. Piling damaged beyond structural use.

### 3.3.3 Final Disposition of Materials

After completion of all work required under this contract, the piling materials used for the temporary cofferdam structure shall remain the property of the Contractor.

### 3.4 INSTALLATION RECORDS

Maintain a [pile driving record](#) for each sheet pile. Indicate on the installation record: installation dates and times, type and size of hammer, rate of operation, total driving time, dimensions of driving helmet and cap used, blows required per [foot](#) for each [foot](#) of penetration, final driving resistance in blows for final [6 inches](#), pile locations, tip elevations, ground elevations, cut-off elevations, and any reheading or cutting of piles. Record any unusual pile driving problems during driving. Submit complete records to the Contracting Officer.

-- End of Section --

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SECTION 31 62 13

PRESTRESSED CONCRETE PILES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

- |           |  |
|-----------|--|
| ACI 214R  | (2011) Evaluation of Strength Test Results of Concrete   |
| ACI 304R  | (2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete                     |
| ACI 318   | (2011; Errata 2011; Errata 2012) Building Code Requirements for Structural Concrete and Commentary |
| ACI SP-66 | (2004) ACI Detailing Manual  |

AMERICAN WELDING SOCIETY (AWS)

- |          |   |
|----------|---|
| AWS D1.4 | (2005; Errata 2005) Structural Welding Code - Reinforcing Steel |
|----------|---|

ASTM INTERNATIONAL (ASTM)

- |                 |   |
|-----------------|---|
| ASTM A416/A416M | (2012) Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete      |
| ASTM A421/A421M | (2010) Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete    |
| ASTM A615/A615M | (2012) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| ASTM A82/A82M   | (2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement                   |
| ASTM C136       | (2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates                      |
| ASTM C143/C143M | (2012) Standard Test Method for Slump of Hydraulic-Cement Concrete                                |
| ASTM C150/C150M | (2012) Standard Specification for Portland Cement   |

ASTM C172	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C31/C31M	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2012) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2013) Standard Specification for Chemical Admixtures for Concrete
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C666/C666M	(2003; R 2008) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C70	(2013) Standard Test Method for Surface Moisture in Fine Aggregate
ASTM D4945	(2012) High-Strain Dynamic Testing of Piles
ASTM G109	(2007) Determining the Effects of Chemical Admixtures on the Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments E(2000)

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI JR-119	Grouting of Post-Tensioned Prestressed Concrete
PCI MNL-116	(1999) Manual for Quality Control for Plants and Production of Structural Precast Concrete Products, 4th Edition
PCI STD-112	(1984) Standard Prestressed Concrete Piles Square, Octagonal and Cylinder

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 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G, DO

Drawings including shop and erection details and details of collars, shoes, splices, build-ups and embedded or attached lifting devices, prior to commencing the work or ordering materials. Drawings shall indicate pick-up and support points for piles. Reinforcing steel details shall conform to **ACI SP-66**.

Pile Driving; G, DO

A complete and accurate record of all driven piles. The record shall include the pile number or identification, location, size, length, elevation of tip and top of pile, and the number of blows required for each foot of penetration throughout the entire length of the pile, and the number of blows per inch for the last **18 inches** of penetration. The record shall include the type and size of the hammer, the rate of operation, the type and dimensions of driving helmet, and the cap-block and pile cushion used. Any unusual occurrence during driving of the pile shall be recorded and immediately reported to the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to the driving of piles.

Wave Equation Analysis; G, DO

Submit wave equation analysis including pile driving criteria at least 30 days prior to installing any test piles. Revise analysis based on the results of pile load test program and submit updated analysis prior to driving permanent piles.

Professional Engineer; G, DO

The Contractor shall submit a letter certifying who will be the Professional Engineer with a minimum of 5 years of pile design and construction experience, licensed in the state of Florida, who will perform design work related to this section, and sign and seal calculations and as-built drawings/conditions for that work.

SD-03 Product Data

Pile Driving Equipment; G, DO

Submit descriptions of pile driving equipment to be employed in the work, 10 days prior to commencement of pile installations, including details of the pile hammer, power plant, lead, cushion material, cap block, and helmet.

Epoxy Bonding Compound for Pile Build-Ups; G, DO

SD-05 Design Data

Calculations; G, DO

Submit calculations showing the pile is capable of handling ultimate loadings specified in subparagraph "Pretensioned Piles" below prior to commencing work or ordering materials. Calculations shall be signed and sealed by the Professional Engineer indicated in the above submittal.

#### SD-06 Test Reports

Pile Dynamic Test Reports; G, DO

Field Tests and Inspections; G, DO

Pile Dynamic Test Reports: A complete report on the dynamically test piles including, but not limited to, a description of the pile driving equipment, driving records, complete test data, analysis of test data, and recommended pile driving criteria for permanent piles within 10 days of completion of dynamic test. The report shall be prepared by or under the direct supervision of a registered professional engineer experienced in pile dynamic load testing and analysis. The Pile Testing Engineer shall be employed by the Contractor with the approval of the Contracting Officer's Representative.

Material Test Reports: Copies of material test reports including concrete compression and mix proportioning studies, within 24 hours after completion of tests.

Aggregates; G, DO

Silica Fume; G, DO

Concrete Compressive Strength; G, DO

Test piles; G, DO

Load tests; G, DO

Submit concrete cylinder compressive strength test results.  
Submit test pile records and load test data.

Dynamic Pile Analysis; G, DO

Submit a summary report of dynamic test results for test piles within 7 calendar days of completing field work. For permanent piles, submit a field summary report within one (1) day of testing. Submit a typed report summarizing the results of dynamic testing of permanent piles on a monthly basis.

#### SD-07 Certificates

Aggregates; G, RO

Admixtures; G, RO

Silica fume manufacturer's representative; G, RO

Prestressing steel; G, RO

Cement; G, RO

Fly ash and pozzolan; G, RO

Ground Slag; G, RO

Epoxy coating; G, RO



Load Test Supporting Data; G, RO

SD-11 Closeout Submittals

File records; G, DO

Submit pile and test pile records. Submit load test data and results.

### 1.3 QUALIFICATIONS

The work shall be performed by a firm specializing in the specified foundation system and having 5 years experience in constructing and installing the specified foundation system under similar subsurface conditions.

### 1.4 SUBSURFACE DATA

Subsurface soil data logs are shown in Section 00 31 32 GEOTECHNICAL DATA.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Piles shall be stored, handled, and transported in accordance with **PCI MNL-116** except as follows. Methods used for handling and storage of piles shall be such that the piles are not subjected to excessive bending stress, cracking, spalling, or other damage.

#### 1.5.1 Damaged Piles

The Contractor shall inspect each pile for sweep and structural damage such as cracking and spalling before transporting them to the project site and immediately prior to placement in the driving leads. Any unusual cracks (cracks other than crazing, surface drying, shrinkage cracks and end cracks) shall be brought to the attention of the Contracting Officer. Piles which are damaged during delivery, storage, or handling to the extent they are rendered unsuitable for the work, in the opinion of the Contracting Officer, shall be rejected and removed from the project site, or may be repaired, if approved, at no cost to the Government.

##### 1.5.1.1 Repairable Cracks

Piles with cracks equal to or greater than **0.006 inches** but less than **0.06 inches** shall be rejected or repaired. As an alternate to pile rejection, the Contractor may submit a proposal to repair deficient piles, which shall be restored prior to driving to provide its required design capacity, perform its intended function in the structure, and take into consideration long term durability in corrosive environment.

##### 1.5.1.2 Non-Repairable Cracks

Piles with cracks equal to or greater than **0.06 inches** shall be rejected.

#### 1.5.2 Pile Sweep

Sweep shall be limited to **1/8 inch per 10 feet** over the length of the pile. Piles having excessive sweep shall be rejected.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Admixtures

Chemical admixtures shall conform to [ASTM C494/C494M](#). Air-entraining admixture shall conform to [ASTM C260/C260M](#). Admixtures containing chlorides shall not be used.

##### 2.1.1.1 Corrosion Inhibitors

Corrosion inhibitors shall meet the requirements of [ASTM G109](#) and all requirements in this section. Calcium nitrite is a chemically reactive admixture used in concrete to inhibit the corrosion of embedded reinforcing steel and other metallic components. The calcium nitrite supplier shall furnish the Contracting Officer with test certificates from an independent laboratory indicating compliance with this specification. The test certificates shall include corrosion inhibiting properties per [ASTM G109](#) and results of physical tests included in this section. Calcium nitrite shall be supplied by the same manufacturing source throughout the project. If a single primary source of calcium nitrite cannot be maintained throughout the project, new test certificates shall be submitted. The Contracting Officer will determine specification compliance of a new supplier's product, and evaluate the effectiveness of the new calcium nitrite product before approving the source.

The active ingredient shall be calcium nitrite  $\text{Ca}(\text{NO}_2)_2$ . The calcium nitrite shall be furnished in solution containing not less than 29 percent calcium nitrite solids. The concentration of the calcium nitrite solution shall be verified by spectrophotometric analysis or other comparable methods. A volume of one gallon of calcium nitrite solution shall weigh within the range of 10.40 to 11.92 pounds. The calcium nitrite solution shall be added to the concrete mixture at a rate of 4.50 to 4.60 gallons per cubic yard of concrete. The addition of calcium nitrite to the concrete mix shall not adversely affect the properties of fresh and hardened concrete. Calcium Nitrite concrete shall meet the following physical requirements when mixed and tested in accordance with [ASTM C494/C494M](#):

- a. Water Content percent of control 95 to 100.
- b. Time of setting, allowable deviation from control no more than 1 hour earlier nor 1 hour and 30 minutes later, initial and final.
- c. Compressive strength, minimum of 100 percent of control for all ages.
- d. Flexural strength, minimum of 100 percent of control for all ages.
- e. Length change, max shrinkage (alternative requirements), 135 percent of control.
- f. Increase over control, 0.010.
- g. Relative durability factor, minimum of 80.

##### 2.1.2 Aggregates

###### 2.1.2.1 General Requirements

Aggregates shall conform to [ASTM C33/C33M](#), except as specified otherwise herein. Aggregates shall be free from any substance which may be deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete.

#### 2.1.2.2 Fine Aggregates

Fine aggregates from different sources of supply shall not be mixed or stored in the same stock pile, or used alternately in the same concrete mix or the same structure without approval. The fineness MODULUS of fine aggregate shall be not less than 2.40 or greater than 3.0. For piles that will be exposed to freezing and thawing, fine and coarse aggregate subjected to five cycles of the sodium sulfate soundness test shall show a loss not greater than 10 percent. If the selected aggregates fail the soundness test, the Contractor may use the aggregate source, provided concrete specimens made with the aggregates to be used for the piles shall have a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with [ASTM C666/C666M](#).

#### 2.1.3 Anchorage

Anchorage and end fittings for post-tension assemblies shall conform to [ACI 318](#).

#### 2.1.4 Cement

Cement shall conform to [ASTM C150/C150M](#). Type II or Type III (with a maximum tricalcium aluminate (C3A) content of 8 percent and low alkali) cement, a minimum cementitious materials content of [658 pounds per cubic yard](#) and a maximum water to cementitious materials ratio of 0.40.

#### 2.1.5 Grout

Grout materials used in prestressed piles shall conform to the requirements specified herein for concrete mixes. Grout for post-tensioned ducts and bonds shall conform to [PCI JR-119](#). Admixtures, when required for grout, shall have no injurious effects on steel or concrete. Calcium chloride shall not be used.

#### 2.1.6 Prestressing Steel

Prestressing steel shall be seven-wire stress-relieved strand conforming to [ASTM A416/A416M](#) or stress-relieved wire conforming to [ASTM A421/A421M](#), Type WA. The minimum ultimate strength shall be [250,000 psi](#). Prestressing steel shall be free from grease, oil, wax, paint, soil, dirt, loose rust, kinks, bends, or other defects.

#### 2.1.7 Reinforcing Steel

Non-prestressed reinforcing steel shall conform to [ASTM A615/A615M](#) Grade 60. Welding of reinforcing steel shall be in accordance with [AWS D1.4](#).

#### 2.1.8 Ties and Spirals

Steel for ties and spirals shall conform to [ASTM A82/A82M](#).

#### 2.1.9 Water

Water for mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalies, salts, organic materials, or other substances that may be deleterious to concrete or steel. Mortar cubes made with nonpotable mixing water shall have 7-day and 28-day strengths equal to at least 90 percent of the strengths of similar specimens made with potable water.

## 2.2 MANUFACTURED UNITS - GENERAL REQUIREMENTS

Concrete piles shall be designed and fabricated by a precast concrete manufacturer certified under the PCI Plant Certification Program.

### 2.2.1 Pretensioned Piles

Pretensioned piles shall be solid and shall be cast as monolithic units of homogenous high-strength concrete from head to tip and stressed with high-tensile cold-drawn stress-relieved steel strands. Piles shall be capable of resisting an ultimate load combination (LRFD) of 10 kips axial, 20 kips lateral and 70 foot-kips bending moment.

### 2.2.2 Conveying

Concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that will not cause segregation or loss of ingredients in accordance with [ACI 304R](#). It shall be deposited as nearly as practicable in its final position in the forms. At any point in conveying, the free vertical drop of the concrete shall not exceed [3 feet](#). Chuting will be permitted only where the concrete is deposited into a hopper before it is placed in the forms. Conveying equipment shall be cleaned thoroughly before each run. Concrete shall be deposited as soon as practicable after the forms and the reinforcement have been inspected. Concrete that has segregated in conveying shall be removed.

## 2.3 FABRICATION OF PRETENSIONED PILES

### 2.3.1 Workmanship

Workmanship shall conform to [PCI MNL-116](#). Pile pick-up points shall be located where indicated. Unless special lifting devices are attached for pick-up, pick-up points shall be plainly marked on all piles after removal of the forms, and all lifting shall be done at these points. Piles shall be lifted by a suitable bridge or sling attached to the pick-up points. Piling shall not be driven until the concrete attains a compressive strength of not less than 6,000 [psi](#) as indicated by breaking test cylinders.

### 2.3.2 Forms

Forms shall be of metal, shall be well braced and stiffened against deformation, and shall be accurately constructed and watertight. Forms shall permit movement of the pile without damage during release of the prestressing force. Bottom of the form shall be within [1/4 inch](#) of a true plane in a length of [50 feet](#). Inside forms or void tubes may be of treated fiberboard, plywood, or other material and/or method approved by the Contracting Officer. Void forms shall be anchored firmly so they will not move, float, or collapse during the placing of concrete. If a moving mandrel is used for forming the inner void, special precautions shall be taken to prevent fallout of inner surfaces, tensile cracks, and separation of concrete from strands.

### 2.3.3 Reinforcement and Embedments

Reinforcing steel, prestressing steel, and embedded items shall be accurately positioned in the forms and secured to prevent movement during concrete placement. All steel shall have a minimum concrete cover of [3 inches](#).

#### 2.3.4 Concrete Work

The concrete mix shall have an ultimate compressive strength of 6,000 psi at 28 days and a slump of 2 to 4 inches. Concrete piles exposed to conditions of freezing and thawing shall contain from 4 to 7 percent entrained air provided by the use of an air-entraining admixture conforming to ASTM C260/C260M. Concrete shall not be deposited in the forms until the placement of reinforcement and anchorages has been inspected and approved by the Contracting Officer. Each pile shall be produced of dense concrete with smooth surfaces. Concrete shall be placed promptly after mixing is completed and shall be deposited close to its final position in the form. Vibrator heads shall be smaller than the minimum distance between steel for pretensioning. Dimensional tolerances shall conform to PCI MNL-116. Side forms shall not be removed until concrete has attained 4000 psi compressive strength.

#### 2.3.5 Pretensioning

Pretensioning shall be in accordance with PCI MNL-116. Anchorages for tensioning the prestressing steel shall be a type approved by the Contracting Officer. The tension to which the steel is to be pretensioned shall be measured by the elongation of the steel and verified by the jack pressure reading on a gauge. The gauge shall have been recalibrated by a calibration laboratory approved by the Contracting Officer within 12 months of commencing work and every 6 months thereafter during the term of the contract. Means shall be provided for measuring the elongation of the steel to at least 1/8 inch. When the difference between the results of measurement and gauge reading is more than 5 percent, the cause of the discrepancy shall be corrected. The tensioning steel shall be given a uniform prestress prior to being brought to design prestress. The same initial prestress shall be induced in each unit when several units of prestressing steel in a pile are stretched simultaneously.

#### 2.3.6 Detensioning

Releasing of prestressing force in pretensioned piles shall be performed in a manner that minimizes eccentricity of prestress. Tension in the strands shall be released from the anchorage gradually. In no case shall the stress be released after casting without approval by the Contracting Officer. The transfer of prestressing force shall be done in accordance with the prestressed concrete pile design.

#### 2.3.7 Casting

##### 2.3.7.1 Conveying

Convey concrete to formwork in accordance with PCI MNL-116, and as specified herein. Clean conveying equipment thoroughly before each run. During placing, make any free vertical drop of the concrete less than 3 feet. Remove concrete which has segregated in conveying or placing.

##### 2.3.7.2 Placing and Casting

Perform concrete casting within 3 days after pretensioning steel; however, do not deposit concrete in forms until placement of reinforcement and anchorages has been inspected and approved by pile manufacturer's quality control representative. Produce each pile of dense concrete straight with smooth surfaces with reinforcement retained in its proper position during

fabrication. Use vibrator with heads smaller than the minimum distance between steel for pretensioning. Make surface of pile ends perpendicular to axis of pile. Chamfer, between 3/4 inch and 1 1/4 inch, ends of piles and corners of square piles.

#### 2.3.8 Curing of Piles

Prior to the start of curing operations, the methods and details of curing shall be submitted for record and shall be approved by the Contracting Officers. All piles shall be cured in accordance with Section 4 of [PCI MNL-116](#).

#### 2.3.9 Build-Ups

If, in driving pretensioned piles, the Contracting Officer determines that the pile length is insufficient so that the final elevation of the pile head is below the indicated cut-off elevation, the pile section may be extended to the required elevation by means of a cast-in-place reinforced concrete build-up in accordance with procedures for build-up without driving as detailed in [PCI STD-112](#). Details of means for protecting the joints by a suitable epoxy compound shall be approved by the Contracting Officer. [Epoxy bonding compound for pile build-ups](#) shall have an ultimate compressive strength of 6,000 psi. Build-ups to be driven shall conform to the details of "Build-up with Driving" shown in the standard drawings referenced above. Where build-ups are exposed to water, the Contractor shall protect the cast-in-place section from the water during the curing period. Concrete in build-up shall have a minimum ultimate compressive strength of 6,000 psi. Build-ups will not be permitted on more than 5 percent of the total number of piles. If this percent figure is exceeded or if in the judgment of the Contracting Officer the clustered location of the build-ups is undesirable, piles of insufficient length shall be withdrawn and replaced with longer piles. Payment for such withdrawal and replacement will be made in accordance with the CONTRACT CLAUSES.

#### 2.3.10 Splices

Splices shall not be allowed.

### 2.4 MANUFACTURING CONTROLS

#### 2.4.1 Product Quality Control

Where piling is manufactured in a plant with an established quality control program as attested to by a current certification in the PCI "Certification Program for Quality Control" perform product quality control in accordance with [PCI MNL-116](#). Where piling is manufactured by specialists or in plants not currently enrolled in the PCI "Certification Program for Quality Control," set-up a product quality control system in accordance with [PCI MNL-116](#) and perform concrete and aggregate quality control testing using an independent commercial testing laboratory approved by the Contracting Officer in accordance with the following.

##### 2.4.1.1 Aggregates

Fine and coarse aggregates shall be tested for conformance with [ASTM C33/C33M](#).

#### 2.4.1.2 Cement Test

Cement shall be tested at the mill or at the mixing plant for conformance with [ASTM C150/C150M](#).

#### 2.4.1.3 Mix Proportions

Prior to commencing pile fabrication, the Contractor shall furnish a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete and lightweight concrete, proposed for use. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory. The statement shall also be accompanied by test results demonstrating compliance of aggregate and cement, as specified herein.

#### 2.4.2 Sampling and Testing During Fabrication

##### 2.4.2.1 Aggregate

Twice during each shift when the concrete plant is operating, the gradation of each size of aggregate shall be tested in accordance with [ASTM C136](#). At least one test of moisture content of coarse aggregate, in accordance with [ASTM C566](#), and at least two tests of moisture content of fine aggregate, in accordance with [ASTM C70](#) or [ASTM C566](#), shall be made per shift.

##### 2.4.2.2 Slump and Strength of Concrete

Two slump tests in accordance with [ASTM C143/C143M](#) shall be made for each **50 cubic yards** of concrete produced per shift. Samples of fresh concrete shall be taken in accordance with [ASTM C172](#). Cylinders shall be molded and cured in accordance with [ASTM C31/C31M](#), and tested in accordance with [ASTM C39/C39M](#). Samples for each class of concrete shall be taken not less than once a day nor less than once for each **30 cubic yards** of concrete placed. Each strength test result shall be the average of two cylinders from the same sample tested at 28 days. Additional specimens shall be molded as needed by the Contractor or pile manufacturer. The Contractor or pile manufacturer shall mold, ship, cure, and test the cylinders. The cylinders shall be cured in the same manner as the piles and shall be placed at the point where the poorest curing conditions are offered. Evaluation of the compressive test results tested at 28 days shall be in accordance with [ACI 214R](#). The Contractor or pile manufacturer shall certify that the sampling and test methods conform to the requirements of [ASTM C31/C31M](#) and [ASTM C39/C39M](#) and that sufficient samples were taken to evaluate the concrete as follows: The average of three consecutive strength tests shall equal or exceed the specified strength and no individual strength test result shall have less than the specified strength by more than 500 **psi**. All test results shall be submitted to the Contracting Officer.

#### 2.4.3 Changes in Proportions

If the test results of the laboratory cured cylinders at 28 days fall below the specified compressive strength, adjustments in the proportions, the water content, or both shall be made as necessary; if the test results of

the field-cured specimens fall below the specified strength, changes in the casting, handling, or storage method and the moisture and curing procedures of such specimens shall be made as necessary to secure the specified strength. All changes shall be submitted in writing to the Contracting Officer. The slump shall be as specified.

### PART 3 EXECUTION

#### 3.1 PRELIMINARY WORK

##### 3.1.1 Wave Equation Analysis of Pile Drivability

- a. Prior to driving any pile, the Contractor shall submit a pile Wave Equation Analysis, performed by his Geotechnical Consultant, for each size pile and distinct subsurface profile condition. These analyses shall take into account the proposed hammer assembly, pile cap block and cushion characteristics, the pile properties and estimated lengths and the soil properties anticipated to be encountered throughout the installed pile length based on static capacity analysis with consideration of driving gain/loss factors. Only one specific model of pile hammer may be used for each pile type and capacity.
- b. The Wave Equation Analysis shall demonstrate that the piles will not be damaged during driving, shall indicate that the driving stresses will be maintained within the limits below and indicate the blow count necessary to achieve the required ultimate static pile capacities.

#### Allowable Driving Stresses

##### Steel Piles

Compression - 0.9 fy  
Tension - 0.9 fy

Where fy is yield strength of steel

##### Concrete

Compression -  $0.85f'_c$  minus UPL  
Tension - (3 times (the square root of  $f'_c$ )) plus UPL

$f'_c$  is compressive strength of concrete

UPL = Unit Prestress after Losses

(Obtain values from pile manufacturer)

- c. Upon completion of the dynamic and static testing programs outlined in this specification section, a refined Wave Equation Analysis shall be performed taking into consideration the evaluated capacities, gain/loss factors and recommended production pile lengths. Production pile driving criteria shall be developed based on the results of the refined Wave Equation Evaluations.
- d. All pile driving equipment furnished by the Contractor shall be subject to the approval of the Contractor's Geotechnical Consultant. Complete the attached pile and driving equipment data form, including hammer information, in full as part of the submittal of the results of the Wave Equation Analyses.
- e. The cost of performing the Wave Equation Analyses shall be paid for by



the Contractor and included in the base bid.

### 3.2 INSTALLATION

#### 3.2.1 Handling and Driving

Piles or pile sections shall not be handled or moved in any manner that would result in cracking or permanent damage to the concrete or to the grout surrounding the prestressing cables. Piles shall not be driven until the concrete has attained a minimum strength of 6,000 psi. Piles may be driven without pile guides or leads providing a hammer guide frame is used to keep the pile and hammer in alignment.

#### 3.2.2 Pile Driving

Excavation shall be stopped at 1 foot above foundation grade before piles are driven. When pile driving is completed, excavation shall be completed to lines and grade shown. Piles shall be driven continuously and without interruption to or below the tip elevation established from the load test program to reach a driving resistance in accordance with the schedule which the Contracting Officer will prepare. The pile hammer used for driving shall be the same type, operated at the same rate and in the same manner, as that used for driving the test piles. Diesel-powered hammers shall be operated at the rate recommended by the manufacturer throughout the entire driving period. Sufficient pressure shall be maintained at the steam hammer so that:

- a. For a double-acting hammer, the number of blows per minute during and at the completion of driving of the pile is equal approximately to that at which the hammer is rated.
- b. For a single-acting hammer, there is a full upward stroke of the ram.
- c. For a differential type hammer, there is a slight rise of the hammer base during each upward stroke.

If a pile fails to reach the required tip elevation or if a pile reaches the tip elevation without reaching the required driving resistance, the Contractor shall notify the Contracting Officer and perform corrective measures as directed by him.

#### 3.2.3 Cutting of Piles

When necessary and approved by the Contracting Officer, cutting of piles shall be with pneumatic tools, sawing, or other approved methods. The use of explosives for cutting will not be permitted.

#### 3.2.4 Protection of Piles

Care shall be taken to avoid damage to the piles in handling piles, in placing the pile in the leads, and during the pile driving operations. Where pile or projecting reinforcement orientation is essential, special care shall be taken to maintain the orientation during driving. The top of the pile shall be squared to the longitudinal axis of the pile. If the Contractor elects to use a pile head with projecting strands or mild steel reinforcing, a special driving head shall be used to prevent damage to the reinforcement and prevent direct impact forces from being transmitted through the reinforcement.

### 3.2.5 Tolerances in Driving

All piles shall be driven with a variation of not more than 0.20 inch per foot of pile length from the vertical for plumb piles. Top of pile shall be within 3 inches of the location indicated. Manipulation of piles to force them into position will not be permitted. All piles will be checked for heave. Piles found to have heaved shall be redriven to the required point elevation.

### 3.2.6 Build-Ups

If any pile does not attain sufficient resistance or penetration when the pile head is at the established cut-off elevation, driving shall continue until the required resistance or penetration is reached. The pile shall be built-up to the specified cut-off elevation by a cast-in-place extension of the pile, by a pile section, or by use of an acceptable length of pile cut-off. The splice between the pile and build-up shall be accomplished by a poured plug of reinforced concrete extending a minimum of one outside-pile-diameter into the pile and an equal length into the build-up where possible. The splice plug may be an extension of the pile-to-cap connecting plug. If pile tops are damaged during driving, the damaged portion shall be removed and the pile built-up as necessary.

## 3.3 PILE DRIVING EQUIPMENT

### 3.3.1 Pile Hammers

The hammer used shall have a delivered energy suitable for the total weight of the pile, the character or subsurface material to be encountered, and the pile capacity to be developed. The driving energy of the hammer shall be as recommended by the manufacturer for the piling weight and subsurface material to be encountered. Repair damage to piling caused by use of a pile hammer with excess delivered force or energy.

### 3.3.2 Driving Helmets and Pile Cushions

A driving helmet or cap including a pile cushion shall be used between the top of the pile and the ram to prevent impact damage to the pile. The driving helmet or cap and pile cushion combination shall be capable of protecting the head of the pile, minimize energy absorption and dissipation, and transmit hammer energy uniformly over the top of the pile. The driving helmet or cap shall fit loosely around the top of the pile so that the pile is not restrained by the driving cap if the pile tends to rotate during driving. The pile cushion may be of solid wood or of laminated construction, shall completely cover the top surface of the pile, and shall be retained by the driving helmet. The minimum thickness of the pile cushion shall be 3 inches and the thickness shall be increased so as to be suitable for the size and length of pile, character of subsurface material to be encountered, hammer characteristics, and the required driving resistance. The pile cushion shall be replaced if it has been highly compressed, charred, or burned or has become deteriorated in any manner during driving.

### 3.3.3 Capblocks

The capblock used between the driving cap and the hammer ram may be of solid hardwood block with grain parallel to the pile axis and enclosed in a close fitting steel housing or may consist of aluminum and approved

industrial type plastic laminate discs stacked alternately in a steel housing. Steel plates shall be used at the top and the bottom of the capblock. Where the block is other than that specified above, the Contractor shall submit to the Contracting Officer at least 2 weeks before the start of test pile driving operations, detailed drawings of the capblock he proposes to use accompanied by records of the successful use. The capblock shall be replaced if it has been damaged, highly compressed, charred, or burned or has become spongy or deteriorated in any manner. If a wood capblock is used, it shall not be replaced during the final driving of any pile. Under no circumstances will the use of small wood blocks, wood chips, rope, or other material permitting excessive loss of hammer energy be permitted.

### 3.4 PILE TESTS

Pile Tests - Pile dynamic load tests shall be performed as specified and as shown or as directed. The Pile Testing Engineer will develop the correlation between pile driving resistance and pile capacity, and the pile driving criteria during the pile tests for the selected pile driving system. Based on the correlations developed, the Pile Testing Engineer will determine the minimum tip elevations, required driving resistance or refusal blow count for the permanent piles. Changes in the approved pile driving system during or after completion of tests will not be allowed unless additional tests are performed as directed to establish the correlation between driving resistance and pile capacity for the proposed changed system. For changes in the approved pile driving system proposed by the Contractor, required additional pile tests shall be performed at the Contractor's expense and no additional contract time will be allowed.

The Contractor shall appoint a Professional Engineer with a minimum of 5 years experience in pile design and construction, licensed in the state of Florida, who will perform design work and prepare calculations related to the work in this section, and sign and seal calculations and as-built drawings/conditions for that work.

#### 3.4.1 Test Piles

Test piles shall be of the indicated lengths and shall be placed at the indicated or directed locations. Test piles shall be driven with the same equipment specified in paragraph PILE DRIVING EQUIPMENT and in the same manner specified in paragraph DRIVING for permanent piles. The driving record data shall be recorded for each test pile driven. A pile driving analyzer shall be provided and operated as specified by the manufacturer during the driving of each test pile.

#### 3.4.2 Dynamic Testing of Piles

Dynamic testing of piles shall be performed as specified herein and in accordance with [ASTM D4945](#) for dynamic load tests. The purpose of this testing shall be to determine velocity of stress wave propagation, acceleration, monitor hammer and drive system performance, assess pile installation stresses and integrity, evaluate pile capacity, and develop pile driving criteria. The Contractor shall inform the Contracting Officer at least 21 days before beginning all load tests and shall make provisions available for the Contracting Officer or his Authorized Representative to be presented during all load tests. Dynamic Load Tests will be performed by a Testing Engineer supplied and paid for by the Contractor with the approval of the Contracting Officer. The Contractor shall cooperate with the Testing Engineer for installation and removal of instrumentation along

with pile monitoring during driving. The Contractor's driving system shall not cause damage to the required instrumentation. All power requirements for operating the equipment shall be supplied by the Contractor. Prior to commencing pile driving, a wave equation analysis shall be performed and the results submitted in accordance with paragraph SUBMITTALS. Test piles for which dynamic load tests have been performed and in which the test pile has been damaged to the extent of making the test pile data of insufficient value, in the opinion of the Contracting Officer, shall be replaced with a new test pile, with an equivalent dynamic load test, driven at the same location. Damaged piles shall be extracted and disposed of.

#### 3.4.2.1 Dynamic Test Piles

Dynamic testing shall be performed on 6 test piles as indicated in the drawings or at locations directed by the Contracting Officer. These test piles shall be at permanent pile locations. Test piles shall be provided in lengths sufficient to install piles to at least 15 feet below the target tip elevations indicated on the drawings and to allow piles to sufficiently extend above the ground surface. If undamaged, test piles may be used as permanent piles. Testing shall be performed during the full length of pile driving. All piles installed as part of "dynamic" pile test program shall be restruck after a minimum waiting period of 7 days. The hammer shall be warmed up prior to restriking. Restriking shall consist of restriking the pile for 50 blows or until the pile penetrates an additional 3 inches, whichever occurs first. In the event the pile movement is less than one-quarter inch during restrike, the restrike may be terminated after 20 blows. All restrikes shall include dynamic testing. The Contractor shall develop the pile driving criteria based on the pile test program for use of production pile installation.

#### 3.4.2.2 Reports

A summary report of dynamic test results for test piles shall be prepared by the Testing Engineer and submitted in accordance with paragraph SUBMITTALS. The report shall discuss pile capacity obtained from dynamic testing, and also include velocity of stress wave propagation, acceleration, evaluation of hammer and driving system performance, driving stress levels, and pile integrity. A CAPWAPC, or similar, analysis of the dynamic test data shall be performed on data obtained from the end of initial driving and the beginning of restrike for all test piles. The analysis shall be used to predict pile capacity, establish resistance distribution, and predict quake and damping factors. Refined wave equation analyses incorporating the results of dynamic testing and analysis shall be included. The Contracting Officer will make the report available to the Contractor to be included in the pile driving record as an attachment. The report shall also include the recommended pile driving criteria for production pile installation.

#### 3.4.2.3 Dynamic Testing Permanent Piles

In addition to the six test piles, ten dynamic load tests on production piles shall be performed at piles selected by the Contracting Officer in accordance with all of the requirements of the paragraph DYNAMIC TESTING OF PILES above, and all of the appertaining subparagraphs, to verify pile capacities. If the dynamic load test demonstrates a change in the Contractor's pile driving system, which requires recalibration of the system in order to have confidence in obtaining the required pile capacities, the cost of the dynamic load test shall be paid by the Contractor.

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SECTION 32 11 23

LIMEROCK BASE FOR ROADS

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.

FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT)

**FDOT** Standard Specifications for Road and  
Bridge Construction

Special Provisions, when applicable, are appended and included as an attachment to this specification section.

Where an FDOT Standard, Supplemental Specification Section, and/or Special Provision(s) is cited that contains references to other FDOT sections, they shall also form a part of this specification to the extent referenced.

The most recent accepted FDOT Standard Specifications will apply. Copies of the FDOT Standard Specifications can be obtained from the Florida Department of Transportation Map & Publication Sales, 605 Suwannee Street, Mail Station 12 Tallahassee, FL 32399-0450. Phone (850) 414-4050, Fax (850) 414-4915 or online at [www.dot.state.fl.us/specificationsoffice](http://www.dot.state.fl.us/specificationsoffice).

Where reference is made to "Department" or "Engineer" in the FDOT Standard Specifications, Supplemental Specifications, or Special Provisions, it shall mean "Government" or "Contracting Officer" as defined in the Contract Documents.

Requirements specified herein, specifically method of measurement and basis of payment, take precedence over FDOT Standard Specifications, Supplemental Specifications, and Special Provisions.

ASTM INTERNATIONAL (ASTM)

**ASTM D1556** (2007) Density and Unit Weight of Soil in  
Place by the Sand-Cone Method

**ASTM D2487** (2011) Soils for Engineering Purposes  
(Unified Soil Classification System)

**ASTM D6938** (2010) Standard Test Method for In-Place  
Density and Water Content of Soil and  
Soil-Aggregate by Nuclear Methods (Shallow  
Depth)

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 01 33 00 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

##### Offsite Plant, Equipment, and Tools; G, RO

List of proposed equipment to be used in performance of construction work, including descriptive data.

##### Waybills and delivery tickets; G, RO

##### Aggregate Sources; G, DO

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all materials actually used. Plan for operation of a new source of aggregates well in advance of starting production.

#### SD-06 Test Reports

##### Sampling and Testing; G, RO

##### Field Density Tests; G, RO

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.

### 1.3 SAMPLING AND TESTING

#### 1.3.1 Aggregate Sampling and Testing

Base courses shall be sampled and tested in accordance with the following FDOT Standard Specifications:

ROCK BASE.....Section 200-7

#### 1.3.2 Field Density Tests

The Contractor shall perform field density tests as required by the Contracting Officer. Density shall be field measured in accordance with ASTM D6938. For the method presented in ASTM D6938, the calibration curves shall be checked and adjusted if necessary using only the sand cone method (ASTM D1556) as described in paragraph Calibration of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight, and ASTM D6938 shall be used to determine the moisture content. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed.

### 1.4 WEATHER LIMITATIONS

It shall be the responsibility of the Contractor to protect, by approved



method or methods, all areas of surfacing that have not been accepted by the Contracting Officer. Surfaces damaged by rainfall or other weather conditions shall be brought to a satisfactory condition by the Contractor.

#### 1.5 OFFSITE PLANT, EQUIPMENT, AND TOOLS

##### 1.5.1 Aggregate Plant, Equipment, and Tools

All offsite aggregate plant, equipment, and tools used in the performance of the work shall 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.

#### 1.6 WAYBILLS AND DELIVERY TICKETS

Copies of waybills and delivery tickets shall be submitted during progress of work. Before the final statement is allowed, the Contractor shall submit certified waybills and certified delivery tickets for all aggregate material actually used in construction covered by the contract.

### PART 2 PRODUCTS

#### 2.1 QUALIFIED PRODUCTS LIST

The FDOT maintains a list of qualified products which have previously been determined as meeting requirements for use on FDOT projects. Products included on this list, as specified in FDOT Standard Specifications Section 6-1, will be permitted without further testing. The FDOT Qualified Products List Internet address is <http://www.dot.state.fl.us/SpecificationsOffice/ProductEvaluation/QPL/QPLIndex.shtm>. The inclusion of any specific product on the Qualified Products List, as specified in FDOT Standard Specifications Section 6-1, indicates that the product has been given contingent approval, as evidence by previous tests and apparent effectiveness under field conditions.

#### 2.2 AGGREGATE BASE COURSE MATERIALS (LBR 100)

##### 2.2.1 Limerock

Limerock utilized in a base course shall be in accordance with the following FDOT Standard Specifications:

LIMEROCK MATERIAL FOR BASE  
AND STABILIZED BASE.....Section 911

### PART 3 EXECUTION

#### 3.1 AGGREGATE BASE COURSE MATERIALS (LBR 100)

##### 3.1.1 General Requirements

When the aggregate base course 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.

### 3.1.2 Operation of Aggregate Sources

Clearing, stripping, and excavating shall be the responsibility of the Contractor in accordance with Section 35 41 00 EMBANKMENT CONSTRUCTION. The aggregate sources shall be operated to produce the quantity and quality of materials meeting these specifications requirements in the specified time limit. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.

#### 3.1.2.1 Monitoring Aggregate Sources

Monitoring of aggregate sources utilized for construction aggregates shall be in accordance with the requirements of the FDOT Materials Manual Chapter 1 - Mineral Aggregates. The FDOT Materials Manual Internet address is: <http://www.dot.state.fl.us/statematerialsoffice/administration/resources/library/publications/materialsmanual/index.shtm>.

### 3.1.3 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.

### 3.1.4 Preparation of Underlying Course

Prior to constructing the aggregate base course(s), the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the base course(s), the underlying course shall contain no deleterious material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 35 41 00 EMBANKMENT CONSTRUCTION. 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 D2487, the surface shall be stabilized prior to placement of the base course(s). Stabilization shall be accomplished by mixing aggregate base course 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 base course is placed.

### 3.1.5 Installation

#### 3.1.5.1 Equipment

Equipment used for aggregate base course installation shall be in

accordance with the following **FDOT** Standard Specification:

ROCK BASE.....Section 200-3

#### 3.1.5.2 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary offsite plant, or in an offsite 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 ensure a satisfactory base course meeting all requirements of this specification. Adjustments to the JMF shall be limited to plus or minus 5 percent on the 1-1/2 inch and coarser sieves; plus or minus 8 percent on the 1 inch to No. 4 sieves; plus or minus 5 percent on the No. 30 sieve; and plus or minus 3 percent on the No. 200 sieve.

#### 3.1.5.3 Transporting Aggregates

Aggregates for base courses shall be transported in accordance with the following **FDOT** Standard Specification:

ROCK BASE.....Section 200-4

#### 3.1.5.4 Spreading Aggregates

Aggregates for base courses shall be spread in accordance with the following **FDOT** Standard Specification:

ROCK BASE.....Section 200-5

#### 3.1.5.5 Grade Control

The finished and completed base course shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required base course thickness so that the finished base course and the subsequent surface course will meet the designated grades.

#### 3.1.5.6 Edges of Base Course

The base course(s) shall be placed so that the completed section will be a minimum of 2 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 the base course 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 2 foot width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of base course. 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.

#### 3.1.5.7 Compaction and Finishing

Limerock base courses shall be compacted a minimum 98% of Modified Proctor maximum dry density and finished in accordance with the following **FDOT** Standard Specifications:

ROCK BASE.....Section 200-6 and 7

At least one density test shall be performed per lift, or as specified by  
FDOT Standard Specs, whichever frequency is greater.

#### 3.1.5.8 Smoothness

The surface of the top layer shall show no deviations in excess of  $\frac{3}{8}$  inch when tested with a 12 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 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.

#### 3.1.5.9 Thickness Requirements

Finished thickness of aggregate base courses shall be as shown on the drawings.

#### 3.1.6 Traffic

Completed portions of the aggregate base courses may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

#### 3.1.7 Maintenance

The base course 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 area of base course that is damaged shall be reworked or replaced as necessary to comply with this specification. Aggregate base courses shall be primed and maintained in accordance with the following FDOT Standard Specifications:

ROCK BASE.....Section 200-8

#### 3.1.8 Disposal of Unsatisfactory Materials

Any unsatisfactory materials that must be removed shall be disposed of as directed by the Contracting Officer. No additional payments will be made for materials that must be replaced.

-- End of Section --

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SODDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4972 (2001; R 2007) pH of Soils

ASTM D5268 (2007) Topsoil Used for Landscaping  
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 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Delivery

Delivery Schedule.

Finished Grade and Topsoil

Finished Grade Status.

Topsoil

Availability of topsoil from the stripping and stock piling operation.

Quantity Check; G, RO

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; G, RO

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.

#### 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  
Topsoil  
Fertilizer

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 and state certification.
- b. Topsoil. Particle size, pH, organic matter content, textural  
class, chemical and mechanical analyses.
- c. Fertilizer. Chemical analysis and composition percent.
- d. Soil Conditioner: Composition and source.

#### 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.

#### 1.4.2 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 1-1/2 inch 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.

##### 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 material 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.

#### 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

State-certified 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 at least 90 percent Argentine Bahiagrass (*paspalum notatum*).

#### 2.1.3 Quality

Sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 1 inch 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 1-3/8 inch thickness. Measurement for thickness shall exclude top growth and thatch.

#### 2.1.5 Anchors

Sod anchors shall be used as recommended by the sod supplier.

### 2.2 TOPSOIL

Topsoil shall be as defined in [ASTM D5268](#). When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite. 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 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts. Topsoil shall be tested in accordance with subparagraph "Soil Test" below.

### 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 Fertilizer

Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition. 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. Fertilizer shall not contain phosphorous.

## 2.3.2 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

### 2.3.2.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

### 2.3.2.2 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.

### 2.3.2.3 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.

### 2.3.2.4 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 3/8 inch 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 2 inches in length.

### 2.3.2.5 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

## 2.3.3 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.

### 2.3.3.1 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.

### 2.3.3.2 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95

percent calcium sulfate by volume.

## 2.4 WATER

Water shall be the responsibility of the Contractor unless otherwise noted. Water shall not contain elements toxic to plant life.

## PART 3 EXECUTION

### 3.1 INSTALLING SOD TIME AND CONDITIONS

#### 3.1.1 Areas to be Sodded

Sod all disturbed areas within the limits of construction.

#### 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 D5268](#) and [ASTM D4972](#) 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 [35 41 00](#) EMBANKMENT CONSTRUCTION. Place topsoil to a minimum of 4 inches thick under sod.

### 3.2.2 Application of Soil Amendments

#### 3.2.2.1 Applying Fertilizer

The application rate shall be 275 pounds per acre. Fertilizer shall be incorporated into the soil to a maximum 4 inch depth.

#### 3.2.2.2 Applying Soil Conditioner

The application rate shall be 2,200 pounds per acre. The soil conditioner shall be spread uniformly over the soil a minimum 1 inch depth and thoroughly incorporated by tillage into the soil to a maximum 4 inches depth.

#### 3.2.2.3 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 2 inches 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 4 inches deep. Slopes greater than 3-horizontal-to-1-vertical are not permitted. 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 1 inch 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 5/8 inch 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 on the drawings. 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 1 inch 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 2 feet on center with a minimum 2 anchors per sod section.

### 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 90 pounds per foot 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 1 inch. 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 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.

## 3.5 RESTORATION AND CLEAN UP

### 3.5.1 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.

### 3.5.2 Clean Up

Excess and waste material shall be removed from the sodded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

### 3.6 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.

### 3.7 SOD ESTABLISHMENT PERIOD

#### 3.7.1 Commencement

The sod establishment period to obtain a healthy stand of grass plants shall begin on the first day of work under this contract and shall end 3 months after the last day of sodding operation. 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 and provided by the Contractor. The sod establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

#### 3.7.2 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 2 inch square. Joints between sod pieces shall be tight and free from weeds and other undesirable growth.

#### 3.7.3 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. Weeds shall not exceed 10 percent of established grass, as measured by surface area, at the conclusion of the establishment period.

##### 3.7.3.1 Mowing

Mowing shall not begin until the grass has produced seed. Areas shall be mowed to a range of 4 to 8 inches in height. Frequency of mowing shall be as necessary to maintain this height range. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface. The Contractor shall be responsible for determining if proper maintenance requires more frequent mowing.

##### 3.7.3.2 Post-Fertilization

The application rate shall be 275 pounds per acre. A maximum 1/2 pound per 1000 square feet 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.

##### 3.7.3.3 Repair

Unsatisfactory stand of grass plants shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

3.7.3.4 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.

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SECTION 33 29 00

DECOMMISSIONING WELLS

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all plant, labor, equipment, and materials and performing all operations in connection with the decommissioning of dewatering wells and piezometers as part of the culvert replacement.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C150/C150M (2012) Standard Specification for Portland Cement

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA A100 (2006; Errata 2007) Water Wells

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Well Closure Plan; G, DO

The Contractor shall provide a plan describing the equipment, procedures, materials, and person(s) to be used in the decommissioning of dewatering wells and piezometers identified on the drawings or discovered during construction.

SD-06 Test Reports

Post Construction Well Closure Report; G, DO

The Contractor shall provide a report that documents the procedures and results of the well closure operations for all decommissioned wells. The report shall indicate the wells that were decommissioned and all information indicated in the paragraph DOCUMENTATION AND QUALITY CONTROL REPORTS.

Water Level Summary Report; G, DO

The Contractor shall provide a spreadsheet documenting the water levels recorded in all wells within the work limits. The well ID and water level for each date, and date that a well is decommissioned shall be included.

## PART 2 PRODUCTS

### 2.1 CEMENT AND BENTONITE GROUT

Cement grout shall consist of Portland cement conforming to ASTM C150/C150M, Type I or II, sand and water. Cement grout shall be not more than 6 gallons of water per 94 lb bag of Portland cement. Five (5) percent by weight of bentonite powder shall be added to reduce shrinkage. The Contractor may propose an alternative mix as part of the Well Closure Plan.

## PART 3 EXECUTION

### 3.1 WATER LEVEL MEASUREMENTS

Groundwater levels of all wells within the work limits of the project shall be measured weekly until abandoned, or the completion of work. These water levels shall be included in the decommissioning/abandonment records and provided on the Water Level Summary Report.

### 3.2 WELL DECOMMISSIONING

The Contractor shall request permission from the Contracting Officer to abandon wells that are expected to be impacted by the construction activities or dewatering wells once construction is near completion or complete. Any well to be abandoned shall be decommissioned by the Contractor according to the requirements of the State of Florida (web address <http://www.dep.state.fl.us/mainpage/programs/water.htm>), the Department of Health, and the requirements herein. Wells or holes decommissioned or abandoned for any reason shall be flushed to remove sediments, measured to determine the overall length of the well, and grouted from the bottom to the ground surface according to paragraph GROUT PLACEMENT, using the grout mix specified in paragraph CEMENT AND BENTONITE GROUT above. Notify the Contracting Officer at least 2 days prior to decommissioning any well. The Contractor shall maintain a well decommissioning and abandonment record as specified in paragraph DOCUMENTATION AND QUALITY CONTROL REPORTS.

### 3.3 GROUT PLACEMENT

Cement grout shall be mixed according to the requirements of paragraph CEMENT AND BENTONITE GROUT above, and place by tremie pipe, in one continuous operation, into the borehole/well as indicated in paragraph WELL DECOMMISSIONING above. Inject grout in accordance with AWWA A100. The discharge end of the tremie pipe shall be submerged at all times. Additional grout shall be added from the surface to maintain the required level of grout as settlement occurs.

### 3.4 DOCUMENTATION AND QUALITY CONTROL REPORTS

The Contractor shall establish and maintain documentation and quality control reports including records on well/borehole decommissioning and abandonment. These records shall include, as a minimum, the following:

- a. Project name.
- b. Well or test hole number.
- c. Well/boring location, depth and diameter.
- d. Date of decommissioning/abandonment.
- e. Method of decommissioning/abandonment.
- f. All materials used in the decommissioning/abandonment procedure, and the interval in which test materials were placed.
- g. Casing, and other items left in the hole by depth, description, and composition.
- h. Description and total quantity of grout used initially.
- i. Description and daily quantities of grout used to compensate for settlement.
- j. Water or mud level (specify) prior to grouting and date measured.
- k. The reason for decommissioning/abandonment of the well/test hole.

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SECTION 33 46 13

INTERNAL DRAINAGE SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 252 (2009) Standard Specification for  
Corrugated Polyethylene Drainage Pipe

ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M (2013) Standard Specification for Concrete  
Aggregates

ASTM F2648 (2010) 2 to 60 inch Annular Corrugated  
Profile Wall Polyethylene (PE) Pipe and  
Fittings for Land Drainage Applications

ASTM F405 (2005) Corrugated Polyethylene (PE) Tubing  
and Fittings

ASTM F667 (2012) Large Diameter Corrugated  
Polyethylene Pipe and Fittings

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Materials; G, RO

Submit a certification for each type of drainage pipe used attesting that pipe material meets specification requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

Protect materials placed in storage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Do not expose plastic pipe to direct sunlight for more than 6 months from time of manufacturer to installation.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Pipe for internal drainage system shall be of the type and size indicated. Appropriate transitions, adapters, or joint details shall be used where pipes of different types or materials are connected.

#### 2.1.1 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

##### 2.1.1.1 Corrugated High Density Polyethylene (HDPE) Drainage Pipe

For perforated pipe, 8 inches in diameter, furnish pipe classified as "Type SP" per AASHTO M 252. For non-perforated pipe, furnish pipe classified as "Type S" per AASHTO M 252. Pipes shall meet the minimum requirements of ASTM F2648 with a minimum hydrostatic design basis of 1,000 psi. Fittings shall be pipe manufacturer's standard type and shall conform to the indicated specification.

##### 2.1.1.2 Circular Perforations in Plastic Pipe

Circular holes for pipe bedded in ASTM C33/C33M No. 89 stone (landside pipes) shall be cleanly cut in the valley of the corrugations, not more than 0.16 inch or less than 0.125 inch in diameter. Holes shall be arranged in rows parallel to the longitudinal axis of the pipe, with a minimum of 4 holes per valley. The spigot or tongue end of the pipes shall not be perforated for a length equal to the depth of the socket and perforations shall continue at uniform spacing over the entire length of the pipe. Manufacturer's standard perforated pipe which essentially meets these requirements may be used with prior approval of the Contracting Officer.

#### 2.1.2 Bedding and Backfill for Drain Pipes

Bedding and backfill shall be in accordance with Section 35 41 00 EMBANKMENT CONSTRUCTION.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### 3.1.1 Trenching and Excavation

Perform required trenching and excavation in accordance with Section 35 41 00 EMBANKMENT CONSTRUCTION. Keep trenches dry during installation of drainage system.

#### 3.1.2 Bedding

Place bedding, minimum 6 inches in depth, in the bottom of trench for its full width and length compacted as specified prior to laying the drain pipe. Each section shall rest firmly upon the bedding, through the entire length, with recesses formed for bell joints. Except for recesses for bell joints, the bedding shall fully support the lower quadrant of the pipe.

### 3.1.3 Pipe Laying

Lay drain lines to true grades and alignment indicated on the drawings. Bells of pipe sections shall face upgrade. Clean interior of pipe thoroughly before being laid. When drain lines are left open for connection to discharge lines, the open ends shall be temporarily closed and the location marked with wooden stakes. Any length that has had its grade or joints disturbed shall be removed and relaid at no additional cost to the Government. Perforated drainage piping shall be installed in accordance with manufacturer's specifications and as specified herein. Tubing and piping with physical imperfections shall not be installed.

### 3.1.4 Jointing

#### 3.1.4.1 Corrugated Polyethylene

Corrugated polyethylene (PE) pipe joints shall be in accordance with ASTM F405 or ASTM F667.

### 3.1.5 Cleanouts

Provide cleanouts in locations indicated on the drawings.

## 3.2 BACKFILLING

See Section 35 41 00 EMBANKMENT CONSTRUCTION.

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UNDERGROUND ELECTRICAL DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318M (2011; Errata 2013) Building Code  
Requirements for Structural Concrete &  
Commentary

ACI SP-66 (2004) ACI Detailing Manual

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO HB-17 (2002; Errata 2003; Errata 2005, 17th  
Edition) Standard Specifications for  
Highway Bridges

AASHTO M 198 (2010) Standard Specification for Joints  
for Concrete Pipe, Manholes, and Precast  
Box Sections Using Preformed Flexible  
Joint Sealants

ASTM INTERNATIONAL (ASTM)

ASTM B1 (2012) Standard Specification for  
Hard-Drawn Copper Wire

ASTM B3 (2012) Standard Specification for Soft or  
Annealed Copper Wire

ASTM B8 (2011) Standard Specification for  
Concentric-Lay-Stranded Copper Conductors,  
Hard, Medium-Hard, or Soft

ASTM C139 (2011) Standard Specification for Concrete  
Masonry Units for Construction of Catch  
Basins and Manholes

ASTM C309 (2011) Standard Specification for Liquid  
Membrane-Forming Compounds for Curing  
Concrete

ASTM C478 (2013) Standard Specification for Precast  
Reinforced Concrete Manhole Sections

ASTM C857	(2013) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM F512	(2012) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)	
IEEE C2	(2012; Errata 2012; INT 1-4 2012; INT 5 2013) National Electrical Safety Code
IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)	
NETA ATS	(2013) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA C119.1	(2006) Sealed Insulated Underground Connector Systems Rated 600 Volts
NEMA RN 1	(2005) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 6 & 8	(2003) Standard for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations
NEMA TC 9	(2004) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2014) National Electrical Code
TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)	
TIA-758-A	(2004) Customer-Owned Outside Plant Telecommunications Cabling Standard
U.S. DEPARTMENT OF AGRICULTURE (USDA)	
RUS Bull 1751F-644	(2002) Underground Plant Construction

UNDERWRITERS LABORATORIES (UL)

UL 44	(2010) Thermoset-Insulated Wires and Cables
UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2013) Wire Connectors
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013) Metallic Outlet Boxes
UL 514B	(2012) Conduit, Tubing and Cable Fittings
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 651	(2011; Reprint Mar 2012) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 854	(2004; Reprint Sep 2011) Standard for Service-Entrance Cables

1.2 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.
- c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for 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 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast underground structures; G, DO

SD-03 Product Data

Precast concrete structures; G, DO

Sealing Material

Handhole frames and covers; G, DO

Composite/fiberglass handholes; G, DO

Cable supports (racks, arms and insulators); G, DO

Pulling-In Irons; G, DO

#### SD-06 Test Reports

Field Acceptance Checks and Tests; G

Cable Installation Plan and Procedure

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling tensions.
- f. The actual cable pulling tensions encountered during pull.

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Precast Underground Structures

Submittal required for each type used. Provide calculations and drawings for precast handholes bearing the seal of a registered professional engineer including:

- a. Material description (i.e.,  $f'_c$  and  $F_y$ )
- b. Manufacturer's printed assembly and installation instructions
- c. Design calculations
- d. Reinforcing shop drawings in accordance with ACI SP-66
- e. Plans and elevations showing opening and pulling-in iron locations and details
- f. Precast underground structures provided by the utility provider.

##### 1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been

substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

## PART 2 PRODUCTS

### 2.1 CONDUIT, DUCTS, AND FITTINGS

#### 2.1.1 Rigid Metal Conduit

UL 6.

##### 2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi.

##### 2.1.2 Plastic Conduit for Direct Burial

UL 651, Schedule 80.

##### 2.1.3 Plastic Duct for Concrete Encasement

NEMA TC 6 & 8 and ASTM F512, UL 651, EPC-80-PVC.

##### 2.1.4 Innerduct

Provide corrugated or solid wall polyethylene (PE) or PVC innerducts with pullwire. Size as indicated.



#### 2.1.5 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials. Inflatable bladders may be used as an option.

#### 2.1.6 Fittings

##### 2.1.6.1 Metal Fittings

UL 514B.

##### 2.1.6.2 PVC Conduit Fittings

UL 514B, UL 651.

##### 2.1.6.3 PVC Duct Fittings

NEMA TC 9.

##### 2.1.6.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit shall be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and shall conform to UL 514A.

#### 2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors shall be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 24 months prior to date of delivery to the site shall not be accepted. Service entrance conductors shall conform to UL 854, type USE.

##### 2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller shall be solid copper. Conductors No. 8 AWG and larger shall be stranded copper. All conductors shall be copper.

##### 2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, shall be 600-volt, Type XHHW conforming to UL 44. Copper conductors shall be annealed copper complying with ASTM B3 and ASTM B8.

##### 2.2.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

#### 2.2.4 Direct Buried

Single-conductor and multi-conductor cables shall be of a type identified for direct burial.

#### 2.2.5 In Duct

Cables shall be single-conductor cable.

#### 2.2.6 Cable Marking

Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Each cable shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves, or colored electrical tape. Control circuit terminations shall be properly identified. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows

a. 208/120 volt, three-phase

- (1) Phase A - black
- (2) Phase B - red
- (3) Phase C - blue

b. 480/277 volt, three-phase

- (1) Phase A - brown
- (2) Phase B - orange
- (3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

#### 2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Shall provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

- a. For use with copper conductors: **UL 486A-486B.**

## 2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply **NEMA C119.1**.

### 2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied in accordance with the manufacturer's written instructions.

### 2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation shall not require heat or flame, or any additional materials such as covering or adhesive. It shall be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

## 2.5 TAPE

### 2.5.1 Insulating Tape

**UL 510**, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

### 2.5.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section **35 41 00 EMBANKMENT CONSTRUCTION**.

## 2.6 PULL ROPE

Shall be plastic or flat pull line (bull line) having a minimum tensile strength of **200 pounds**.

## 2.7 GROUNDING AND BONDING

### 2.7.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to **UL 467** not less than **3/4 inch** in diameter by **10 feet** in length. Sectional type rods may be used for rods 20 feet or longer.

### 2.7.2 Grounding Conductors

Stranded-bare copper conductors shall conform to **ASTM B8**, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors shall conform to **ASTM B1** for sizes No. 8 and smaller. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Aluminum is not acceptable.

## 2.8 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section **03 31 01 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS**. In addition, provide concrete for

encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength unless specified otherwise.

## 2.9 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C857 and ASTM C478. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.

### 2.9.1 Cast-In-Place Concrete Structures

Concrete shall conform to Section 03 31 01 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS. Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers. Concrete block shall conform to ASTM C139.

### 2.9.2 Precast Concrete Structures, Risers and Tops

In lieu of cast-in-place, Contractors, at their option, may provide precast concrete underground structures subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

#### 2.9.2.1 General

Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

#### 2.9.2.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

- a. Angle of Internal Friction ( $\phi$ ) = 30 degrees

- b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated)  
= 130 pcf
- c. Coefficient of Lateral Earth Pressure (Ka) = 0.33
- d. Ground Water Level = 3 feet below ground elevation
- e. Vertical design loads shall include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads shall consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load shall be for H20 highway loading per AASHTO HB-17.
- f. Horizontal design loads shall include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, shall be considered, along with a pulling-in iron design load of 6000 pounds.
- g. Each structural component shall be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.
- h. Design shall also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

#### 2.9.2.3 Construction

Structure top, bottom, and wall shall be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as directed, and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

#### 2.9.2.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M 198, Type B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

### 2.9.3 Handhole Frames and Covers

Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Steel covers shall be rolled-steel floor plate having an approved antislip surface. Hinges shall be of wrought steel, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and shall be for full surface application by fillet welding. Hinges shall have nonremovable pins and five knuckles. The surfaces of plates under hinges shall be true after the removal of raised antislip surface, by grinding or other approved method.

### 2.9.4 Composite/Fiberglass Handholes and Covers

Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass.

## 2.10 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

The metal portion of racks and arms shall be zinc-coated after fabrication.

### 2.10.1 Cable Racks

The wall bracket shall be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, 48 inches long (minimum) in manholes. Slots for mounting cable rack arms shall be spaced at 8 inch intervals.

### 2.10.2 Rack Arms

Cable rack arms shall be steel or malleable iron or glass reinforced nylon and shall be of the removable type. Rack arm length shall be a minimum of 8 inches and a maximum of 12 inches.

### 2.10.3 Insulators

Insulators for metal rack arms shall be dry-process glazed porcelain. Insulators are not required for nylon arms.

## 2.11 UNDERGROUND UTILITY

### 2.11.1 FPL Responsibilities

Florida Power and Light (FPL) will modify the existing overhead power lines near spillway S-84A with new pole (if required) and all other necessary hardware to make connections for the new underground utility as shown on the contract plan to provide a 120/240VAC, 150A, 1-phase, 60 Hz service. FPL will furnish primary conductors, conduits, pull boxes, meter, transformer, and transformer base. FPL will install primary conductors, meter, pad-mounted transformer, and high side service connections at the new service point.

### 2.11.2 Contractor Responsibilities

The Contractor shall coordinate with FPL to install approximately one linear mile of underground utility along the access road next to canal C-41A from the FPL pole near spillway S-84A to new structure S-65EX1. The Contractor shall arrange appropriately with FPL to pick up FPL-furnished materials and equipment or to have them delivered to the site accordingly. The Contractor shall clearly understand what FPL will furnish and perform and what

contractor shall furnish and perform to avoid any conflict or disruption during the contact work. The Contractor shall install underground conduits and pull boxes at locations as shown on the contract plan. The Contractor shall furnish and install pull wires along the underground conduit at each pull box for PFL to install primary conductors. The Contractor shall furnish and install meter socket, protective bollards, and other necessary hardware as required by FPL standards. The Contractor shall furnish and install the underground secondary conduit and cable. The Contractor shall coordinate with FPL for point of connection, power line routing, overall planning and scheduling for time completion of the new power line. The Contractor shall make all necessary arrangements with FPL for final inspection and complete testing. The Contractor shall pay FPL specified amount of expenses (as shown in the Bid Schedule) for upgrade or modification of existing FPL power lines system. The Contractor shall be responsible for any accidental service charges connected therewith and for monthly energy charges thereafter until acceptance of the complete work by the Contracting Officer. Upon acceptance, the meter shall be read and the Contractor shall be relieved of responsibility for energy charges as of the date and meter reading. In addition, the Contractor shall perform all other required work for complete operational system as specified in the contract plans and specifications.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758-A and RUS Bull 1751F-644.

#### 3.2 CABLE INSPECTION

Prior to installation, each cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable prior to installation in accordance with the cable manufacturer's recommendations.

#### 3.3 CABLE INSTALLATION PLAN AND PROCEDURE

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. The Contractor shall then perform pulling calculations and prepare a pulling plan which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS. Cable shall be installed strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

Calculations and pulling plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.
- b. List of cable installation equipment.

- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall bearing pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

### 3.4 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 5 feet outside the building and projections thereof, except that conductors shall be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit shall be PVC, Type EPC-40 from the supply equipment to a point 5 feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

### 3.5 UNDERGROUND STRUCTURE CONSTRUCTION

Provide standard type cast-in-place construction as specified herein and as indicated, or precast construction as specified herein. Underground precast structures as shown on the drawings and are provided by the local utility provider will be acceptable. Horizontal concrete surfaces of floors shall have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound shall conform to ASTM C309. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures shall fit the frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete.

#### 3.5.1 Cast-In-Place Concrete Structures

Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers. Provide concrete block conforming to ASTM C139.



### 3.5.2 Precast Concrete Construction

Set commercial precast structures on 6 inches of level, 90 percent compacted granular fill, 3/4 inch to 1 inch size, extending 12 inches beyond the structure on each side. Compact granular fill by a minimum of four passes with a plate type vibrator. Installation shall additionally conform to the manufacturer's instructions.

### 3.5.3 Pulling-In Irons

Provide steel bars bent as indicated, and cast in the walls and floors, if indicated. Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices shall be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor the irons shall be a minimum of 6 inches from the edge of the sump, and in the walls the irons shall be located within 6 inches of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron shall not be located within 6 inches of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the 6 inch clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 3 foot length of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner shall be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 3 inches from any edge of the cast-in-place duct bank envelope or any individual duct. Pulling-in irons shall have a clear projection into the structure of approximately 4 inches and shall be designed to withstand a minimum pulling-in load of 6000 pounds. Irons shall be hot-dipped galvanized after fabrication.

### 3.5.4 Cable Racks, Arms and Insulators

Cable racks, arms and insulators shall be sufficient to accommodate the cables. Racks in power manholes shall be spaced not more than 3 feet apart, and each manhole wall shall be provided with a minimum of two racks. Racks in signal manholes shall be spaced not more than 16 1/2 inches apart with the end rack being no further than 12 inches from the adjacent wall. Methods of anchoring cable racks shall be as follows:

- a. Provide a 5/8 inch diameter by 5 inch long anchor bolt with 3 inch foot cast in structure wall with 2 inch protrusion of threaded portion of bolt into structure. Provide 5/8 inch steel square head nut on each anchor bolt. Coat threads of anchor bolts with suitable coating immediately prior to installing nuts.
- b. Provide concrete channel insert with a minimum load rating of 800 pounds per foot. Insert channel shall be steel of the same length as "vertical rack channel;" channel insert shall be cast flush in structure wall. Provide 5/8 inch steel nuts in channel insert to receive 5/8 inch diameter by 3 inch long steel, square head anchor

bolts.

- c. Provide concrete "spot insert" at each anchor bolt location, cast flush in structure wall. Each insert shall have minimum 800 pound load rating. Provide 5/8 inch diameter by 3 inch long steel, square head anchor bolt at each anchor point. Coat threads of anchor bolts with suitable coating immediately prior to installing bolts.

### 3.5.5 Field Painting

Cast-iron frames and covers not buried in concrete or masonry shall be cleaned of mortar, rust, grease, dirt and other deleterious materials, and given a coat of bituminous paint.

## 3.6 UNDERGROUND CONDUIT AND DUCT SYSTEMS

### 3.6.1 Requirements

Depths to top of the conduit shall be in accordance with NFPA 70. Run conduit in straight lines except where a change of direction is necessary. Numbers and sizes of ducts shall be as indicated. Ducts shall have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in structures.

### 3.6.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

### 3.6.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

### 3.6.4 Jacking and Drilling Under Roads and Structures

Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, shall be zinc-coated, rigid steel, jacked into place. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers.

### 3.6.5 Multiple Conduits

Separate multiple conduits by a minimum distance of 2 1/2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 3 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

### 3.6.6 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weep hole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

### 3.6.7 Conduit and Duct Without Concrete Encasement

Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Provide color, type and depth of warning tape as specified in Section 35 41 00 EMBANKMENT CONSTRUCTION.

#### 3.6.7.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks.

### 3.6.8 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank shall be rectangular in

cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 1/2 inches, except separate light and power conduits from control, signal, and telecommunications conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring shall be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide color, type and depth of warning tape as specified in Section 35 41 00 EMBANKMENT CONSTRUCTION.

#### 3.6.8.1 Connections to Manholes

Duct bank envelopes connecting to underground structures shall be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure shall be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

#### 3.6.8.2 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and bend out to tie into the reinforcing of the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

#### 3.6.8.3 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and bend out to tie into the reinforcing of the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

#### 3.6.8.4 Connections to Existing Ducts

Where connections to existing duct banks are indicated, excavate the banks to the maximum depth necessary. Cut off the banks and remove loose concrete from the conduits before new concrete-encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct bank, to take the shear at the joint of the duct banks.

#### 3.6.8.5 Partially Completed Duct Banks

During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, and, and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately one foot apart. Restrain reinforcing assembly from moving during concrete pouring.

### 3.7 CABLE PULLING

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with tape or wire shield shall have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

#### 3.7.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

### 3.8 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

#### 3.8.1 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

### 3.9 CONDUCTORS INSTALLED IN PARALLEL

Conductors shall be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

### 3.10 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination cabinets.

### 3.11 GROUNDING SYSTEMS

Provide grounding system as indicated, in accordance with NFPA 70 and IEEE C2, and as specified herein.

Noncurrent-carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid earth ground not exceeding the following values:

Pad-mounted transformers without protective fences	5 ohms
Ground in manholes	5 ohms
Grounding other metal enclosures of primary voltage electrical and electrically-operated equipment	5 ohms

#### 3.11.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.

If the specified ground resistance is not met, an additional ground rod shall be provided in accordance with the requirements of NFPA 70 (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

#### 3.11.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

#### 3.11.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

#### 3.11.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

### 3.11.5 Manhole Grounding

Loop a 4/0 AWG grounding conductor around the interior perimeter, approximately 12 inches above finished floor. Secure the conductor to the manhole walls at intervals not exceeding 36 inches. Connect the conductor to the manhole grounding electrode with 4/0 AWG conductor. Connect all incoming 4/0 grounding conductors to the ground loop adjacent to the point of entry into the manhole. Bond the ground loop to all cable shields, metal cable racks, and other metal equipment with a minimum 6 AWG conductor.

### 3.11.6 Fence Grounding

Fences shall be grounded with a ground rod at each fixed gate post and at each corner post. Drive ground rods until the top is 12 inches below grade. Attach a No. 4 AWG copper conductor, by exothermic weld to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 12 inches of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence. Each gate section shall be bonded to its gatepost by a 1/8 by one inch flexible braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

### 3.12 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 35 41 00 EMBANKMENT CONSTRUCTION.

#### 3.12.1 Reconditioning of Surfaces

##### 3.12.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

##### 3.12.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

### 3.13 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 31 01 CAST-IN-PLACE STRUCTURAL CONCRETE FOR CIVIL WORKS.

#### 3.13.1 Concrete Slabs for Equipment

Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4

inches above finished grade with gradual slope for drainage. Edges above grade shall have 1/2 inch chamfer. Slab shall be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

### 3.13.2 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

### 3.14 FIELD QUALITY CONTROL

#### 3.14.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

##### 3.14.1.1 Grounding System

###### a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications

###### b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable megohmmeter tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

##### 3.14.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --



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SECTION 35 20 16

VERTICAL LIFT SLIDE GATES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 8 (2002) Design of Cold-Formed Stainless  
Steel Structural Members

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M (2012a) Standard Specification for  
Chromium and Chromium-Nickel Stainless  
Steel Plate, Sheet, and Strip for Pressure  
Vessels and for General Applications

ASTM A276 (2010) Standard Specification for  
Stainless Steel Bars and Shapes

ASTM A320/A320M (2011a) Standard Specification for  
Alloy/Steel and Stainless Steel Bolting  
Materials for Low-Temperature Service

ASTM D2240 (2005; R 2010) Standard Test Method for  
Rubber Property - Durometer Hardness

ASTM D395 (2003; R 2008) Standard Test Methods for  
Rubber Property - Compression Set

ASTM D4020 (2011) Ultra-High-Molecular-Weight  
Polyethylene Molding and Extrusion  
Materials

ASTM D412 (2006a; R 2013) Standard Test Methods for  
Vulcanized Rubber and Thermoplastic  
Elastomers - Tension

ASTM D471 (2012a) Standard Test Method for Rubber  
Property - Effect of Liquids

ASTM D572 (2004; R 2010) Rubber Deterioration by  
Heat and Oxygen

AMERICAN WATER WORKS ASSOCIATION (AWWA)

ANSI/AWWA C542 (2009) Electric Motor Actuators for Valves  
and Slide Gates

U.S. ARMY CORPS OF ENGINEERS (USACE)

ETL 1110-2-584

(2014) Engineering and Design -- Design of  
Hydraulic Steel Structures

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 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G, DO

Detail design and fabrication drawings of combination slide/flap gate, frame, stem, attachments and actuator.

SD-03 Product Data

Materials

System of identification which shows the disposition of specific lots of approved materials and fabricated items in the work before completion of the contract.

Welding; G, DO

Schedules of welding procedures for structural steel.

Materials

Material orders, material lists, and material shipping bills.

Gate Lifting Stem; G, DO

Gate Lifting Stem, Gate Gear Reduction Actuator, and Electric Motor. Manufacturer's catalog data, shop drawings, and installation instructions

SD-05 Design Data

Gate Component Design; G, DO

Design calculations for the stem, operating systems and controls, signed and sealed by Licensed Professional Engineers. Include all structural, hydraulic, mechanical, and electrical calculations.

SD-06 Test Reports

Tests, Inspections, and Verifications G, DO

Certified material test reports with all material delivered to the site.

Acceptance Trial Operation and Test Procedures; G, DO

Prior to conducting the "Acceptance Trial Operation and Test" indicated below, submit for approval test procedures detailing the means and methods of gate acceptance testing.

Acceptance Trial Operation and Test

Operation and test results before completion of the contract.

SD-10 Operation and Maintenance Data

Operation and Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Operation and Maintenance Instructions Manual; G, DO

Furnish copies of manual containing complete information on operation, lubrication, adjustment, routine, and special maintenance, disassembly, repair, reassembly, and trouble diagnostics of gate operating units. Disassembly and reassembly portions of the manual shall take into account the specific system that is being provided. Operation and maintenance manual and both parts lists shall be printed on good quality 8-1/2 by 11-inch paper, bound separately between flexible, durable covers. Drawings incorporated in the manual or parts lists may be reduced to page size provided they are clear and legible, or they may be folded into the manual to page size. Photographs or catalog cuts of components may be included for identification.

1.3 DESIGN REQUIREMENTS

The combination slide/flap gate and framing shall be fabricated as shown on the drawings. The gate manufacturer shall be responsible for the design and manufacture of the following components of the slide/flap gate system: stem, operating system and controls. Stem, operating system and controls shall be designed and fabricated by a manufacturer with at least 10 years experience in the design and fabrication of hydraulic control gates used in dam outlet works (sluice gates, service gates, vertical lift gates, flap gates, emergency bulkheads, etc.). The components shall be designed in accordance with the requirements of ETL 1110-2-584, ANSI/AWWA C542, ASCE 8 or the manufacturer's standard practice, whichever provides for a more conservative and robust design.

1.4 QUALIFICATION OF WELDERS AND WELDING OPERATORS

Qualification of welders and welding operators shall conform to the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 General

Perform delivery, handling, and storage of materials and fabricated items conforming to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

### 1.5.2 Rubber Seals

Store rubber seals in a place which permits free circulation of air, maintains a temperature of 70 degrees F or less, and prevents the rubber from being exposed to the direct rays of the sun. Keep rubber seals free of oils, grease, and other materials which would deteriorate the rubber. Rubber seals shall not be distorted during handling.

### 1.6 WARRANTY

The gates and appurtenances shall be guaranteed against defective design, materials and workmanship for a period of one year from the date of final acceptance.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Materials orders, material lists and material shipping bills shall conform with the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.1.1 Metals

Structural steel, monel, babbit, steel forgings, steel castings, stainless steel, bronze, aluminum bronze, brass and other metal materials used for fabrication shall conform to the requirements as shown and as specified herein and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

##### 2.1.1.1 Stainless Steel Bars and Shapes

Stainless steel bars and shapes shall conform to ASTM A276, UNS S 30403 (Type 304L) or S 30603 (Type 316L) Condition A, hot-finished or cold-finished, Class C.

##### 2.1.1.2 Stainless Steel Plate, Sheet, and Strip

Stainless steel plate, sheet, and strip shall conform to ASTM A240/A240M, UNS S 30403 or S 31603. Plate finish shall be hot-rolled, annealed or heat-treated, and blast-cleaned or pickled. Sheet and strip finish shall be No. 1.

#### 2.1.2 Rubber Seals

Rubber seals shall be compounded of natural rubber, synthetic polyisoprene, or a blend of both, and shall contain reinforcing carbon black, zinc oxide, accelerators, antioxidants, vulcanizing agents, and plasticizers.

##### 2.1.2.1 Physical Characteristics

Physical characteristics of the seals shall meet the following requirements:

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
Tensile Strength	2500 psi (min.)	ASTM D412
Elongation at Break	450 percent (min.)	ASTM D412

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
300 percent	900 psi (min.)	ASTM D412
Durometer Hardness (Shore Type A)	60 to 70	ASTM D2240
*Water Absorption	5 percent by weight (max.)	ASTM D471
Compression Set	30 percent (max.)	ASTM D395
Tensile Strength (after aging 48 hrs)	80 percent of tensile strength (min.)	ASTM D572

The "Water Absorption" test shall be performed with distilled water. The washed specimen shall be blotted dry with filter paper or other absorbent material and suspended by means of small glass rods in the oven at a temperature of 70 degrees F plus or minus 2 degrees for 22 hours plus or minus 1/4 hour. The specimen shall be removed, allowed to cool to room temperature in air, and weighed. The weight shall be recorded to the nearest 1 mg as M subscript 1 (M subscript 1 is defined in ASTM D471). The immersion temperature shall be 70 degrees F plus or minus 1 degree and the duration of immersion shall be 166 hours.

#### 2.1.3 Ultra High Molecular Weight Extrusion Materials

Gate stop and gate guide track shall conform to ASTM D4020 UHMW.

### 2.2 MANUFACTURED UNITS

Bolts, nuts, washers, screws and other manufactured units shall conform with the requirements as shown and as specified and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

#### 2.2.1 Bolts, Nuts and Washers

High-strength bolts, nuts, and washers shall conform to ASTM A320/A320M, Ferritic Steel, Grade L73 or Austenitic Steel, Grade B8M, Class 2. Bolts 1/2 inch and larger shall have hexagon heads. The finished shank of bolts shall be long enough to provide full bearing. Washers for use with bolts shall conform to the requirements specified in the applicable specification for bolts. For each bolted connection, the material of one hardware item (e.g. the nut) shall be Nitronic 60 (Alloy 218, UNS S21800).

#### 2.2.2 Gate Operating System

The Gate Operating System shall be capable of moving the gate upward and downward. The maximum normal length of travel will be 7 feet. The maximum seating head differential for the design of the gate operating system is shown on the drawings. The weight of the gate assembly is shown on the drawings. Design calculations shall take into account gate weight, maximum static head, gate unseating force, and gate sliding resistance. The actuator shall be sized by the gate manufacturer based on the gate physical characteristics.

##### 2.2.2.1 Gate Lifting Stem

Gate lifting stem shall be Type 304 or 316 stainless steel. The stem

length will be determined by the gate supplier. If the manufacturer requires, the stem shall have a stem guide at the approximate mid-point of the stem.

#### 2.2.2.2 Gate Actuator

Provide operating machinery in accordance with Section 26 29 10 ELECTRIC MOTOR ACTUATOR FOR LIFT GATES. Sizing and gear reduction shall be based on information given in the paragraph "Gate Operating System" above.

### 2.3 FABRICATION

#### 2.3.1 Detail Drawings

Detail drawings, including fabrication drawings, shop assembly drawings, delivery drawings, and field installation drawings, shall conform to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

##### 2.3.1.1 Fabrication Drawings

Fabrication drawings shall show complete details of materials, tolerances, connections, and proposed welding sequences which clearly differentiate shop welds and field welds.

##### 2.3.1.2 Shop Assembly Drawings

Shop assembly drawings shall provide details for connecting the adjoining fabricated components in the shop to assure satisfactory field installation.

##### 2.3.1.3 Delivery Drawings

Delivery drawings shall provide descriptions of methods of delivering components to the site, including details for supporting fabricated components during shipping to prevent distortion or other damages.

##### 2.3.1.4 Field Installation Drawings

Field installation drawings shall provide a detailed description of the field installation procedures. The description shall include the location and method of support of installation and handling equipment; provisions to be taken to protect concrete and other work during installation; method of maintaining components in correct alignment; plan for prestressing gate leaf diagonals, which shall include descriptions of connections, riggings, anchorages, and measuring equipment; methods for installing quoin and miter blocks, including checking and maintaining alignments of the blocks during concreting and placement of epoxy filler; procedures and equipment used for heating and placing of the zinc filler; and methods for installing other appurtenant items.

#### 2.3.2 Structural Fabrication

Structural fabrication shall conform to the requirements as shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Dimensional tolerances shall be as specified and as shown. Splices shall occur only where shown. Pin holes shall be bored in components after welding, straightening, stress-relieving, and threading operations are completed. Brackets, eye bar sections, and other components requiring straightening shall be straightened by methods which will not damage the



material. Bushings shall be press-fitted with supporting components. Bolt connections, lugs, clips, or other pick-up assembly devices shall be provided for components as shown and required for proper assembly and installation. Provisions shall be made for the installation of cathodic protection system devices and other appurtenances as required.

#### 2.3.2.1 Welding

Welding shall conform with the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Welds shall be of the type shown and approved detail drawings. Radiographic examination is required on the major shop and field welds of the type and location indicated and as follows: 10% representative sample randomly selected by the Contracting Officer's Representative. Welds which have been designated to receive radiographic examination and are found to be inaccessible to a radiation source or film, or are otherwise situated where radiographic examination is not feasible may be examined, with written approval, by dye penetrant, magnetic particle tests, or ultrasonic tests. Components shall be stress-relief heat treated after welding where shown. Stress-relieving of components shall be performed prior to the attachment of miscellaneous appurtenances.

#### 2.3.2.2 Bolted Connections

Bolted connections shall conform with the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.3.2.3 Machine Work

Machine work shall conform with the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.3.2.4 Miscellaneous Provisions

Miscellaneous provisions for fabrication shall conform with the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.3.3 Combination Slide/Flap Gate Leaf

Combination slide/flap gate leaf shall be Type 304L (ASTM A276, S 30403) or Type 316L (ASTM A276, S 31603) corrosion resisting steel of single-component structural fabrication. Slide/flap gate shall be shop fabricated and shall be provided complete with gate stem, stem guides, leaf nut, leaf nut spanner wrench, bar seals, seal collars and other appurtenant items as required for installation. Surfaces of leaf framing elements to which skin plates are to be welded shall not vary from a true plane by more than 1/16 inch to provide uniform bearing. The outside surfaces of skin plates welded to framing elements shall not vary from a true plane by more than 1/16 inch. Splices in skin plates shall be located only where shown. The overall width and height of the fabricated gate leaf shall not vary from the respective dimensions shown by more than 1/16 inch. Gate leaf shall be stress-relieved prior to the attachment of bar seals. Surfaces where bar seals are attached shall be accurately machined to provide uniform bearing for the full contact dimensions. Top and side bar seals shall be firmly butted together at the corners. The ends of side bar seals shall be flush with the bottom seating surface of the gate leaf. Final machining of bar seals shall be performed after they are attached to the gate leaf. The bottom seat of the gate leaf shall be machined for a tight

fit with the gate frame sill.

#### 2.3.4 Slide Gate Frame

Combination slide/flap gate leaf shall be Type 304L (ASTM A276, S 30403) or Type 316L (ASTM A276, S 31603) corrosion resisting steel of single-component structural fabrication. Slide gate frame shall be shop fabricated. Guiding and seal surfaces of slide gate frame shall be in a true vertical plane and shall be machined finished. Unmachined surfaces exposed to water flow shall match at joints between component parts, shall not depart from true planes shown by more than 1/16 inch and shall be free of offsets or irregularities greater than 1/16 inch. Allowable offsets or irregularities less than 1/16 inch shall be ground to a bevel of not greater than one on twenty-four. The bottom seat of the gate leaf shall be machined for a tight fit with the gate frame sill. Gate frame shall be stress relieved prior to the attachment of bar seals. Surfaces where bar seals are attached shall be accurately machined to provide uniform bearing for the full contact dimensions. Top, side, and invert bar seals shall be firmly butted together at the corners. Final machining of bar seals shall be performed after they are attached to the gate frame and bonnet. Babbit shall be poured in the gate frame sill and peened before machining the frame. When machining the gate frame sill, the tool travel shall be parallel to the long dimension of the babbit.

#### 2.3.5 Slide Gate Pedestal and Base Plate

The flanges of the pedestal and base plate for the supporting the operating machinery for the slide gate shall be accurately machined and drilled to match mating flanges and provide the required true alignment. Unmachined oil-contacting surfaces of pedestal shall be coated with alkyd resin as specified for the unmachined oil-contacting surfaces of hydraulic cylinder heads. Base plate dimensions may be altered to fit the operating machinery furnished, provided the basic configuration, plate thickness, and number and sizes of fasteners are equal to that shown and the altered dimensions are approved.

#### 2.3.6 Slide Gate Leakage

The gate leakage shall not exceed 0.1 gallons per minute per foot of wetted perimeter under seating head conditions (total leakage for both sliding and flap perimeters), and shall not exceed 0.2 gallons per minute per foot of seating perimeter of the slide gate portion for unseating head conditions (total leakage for combination gate system).

#### 2.3.7 Shop Assembly

Shop assembly requirements for combination gate and frame and appurtenant items shall be as shown and as specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Combination gate, frame, guides, and appurtenant items shall be assembled completely in the shop to assure satisfactory field installation. The matchmarking of unassembled components shall be carefully preserved until the components are assembled. Adequate support shall be provided during assembly to maintain components within 1/16 inch of actual installation planes. Mating surfaces and machined surfaces shall be coated with a rust preventive coating until assembled. Other connecting surfaces which are not required to be disassembled for shipment shall be thinly coated with an approved rust preventive coating before being joined. Adjoining components shall be fitted and bolted together to facilitate field connections. Shop assembled components shall be delivered

assembled, if practically permitted by shipping and field installation conditions. Assembled components shall be shop welded in their final positions as much as delivery and field installation conditions allow. Shop assembly and disassembly work shall be performed in the presence of the Contracting Officer unless otherwise approved. The presence of the Contracting Officer will not relieve the Contractor of any responsibility under this contract.

#### 2.3.7.1 Gate Leaf

Shop assembly of the gate leaf shall be in the horizontal position with the skin side of the gate leaf facing down. Shop assembly shall include the attachment of all accessories to the gate leaf. The leaf shall be lifted by the lifting brackets and inspected for balance about the center of gravity after being shop assembled. If the gate leaf is out of plumb by more than  $\frac{1}{4}$  inch in the total length in a vertical plane in the upstream-downstream direction, or by more than  $\frac{1}{16}$  inch in the total width in a vertical plane perpendicular to the vertical plane in the upstream-downstream direction, it shall be balanced by counterweighting or some other method as approved at the Contractor's expense.

#### 2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

Tests, inspections, and verifications for materials and fabricated items shall be performed prior to delivery, and shall conform to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

##### 2.4.1 Inspection

Shop assembled components shall be inspected for accurate fit and compliance with dimensional tolerances. Sealing, guiding, and connecting surfaces shall be inspected to determine if their planes are true, parallel, and in uniform contact with opposing surfaces. With the gate leaf closed and uniformly blocked in the sealing position, gate leaf and rubber seals shall be inspected to determine if they are in continuous contact with track and seal plates. Compression of rubber seals shall not vary by more than  $\frac{1}{32}$  inch. It shall not be possible to insert a feeler gauge of greater than 0.003 inch thickness at any point between bar seals and seal plates.

##### 2.4.2 Operation Tests

The operation of the shop-assembled combination gate assembly shall be tested, prior to delivery to the site, by opening and closing the gate several times by use of the operating machinery. The force used to operate the gate shall be the minimum required to open and close the gate. Since the sill of the unembedded gate frame is not fully supported during the operation tests, special precaution shall be taken to prevent the application of excessive force on the gate leaf and frame when the gate is closed. Adjustments shall be made as required until operations are satisfactory. The gate assembly shall be tested hydrostatically by applying a hydrostatic pressure of 20 psi, measured at the sill of the gate frame, to the upstream side of the gate leaf in the closed position. For conducting the hydrostatic testing, the gate frame shall be bulkheaded or restrained by some other method as approved. Under hydrostatic testing, the gate seals shall be sufficiently tight to prevent water leakage.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Installation shall conform with the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Combination gate and appurtenant items shall be assembled for installation in strict accordance with the contract drawings, approved installation drawings, and shop match-markings. Bearing surfaces requiring lubrication shall be thoroughly cleaned and lubricated with an approved lubricant before assembly and installation. Components to be field welded shall be in correct alignment before welding is commenced.

#### 3.1.1 Embedded Metals

Frames, bases, and other embedded metal items shall be accurately installed to the alignment and grade required to ensure accurate fitting and matching of components. Shims, jackbolts, or other supports required to align and hold components rigidly in place until embedment concrete has attained the specified strength shall be provided. Anchors shall be installed as shown. Embedded metals, other than stainless steel, shall be given a primer coat of the required paint on all surfaces prior to installation in concrete forms. Items requiring two concrete pours for installation shall be attached to the embedded anchors after the initial pour, adjusted to the proper alignment, and concreted in place with the second pour.

#### 3.1.2 Combination Gate Frame and Guides

Combination gate frame and guides shall be connected to embedded anchors, aligned, and rigidly blocked in place prior to the placement of concrete. The sealing surfaces of the slide gate frame seal bars shall serve as the reference plane for the installation alignment. Alignment shall be to two theoretical control planes described as control plane "A" and control plane "B". Control plane "A" is a vertical plane that is normal to the water passageway and is located at the sealing surface of the gate frame seal bars. Control plane "B" is a vertical plane that is parallel to the water passageway and is located at the centerline of the water passageway. The gate frame shall be aligned to within 0.015 inch of control planes "A" and "B". A taut piano wire and an electric micrometer or some other approved method shall be used to measure the vertical alignment tolerances. The alignment of frame and guides shall be such that planes through the bearing surfaces of track plates and the sealing surfaces of seal plates shall be within 1/16 inch of the alignment shown.

#### 3.1.3 Gate Leaf

Gate leaf shall be completely assembled, including the attachment of all components and accessories, prior to being placed in the gate frame. All necessary precautions shall be taken to avoid distortion of the gate leaf and attached components during installation. Rubber seals shall be fastened securely to metal retainers. Before operating the gate, a suitable lubricant shall be applied to the rubber seal rubbing plates to protect the rubber.

#### 3.1.4 Operating Machinery

Operating machinery for the combination gate assembly and supporting components, including bonnet, bonnet cover, pedestal, and base plate, shall be positioned and aligned to the installed location of the gate frame and

guides and anchored in place. The location of the slide gate stem shall be projected to and scribed on the sill of the installed gate frame to serve as a reference point for the alignment of operating machinery and supporting components. Operating machinery and components shall be aligned to within 0.030 inch of the reference point. Prior to being embedded in concrete, an alignment template shall be bolted to the bonnet, marked, and drilled to match the exact center point of the gate stem.

### 3.1.5 Concrete and Concrete Grout Placement

The embedment of the wall thimble and other components in concrete shall be performed in an approved manner to fill all voids, secure anchorage, prevent seepage, and provide uniform finish surfaces. After embedment concrete has cured for at least 7 days, any voids around embedded components shall be filled by pumping concrete grout around the components. After the pumped grout has cured for at least 7 days, hammer blows to the components shall be used to detect any remaining voids. Where remaining voids are located, 1 inch diameter grout holes shall be drilled in the components and the voids shall be filled by pressure grouting through the grout holes. Grout holes in the components shall be plugged by welding and shall be ground flush.

### 3.2 ACCEPTANCE TRIAL OPERATION AND TEST

After the combination gate assembly has been installed, including operating machinery, the Contracting Officer will examine the complete system for final acceptance. Operation and test results shall be furnished to the Contracting Officer. The assembly will be examined first to determine whether or not the workmanship conforms to the specification requirements. Operate the gate throughout its full operating range a sufficient number of times to demonstrate proper operation. The gate shall be operated from the operating platform controls and the control panel in the control house. The initial operation of the gate assembly shall be conducted in the dry. With the gate leaf in the seated position, the rubber seals shall be checked to ensure that they are uniformly compressed against the frame. The second trial operation and testing of the gate assembly shall be conducted under hydrostatic pressure. Gate exercise shall take into account the duty cycle of the electric motor. Readings shall be recorded of the motor's amperage and voltage at six inches increments of gate movement in both the opening as well as the closing. Hydrostatic tests shall be performed as described below. The workmanship in the fabrication and installation of the gate assembly shall be such that the gate leaf shall seat within the acceptable tolerances defined above when lowered into the seated position. Adjustments shall be made to the operation and control apparatus until all components function as required. Appurtenances will be inspected to assure proper operation. Required repairs or replacements to correct defects, as determined by the Contracting Officer, shall be made at no additional cost to the Government. The trial operation and testing shall be repeated after defects are corrected.

#### 3.2.1 Hydrostatic Testing

The Contractor shall coordinate the use and delivery of Government furnished bulkheads with the Contracting Officer. Hydrostatic testing will work within the structure with bulkheads in place. These areas shall be treated as confined spaces.

### 3.2.1.1 Seating Head Leak Test

Each combination gate shall be tested. The installed gate shall be exposed to a seating head on the lakeside. The Contractor shall install Government furnished bulkheads. This test shall be performed by the Contractor after installing lakeside and landside bulkheads as a means of isolating the structure and controlling the simulated lakeside stage. The area between the lakeside bulkhead and the gate shall be filled with lake water via pump and maintained at elevation 20.0 feet (NAVD88). The landside structure between the landside bulkhead and backside of gate shall remain dewatered to facilitate inspection and observation of leakage from within the conduit. A 12-inch temporary watertight knee wall shall be constructed landside of gate to isolate and measure leakage from the gate. Results of this test shall consist of landside stage measurements taken every minute for 30 minutes after initial stage is achieved. Measurements shall be taken to the nearest 1/16-inch to accurately capture water depth. The gate leakage shall not exceed 2.8 gallons per minute under seating head conditions (total leakage for combination gate system). Total leakage rate shall be monitored and documented as agreed to in the gate testing procedures submittal. Temporary measures shall not cause any permanent damage to the structure and must be completely removed/repaired upon acceptance of the hydrostatic testing.

### 3.2.1.2 Unseating Head Leak Test

Each combination gate shall be tested. Gates shall be exposed to an unseating head on the landside. The Contractor shall install Government furnished bulkheads. With both landside and lakeside bulkheads installed, the Contractor shall bolt the flap gate to the gate slide assembly and dewater the area between the gate and the lakeside bulkhead. The landside area between the gate and the landside bulkhead shall be filled with lake water to an elevation of 15.0 feet (NAVD88). A 12-inch temporary watertight knee wall shall be constructed lakeside of the gate to isolate and measure leakage from the gate. Results of this test shall consist of landside stage measurements taken every minute for 30 minutes after the initial test stage is achieved. Measurements shall be taken to the nearest 1/16-inch to accurately capture water depth. The gate leakage shall not exceed 5.6 gallons per minute for unseating head conditions. Total leakage rate shall be monitored and documented as agreed to in the gate testing procedures submittal. Temporary measures shall not cause any permanent damage to the structure and must be completely removed/repaired upon acceptance of the hydrostatic testing.

### 3.2.1.3 Flap Gate Opening Head Test

Each gate shall be tested. Gate flaps shall be unbolted and the entire assembly lowered into the "closed" position. Gate opening head shall be tested by installing Government furnished landside and lakeside bulkheads. After installing the bulkheads, the Contractor shall pump lake water into the landside structure until the water elevation both landside and lakeside of the closed gate (with flap unbolted) equalizes. Subsequently, the water level on the landside shall be increased by 0.05 feet per minute, and the point at which the flap first opens (i.e. initiates free flow of water) shall be documented. The test shall be completed for a total of ten (10) times: Five (5) in the partially submerged condition and five (5) in the fully submerged condition as described below.

- a. Partially Submerged: The Contractor shall perform five (5) tests when the culvert is in the partially submerged condition, beginning

with an initial equalized water surface elevation of 10.5 feet, NAVD88 and increased incrementally to an elevation not to exceed 13.0 feet, NAVD88. The first test shall be taken at a starting stage of 10.5 feet, NAVD88 and the last test at a starting stage of 13.0 feet, NAVD88, with the three (3) remaining partially submerged tests taken at any stage in between. For example, if the first test begins with an equalized elevation of 10.5 feet, NAVD88 and requires 0.25 feet of head to open the gate, the second test run may begin at an equalized elevation of 10.75 feet, NAVD88.

b. Fully Submerged: The Contractor shall perform five (5) tests when the culvert is in the fully submerged condition, beginning with an initial equalized water surface elevation of 14.5 feet, NAVD88 and increased incrementally to an elevation not to exceed 19.0 feet, NAVD88. The first test shall be taken at a starting stage of 14.5 feet, NAVD88. The remaining four tests may be taken at any stage up to 19.0 feet, NAVD88. The Contractor shall reference the example provided in the "Partially Submerged" testing paragraph above.

The stage and resulting head differential at the point when the gate first opens (i.e. initiates free flow of water) shall be reported for all ten (10) test runs. Results shall be monitored and documented as agreed to in the gate testing procedure submittals.

#### 3.2.1.4 Final Gate Position

Once the trial operation and testing has been completed and accepted by the Contracting Officer, the Contractor shall close the slide gate (lowered position) with the flap gate "un-bolted".

### 3.3 PROTECTION OF FINISHED WORK

Protection of finished work shall conform to the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

-- End of Section --

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SECTION 35 20 17

VERTICAL LIFT ROLLER GATES

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 WELDING SOCIETY (AWS)

AWS D1.6/D1.6M (2007) Structural Welding Code - Stainless Steel

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M (2012a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

ASTM A276 (2010) Standard Specification for Stainless Steel Bars and Shapes

ASTM A320/A320M (2011a) Standard Specification for Alloy/Steel and Stainless Steel Bolting Materials for Low-Temperature Service

ASTM A536 (1984; R 2009) Standard Specification for Ductile Iron Castings

ASTM A588/A588M (2010) Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point, with Atmospheric Corrosion Resistance

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 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G, DO

Detail drawings for manatee screens, wheels, plates, and channels.

SD-03 Product Data

## Materials

System of identification which shows the disposition of specific lots of approved materials and fabricated items in the work before completion of the contract.

## Welding; G, DO

Schedules of welding procedures for structural steel.

## Materials

Material orders, material lists, and material shipping bills.

## SD-06 Test Reports

### Tests, Inspections, and Verifications

Certified material test reports with all material delivered to the site.

### Acceptance Trial Operation and Test; G, DO

Operation and test results before completion of the contract.

## 1.3 QUALIFICATION OF WELDERS AND WELDING OPERATORS

Qualification of welders and welding operators shall conform to the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

## 1.4 DELIVERY, STORAGE, AND HANDLING

### 1.4.1 General

Perform delivery, handling, and storage of materials and fabricated items conforming to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Unload materials and equipment delivered to the site by the Contracting Officer. Verify the condition and quantity of the items delivered by the Contracting Officer and acknowledge receipt and condition thereof in writing. If delivered items are damaged or a shortage is determined, notify of such in writing within 24 hours after delivery.

## 1.5 WARRANTY

The rollers, manatee screen, and appurtenances shall be guaranteed for a minimum period of 1 year from the date of final acceptance against defective materials and workmanship.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Materials orders, material lists and material shipping bills shall conform with the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.1.1 Metals

Structural steel, monel, babbitt, steel forgings, steel castings, stainless

steel, bronze, aluminum bronze, brass and other metal materials used for fabrication shall conform to the requirements as shown and as specified herein and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

#### 2.1.1.1 Stainless Steel Bars and Shapes

Stainless steel bars and shapes shall conform to ASTM A276, UNS S 20910, S 21800, S 30403, S 51603, or S 51603 Condition A, hot-finished or cold-finished, Class C. Specific part/material designations are shown in the drawings.

#### 2.1.1.2 Stainless Steel Plate, Sheet, and Strip

Stainless steel plate, sheet, and strip shall conform to ASTM A240/A240M, UNS S 30403, or S 31603. Plate finish shall be hot-rolled, annealed or heat-treated, and blast-cleaned or pickled. Sheet and strip finish shall be No. 1.

### 2.2 MANUFACTURED UNITS

Bolts, nuts, washers, screws and other manufactured units shall conform with the requirements as shown and as specified and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

#### 2.2.1 Bolts, Nuts and Washers

Bars at the pickup points shall meet with the requirements of ASTM A588/A588M Fy=50 ksi. As otherwise indicated in the construction drawings, all bolts, screws, nuts, cotter pins, and washers shall meet the requirements of ASTM A320/A320M, grade B8M, B8, Class 2 or Ferretic Steel, LT3. Bolts 1/2 inch and larger shall have hexagon heads. The finished shank of bolts shall be long enough to provide full bearing. Washers for use with bolts shall conform to the requirements specified in the applicable specification for bolts.

#### 2.2.2 Rollers

Rollers shall be short hub or long hub, rigid type, ductile iron grade 80-55-06 fabricated with ductile iron castings conforming to ASTM A536. Rollers shall be of the size shown. Rollers shall be provided with lubrication fittings, bushings, and removable axle or shaft. Roller treads shall be machined-finished as shown.

### 2.3 FABRICATION

#### 2.3.1 Detail Drawings

Detail drawings, including fabrication drawings, shop assembly drawings, delivery drawings, and field installation drawings, shall conform to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

##### 2.3.1.1 Fabrication Drawings

Fabrication drawings shall show complete details of materials, tolerances, connections, and proposed welding sequences which clearly differentiate shop welds and field welds.

#### 2.3.1.2 Shop Assembly Drawings

Shop assembly drawings shall provide details for connecting the adjoining fabricated components in the shop to assure satisfactory field installation.

#### 2.3.1.3 Delivery Drawings

Delivery drawings shall provide descriptions of methods of delivering components to the site, including details for supporting fabricated components during shipping to prevent distortion or other damages.

#### 2.3.1.4 Field Installation Drawings

Field installation drawings shall provide a detailed description of the field installation procedures. The description shall include the location and method of support of installation and handling equipment; provisions to be taken to protect concrete and other work during installation; method of maintaining components in correct alignment and methods for installing other appurtenant items.

### 2.3.2 Structural Fabrication

Structural fabrication shall conform to the requirements as shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Dimensional tolerances shall be as specified and as shown. Splices shall occur only where shown. Pin holes shall be bored in components after welding, straightening, stress-relieving, and threading operations are completed. Brackets, eye bar sections, and other components requiring straightening shall be straightened by methods which will not damage the material. Bushings shall be press-fitted with supporting components. Bolt connections, lugs, clips, or other pick-up assembly devices shall be provided for components as shown and required for proper assembly and installation.

#### 2.3.2.1 Welding

Welding shall conform to AWS D1.6/D1.6M with the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Welds shall be of the type shown and approved detail drawings. Radiographic examination is required on the major shop and field welds of the type and location indicated and as follows: 10% of the representative samples randomly selected by the COR. Welds which have been designated to receive radiographic examination and are found to be inaccessible to a radiation source or film, or are otherwise situated where radiographic examination is not feasible may be examined, with written approval, by dye penetrant, magnetic particle tests, or ultrasonic tests. Components shall be stress-relief heat treated after welding where shown. Stress-relieving of components shall be performed prior to the attachment of miscellaneous appurtenances.

#### 2.3.2.2 Bolted Connections

Bolted connections shall conform with the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.3.2.3 Machine Work

Machine work shall conform with the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.3.2.4 Miscellaneous Provisions

Miscellaneous provisions for fabrication shall conform with the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.3.3 Roller Manatee Screen

Roller manatee screen shall be of single-component structural fabrication. Roller manatee screen shall be shop fabricated and shall be provided complete with lifting brackets, wheel assemblies, plates and other appurtenant items as required for installation and proper operation. The Contractor shall check the design center of gravity of the manatee screen prior to fabrication and notify the Contracting Officer if an unreasonable amount of counter-weighting is required to attain the center of gravity as designed. Splicing shall be shown in shop drawings for evaluation and approval of the Government. The overall width and height of the fabricated manatee screen shall not vary from the respective dimensions shown by more than 1/16 inch.

##### 2.3.3.1 Manatee Screen Roller Assembly

Roller assemblies shall be products of a manufacturer regularly engaged in the manufacture of such products. Each roller assembly shall be provided complete with roller, shaft, lubrication fittings, fasteners, and other accessories as required for complete and proper installation. Roller diameter and thickness shall not be changed from that shown.

#### 2.3.4 Shop Assembly

Shop assembly requirements for manatee screen and appurtenant items shall be as shown and as specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Manatee screen and appurtenant items shall be assembled completely in the shop to assure satisfactory field installation. The matchmarking of unassembled components shall be carefully preserved until the components are assembled. Adequate support shall be provided during assembly to maintain components within 1/16 inch of actual installation planes. Adjoining components shall be fitted and bolted together to facilitate field connections. Shop assembled components shall be delivered assembled, if practically permitted by shipping and field installation conditions. Assembled components shall be shop welded in their final positions as much as delivery and field installation conditions allow. Shop assembly and disassembly work shall be performed in the presence of the Contracting Officer unless otherwise approved. The presence of the Contracting Officer will not relieve the Contractor of any responsibility under this contract.

##### 2.3.4.1 Manatee Screen

Shop assembly of the manatee screen shall be in the horizontal position with the manatee screen facing down. Shop assembly shall include the attachment of all accessories to the manatee screen. The roller manatee screen shall be lifted by the lifting bars and inspected for balance about the center of gravity after being shop assembled. If the manatee screen is out of plumb by more than 1/4 inch in the total length in a vertical plane in the upstream-downstream direction, or by more than 1/16 inch in the total width in a vertical plane perpendicular to the vertical plane in the upstream-downstream direction, it shall be balanced by counterweighting or

some other method as approved at the Contractor's expense.

#### 2.3.4.2 Roller Assemblies

The manatee screen shall be supported in the horizontal position for adjusting wheel assemblies so that the rollers of the attached roller assemblies are free to rotate to allow the proper adjustment. Attached roller assemblies shall be adjusted so that the rollers remain perpendicular to the manatee screen and the contact surfaces of the rollers on each side of the manatee screen are in a single plane within 0.005 inch when rotated 360 degrees. The top of each roller shall be tapped to ensure that the weight of the roller assembly has caused the shaft to bear firmly on the supporting framing of the manatee screen. After roller assemblies have been adjusted, they shall be locked in position by drilling the lock plate, support plate, and shaft and installing cap screws as shown. Roller assemblies shall be lubricated after being locked in position with a lubricant that is suitable for underwater operation, equal to the lubricant recommended by the manufacturer of the wheel roller bearings, and as approved. Additional lubricant shall be applied at regular intervals until final acceptance of the work.

#### 2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

Tests, inspections, and verifications for materials and fabricated items shall conform to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

##### 2.4.1 Inspection

Shop assembled components shall be inspected for accurate fit and compliance with dimensional tolerances. Connecting surfaces shall be inspected to determine if their planes are true, parallel, and in uniform contact with opposing surfaces.

##### 2.4.2 Operation Tests

The operation tests shall be performed for both the manatee screens and the government furnished bulkheads. The operation of the shop-assembled manatee screen assembly shall be tested for placement and fit into the bulkhead slots by installing and removing the manatee screens once per bulkhead slot. Adjustments shall be made as required until operations are satisfactory. Contractor is responsible for rigging accessories and equipment necessary for installing and removing the manatee screens. The operation of the bulkhead assembly shall be tested by installing and removing the bulkhead once per bulkhead slot by use of the government furnished pickup beam. At the lake side, the bulkheads Type 1 and Type 2 shall be installed in pairs at each bulkhead slot. At the lake side, Type 2 Bulkhead shall be placed first, and Type 1 shall be stacked on top. The bulkheads may remain in pairs for the lakeside dry fit. Adjustments shall be made as required until operations are satisfactory.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Installation shall conform with the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Manatee screen and appurtenant items shall be assembled for installation in strict accordance with the contract drawings, approved installation drawings, and shop

match-markings. Bearing surfaces requiring lubrication shall be thoroughly cleaned and lubricated with an approved lubricant before assembly and installation. Components to be field welded shall be in correct alignment before welding is commenced.

### 3.1.1 Embedded Metals

Rails and other embedded metal items shall be accurately installed to the alignment and grade required to ensure accurate fitting and matching of components. Shims, jackbolts, or other supports required to align and hold components rigidly in place until embedment concrete has attained the specified strength shall be provided. Anchors shall be installed as shown. Items requiring two concrete pours for installation shall be attached to the embedded anchors after the initial pour, adjusted to the proper alignment, and concreted in place with the second pour.

### 3.1.2 Manatee Screen

Manatee screen shall be completely assembled, including the attachment of all components and accessories, prior to being placed in the bulkhead slots. All necessary precautions shall be taken to avoid distortion of the manatee screen and attached components during installation.

### 3.1.3 Concrete and Concrete Grout Placement

The embedment of the rails and other embedded metal items in concrete shall be performed in an approved manner to fill all voids, secure anchorage, prevent seepage, and provide uniform finish surfaces. After embedment concrete has cured for at least 7 days, any voids around embedded components shall be filled by pumping concrete grout around the components. After the pumped grout has cured for at least 7 days, hammer blows to the components shall be used to detect any remaining voids. Where remaining voids are located, 1 inch diameter grout holes shall be drilled in the components and the voids shall be filled by pressure grouting through the grout holes. Grout holes in the components shall be plugged by welding and shall be ground flush.

## 3.2 ACCEPTANCE TRIAL OPERATION AND TEST

After the manatee screens and the government furnished bulkheads have been installed, the Contracting Officer will examine the complete system for final acceptance. Operation and test results shall be furnished to the Contracting Officer. The manatee screens will be examined first to determine whether or not the workmanship conforms to the specification requirements. Operate the manatee screens and bulkheads throughout their full operating range to demonstrate proper operation. The initial operation of the manatee and bulkhead assemblies shall be conducted in the dry. With the bulkheads in the seated position and uniformly blocked so that the rollers are in uniform contact with the track plates, the rubber seals shall be checked to ensure that they are uniformly compressed against the seal plates. Adjustments shall be made to the operation until all components function as required. Each manatee screen and bulkhead shall be installed in each bay of each headwall structure (lakeside and landside). Required repairs or replacements to correct defects, as determined by the Contracting Officer, shall be made at no additional cost to the Government. The trial operation and testing shall be repeated after defects are corrected.



3.3 PROTECTION OF FINISHED WORK

Protection of finished work shall conform to the requirements of Section  
05 50 14 STRUCTURAL METAL FABRICATIONS.

-- End of Section --

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DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

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SECTION 35 20 18

VERTICAL LIFT DUAL LEAF GATES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 8 (2002) Specification for the Design of  
Cold-Formed Stainless Steel Structural  
Members

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C542 (2009) Electric Motor Actuators for Valves  
and Slide Gates

ANSI/AWWA C561 (2012; R 2014) Fabricated Stainless-Steel  
Slide Gates

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M (2013c) Standard Specification for  
Chromium and Chromium-Nickel Stainless  
Steel Plate, Sheet, and Strip for Pressure  
Vessels and for General Applications

ASTM A276 (2013a) Standard Specification for  
Stainless Steel Bars and Shapes

ASTM D2240 (2005; R 2010) Standard Test Method for  
Rubber Property - Durometer Hardness

ASTM D395 (2003; R 2008) Standard Test Methods for  
Rubber Property - Compression Set

ASTM D412 (2006a; R 2013) Standard Test Methods for  
Vulcanized Rubber and Thermoplastic  
Elastomers - Tension

ASTM D471 (2012a) Standard Test Method for Rubber  
Property - Effect of Liquids

ASTM D572 (2004; R 2010) Rubber Deterioration by  
Heat and Oxygen

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-2-2105 (1993) Engineering and Design -- Design of

Hydraulic Steel Structures

EM 1110-2-2701

(1997) Engineering and Design -- Vertical  
Lift Gates

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G, DO

Acceptance Trial Operation and Test Procedures; G, DO

Prior to conducting the "Acceptance Trial Operation and Test" indicated below, submit for approval test procedures detailing the means and methods of gate acceptance testing.

SD-03 Product Data

Materials  
Welding; G, DO

SD-05 Design Data

Gate Component Design; G, DO

Engineering calculations, prepared by a Registered Professional Engineer, demonstrating compliance with the mechanical and structural criteria specified.

SD-06 Test Reports

Tests, Inspections, and Verifications

Certified material test reports with all material delivered to the site.

Acceptance Trial Operation and Test

SD-10 Operation and Maintenance Data

Operation And Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Operation And Maintenance Instruction Manuals; G, DO

Furnish copies of operation and maintenance manuals containing complete information on operation, lubrication, adjustment, routine, and special maintenance, disassembly, repair, reassembly, and trouble diagnostics of gate operating units. Disassembly and reassembly portions of the manual shall take into account the

specific system that is being provided. Operation and maintenance manual shall be printed on good quality 8-1/2 by 11-inch paper, bound separately between flexible, durable covers. Drawings incorporated in the manual or part lists may be reduced to page size provided they are clear and legible, or they may be folded into the manual to page size. Photographs or catalog cuts of components may be included for identification.

### 1.3 DESIGN REQUIREMENTS

The landside culvert shall be equipped with a stainless steel electrically operated double leaf slide gate system with a manual operation capability. The gate manufacturer shall be responsible for the design and manufacture of all components of the entire gate system: gate, frame/guide/yoke, stem, actuator, etc. The gates shall be designed by a registered professional engineer of the gate manufacturer. Gates shall be designed and fabricated by a manufacturer with at least 10 years' experience in the design and fabrication of hydraulic control gates used in outlet works (sluice gates, service gates, vertical lift gates, flap gates, emergency bulkheads, etc.). The gate manufacturer shall have the responsibility for the successful operation of all the slide gates and ancillary equipment. The gates and accessories shall operate properly under a head of 11.5 feet of water. The components shall be designed in accordance with the requirements of EM 1110-2-2105, EM 1110-2-2701, ANSI/AWWA C561, AWWA C542, ASCE 8 or the manufacture's standard practice, whichever provides for a more conservative and robust design. Gates shall be classified Type B in accordance with EM 1110-2-2105, paragraph 4-4.

### 1.4 QUALIFICATION OF WELDERS AND WELDING OPERATORS

Qualification of welders and welding operators shall conform to the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

### 1.5 DELIVERY, STORAGE, AND HANDLING

#### 1.5.1 General

Perform delivery, handling, and storage of materials and fabricated items conforming to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 1.5.2 Rubber Seals

Store rubber seals in a place which permits free circulation of air, maintains a temperature of 70 degrees F or less, and prevents the rubber from being exposed to the direct rays of the sun. Keep rubber seals free of oils, grease, and other materials which would deteriorate the rubber. Rubber seals shall not be distorted during handling.

### 1.6 WARRANTY

The gates and appurtenances shall be warrantied against defective design, material, workmanship for a period of one year from the date of final acceptance.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Furnish materials orders, material lists and material shipping bills conforming with the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.1.1 Metals

Structural steel, monel, steel forgings, steel castings, stainless steel, bronze, aluminum bronze, brass and other metal materials used for fabrication shall conform to the requirements as shown and as specified herein and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

##### 2.1.1.1 Stainless Steel Bars and Shapes

Stainless steel bars and shapes shall conform to ASTM A276, UNS S 30403 (Type 304L) or S 30603 (Type 316L) Condition A, hot-finished or cold-finished, Class C.

##### 2.1.1.2 Stainless Steel Plate, Sheet and Strip

Stainless steel plate, sheet, and strip shall conform to ASTM A240/A240M, UNS S 30403 or S 31603. Plate finish shall be hot-rolled, annealed or heat-treated, and blast-cleaned or pickled. Sheet and strip finish shall be No. 1.

#### 2.1.2 Rubber Seals

Rubber seals shall be compounded of natural rubber, synthetic polyisoprene, or a blend of both, and shall contain reinforcing carbon black, zinc oxide, accelerators, antioxidants, vulcanizing agents, and plasticizers.

##### 2.1.2.1 Physical Characteristics

Physical characteristics of the seals shall meet the following requirements:

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
Tensile Strength	2500 psi (min.)	ASTM D412
Elongation at Break	450 percent (min.)	ASTM D412
300 percent	900 psi (min.)	ASTM D412
Durometer Hardness (Shore Type A)	60 to 70	ASTM D2240
*Water Absorption	5 percent by weight (max.)	ASTM D471
Compression Set	30 percent (max.)	ASTM D395
Tensile Strength (after aging 48 hrs)	80 percent of tensile strength (min.)	ASTM D572

The "Water Absorption" test shall be performed with distilled water. The washed specimen shall be blotted dry with filter paper or other absorbent

material and suspended by means of small glass rods in the oven at a temperature of 70 degrees C plus or minus 2 degrees for 22 hours plus or minus 1/4 hour. The specimen shall be removed, allowed to cool to room temperature in air, and weighed. The weight shall be recorded to the nearest 1 mg as M subscript 1 (M subscript 1 is defined in ASTM D471). The immersion temperature shall be 70 degrees C plus or minus 1 degree and the duration of immersion shall be 166 hours.

## 2.2 MANUFACTURED UNITS

Bolts, nuts, washers, screws and other manufactured units shall conform with the requirements as shown and as specified and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

### 2.2.1 Bolts, Nuts and Washers

Bolts 1/2 inch and larger shall have hexagon heads. The finished shank of bolts shall be long enough to provide full bearing. Washers for use with bolts shall conform to the requirements specified in the applicable specification for bolts.

## 2.3 FABRICATION

### 2.3.1 Detail Drawings

Submit detail drawings, including fabrication drawings, shop assembly drawings, delivery drawings, and field installation drawings, conforming to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.3.1.1 Fabrication Drawings

Fabrication drawings shall show complete details of materials, tolerances, connections, and proposed welding sequences which clearly differentiate shop welds and field welds.

#### 2.3.1.2 Shop Assembly Drawings

Shop assembly drawings shall provide details for connecting the adjoining fabricated components in the shop to assure satisfactory field installation.

#### 2.3.1.3 Delivery Drawings

Delivery drawings shall provide descriptions of methods of delivering components to the site, including details for supporting fabricated components during shipping to prevent distortion or other damages.

#### 2.3.1.4 Field Installation Drawings

Field installation drawings shall provide a detailed description of the field installation procedures. The description shall include the location and method of support of installation and handling equipment; provisions to be taken to protect concrete and other work during installation; method of maintaining components in correct alignment; plan for prestressing gate leaf diagonals, which shall include descriptions of connections, riggings, anchorages, and measuring equipment; methods for installing quoin and miter blocks, including checking and maintaining alignments of the blocks during concreting and placement of epoxy filler; procedures and equipment used for heating and placing of the zinc filler; and methods for installing other



appurtenant items.

## 2.3.2 Structural Fabrication

Structural fabrication shall conform to the requirements as shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Dimensional tolerances shall be as specified and as shown. Splices shall occur only where shown. Pin holes shall be bored in components after welding, straightening, stress-relieving, and threading operations are completed. Brackets, eye bar sections, and other components requiring straightening shall be straightened by methods which will not damage the material. Bushings shall be press-fitted with supporting components. Bolt connections, lugs, clips, or other pick-up assembly devices shall be provided for components as shown and required for proper assembly and installation. Provisions shall be made for the installation of cathodic protection system devices and other appurtenances as required.

### 2.3.2.1 Welding

Submit schedules of welding procedures for structural steel conforming with the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Welds shall be of the type shown and approved detail drawings.

### 2.3.2.2 Bolted Connections

Bolted connections shall conform with the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

### 2.3.2.3 Machine Work

Machine work shall conform with the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

### 2.3.2.4 Miscellaneous Provisions

Miscellaneous provisions for fabrication shall conform with the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

## 2.3.3 Slide Gate Leaf

Each stainless steel slide gate leaf shall be a flat structural plate, reinforced with structural members or formed plates as required to limit its deflection to 1/360 of the gate's span under the design head conditions. Slide gate shall be shop fabricated and shall be provided complete with gate stem, stem guides, leaf nut, leaf nut spanner wrench, bar seals, seal collars, and other appurtenant items as required for installation. Surfaces of leaf framing elements to which skin plates are to be welded shall not vary from a true plane by more than 1/16 inch to provide uniform bearing. The outside surfaces of skin plates welded to framing elements shall not vary from a true plane by more than 1/16 inch. Splices in skin plates shall be located only where shown. The overall width and height of the fabricated gate leaf shall not vary from the respective dimensions shown by more than 1/16 inch. Gate leaf shall be stress-relieved prior to the attachment of bar seals. Surfaces where bar seals are attached shall be accurately machined to provide uniform bearing for the full contact dimensions. Top and side bar seals shall be firmly butted together at the corners. The ends of side bar seals shall be flush

with the bottom seating surface of the gate leaf. Final machining of bar seals shall be performed after they are attached to the gate leaf. The bottom seat of the gate leaf shall be machined for a tight fit with the gate frame sill. All components shall have a minimum material thickness of  $\frac{1}{4}$  inch. Slide gate leafs shall be designed to drain when opened above the water level and not trap debris, soil, etc.

#### 2.3.4 Slide Gate Frame

Stainless steel slide gate frame shall be self contained with yoke mounted gate operators and flush bottom type. The structural members shall be designed to provide the required structural support for the gate operator and the loads produced from the gate operation under worse case design head conditions. The structural members or formed plates of the yoke shall be sized to limit deflections to  $\frac{1}{360}$  of its span and resist the following loads imposed on the yoke, both in raising and lowering the gate, by the gate operator: a) Two (2) times the rated output thrust of a manual crank type gate actuator with 40-lb (pounds) effort. b) One-and-a-quarter (1.25) times the output thrust of an electric-motor-driven actuator in the stalled condition. Guiding and seal surfaces of slide gate frame shall be in a true vertical plane and shall be machined finished. Unmachined surfaces exposed to water flow shall match at joints between component parts, shall not depart from true planes shown by more than  $\frac{1}{16}$  inch and shall be free of offsets or irregularities greater than  $\frac{1}{16}$  inch. Allowable offsets or irregularities less than  $\frac{1}{16}$  inch shall be ground to a bevel of not greater than one on twenty-four. The bottom seat of the gate leaf shall be machined for a tight fit with the gate frame sill. Gate frame shall be stress relieved prior to the attachment of bar seals. Surfaces where bar seals are attached shall be accurately machined to provide uniform bearing for the full contact dimensions. Top, side, and invert bar seals shall be firmly butted together at the corners. Final machining of bar seals shall be performed after they are attached to the gate frame. All components shall have a minimum material thickness of  $\frac{1}{4}$  inch.

##### 2.3.4.1 Slide Guides

Guides shall run the full length of the frame and prevent metal to metal contact between the slide and the frame. The guides shall be designed to accommodate the total thrust produced by water pressure at the design head conditions. The guides shall be mechanically interlocked or attached to the frame.

#### 2.3.5 Slide Gate Stem

Stems shall have machined acme threads. Size stem to be of adequate diameter to safely withstand twice the force created by a 40-pound pull on the handwheel/handcrank. Support with guides spaced to provide L/R ratio less than 200. Provide single stem with clear butyrate plastic stem cover with mylar tape to indicate de "open" and "closed" positions. Attach stem cover to actuator with non-corrosive materials. Vent holes shall be provided in stem cover to prevent condensation. A stop nut shall furnished on the stem to limit the downward travel of the gate. The stop nut shall be fabricated from a single piece matching the stem material, tapped to match the stem, and drilled and tapped for a minimum of two  $\frac{3}{8}$  inch set screws.

#### 2.3.6 Slide Gate Operator and Handwheel/Handcrank

The gates for S-291 shall be equipped with electrically operated

actuators. During manual operation of gate due to lack of electrical power, the handwheel or handcrank shall operate the gate with no more than a 40-pound effort. Provide any necessary attachment or exposed operating nut to allow the use of a portable electric drill and generator (which will be furnished by others) to open and close the gate during a power outage. The gate shall operate under a portable electric gate operator that has an input of 40 ft-lbs. The operator shall have gearing that will open and close the gate to a speed of 6.6 inches per minute when the electric gate operator is at 250 RPM. Provide stop collar to limit the downward travel of the stem and slide gate leaf. Provide handwheel or handcrank with an arrow to show direction of opening.

#### 2.3.7 Shop Assembly

Shop assembly requirements for gate, gate frame and appurtenant items shall be as shown and as specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Gate, frame, guides, and appurtenant items shall be assembled completely in the shop to assure satisfactory field installation. The match marking of unassembled components shall be carefully preserved until the components are assembled. Adequate support shall be provided during assembly to maintain components within 1/16 inch of actual installation planes. Mating surfaces and machined surfaces shall be coated with a rust preventive coating until assembled. Other connecting surfaces which are not required to be disassembled for shipment shall be thinly coated with an approved rust preventive coating before being joined. Adjoining components shall be fitted and bolted together to facilitate field connections. Shop assembled components shall be delivered assembled, if practically permitted by shipping and field installation conditions. Assembled components shall be shop welded in their final positions as much as delivery and field installation conditions allow. Shop assembly and disassembly work shall be performed in the presence of the Contracting Officer unless otherwise approved. The presence of the Contracting Officer will not relieve the Contractor of any responsibility under this contract.

##### 2.3.7.1 Gate Leaf

Shop assembly of the gate leaf shall be in the horizontal position with the skin side of the gate leaf facing down. Shop assembly shall include the attachment of all accessories to the gate leaf. The leaf shall be lifted by the lifting brackets and inspected for balance about the center of gravity after being shop assembled. If the gate leaf is out of plumb by more than 1/4 inch in the total length in a vertical plane in the upstream-downstream direction, or by more than 1/16 inch in the total width in a vertical plane perpendicular to the vertical plane in the upstream-downstream direction, it shall be balanced by counterweighting or some other method as approved at the Contractor's expense.

##### 2.3.7.2 Gate Actuator

Provide operating machinery in accordance with Section 26 29 10 ELECTRIC MOTOR ACTUATOR FOR LIFT GATES. Sizing and gear reduction shall be based on information given in the paragraph "Slide Gate Operator and Handwheel/Handcrank" above.

#### 2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

Submit certified material test reports with all material delivered to the site. Tests, inspections, and verifications for materials and fabricated

items shall conform to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.4.1 Inspection

Shop assembled components shall be inspected for accurate fit and compliance with dimensional tolerances. Sealing, guiding, and connecting surfaces shall be inspected to determine if their planes are true, parallel, and in uniform contact with opposing surfaces. With the gate leaf closed and uniformly blocked in the sealing position, gate leaf and rubber seals shall be inspected to determine if they are in continuous contact with track and seal plates. Compression of rubber seals shall not vary by more than  $1/32$  inch. It shall not be possible to insert a feeler gauge of greater than 0.003 inch thickness at any point between bar seals and seal plates.

#### 2.4.2 Operation Tests

The operation of the shop-assembled gate assembly shall be tested by opening and closing the gate several times by use of the operating machinery. The force used to operate the gate shall be the minimum required to open and close the gate. Since the sill of the unembedded gate frame is not fully supported during the operation tests, special precaution shall be taken to prevent the application of excessive force on the gate leaf and frame when the gate is closed. The operation of the lifting beam shall be tested by engaging and disengaging the lifting beam several times. Adjustments shall be made as required until operations are satisfactory. The gate assembly shall be tested hydrostatically by applying a hydrostatic pressure of 20 psi, measured at the sill of the gate frame, to the upstream side of the gate leaf in the closed position. For conducting the hydrostatic testing, the gate frame shall be bulkheaded or restrained by some other method as approved. Under hydrostatic testing, the gate seals shall be sufficiently tight to prevent water leakage.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Installation shall conform with the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Gate and appurtenant items shall be assembled for installation in strict accordance with the contract drawings, approved installation drawings, and shop match-markings. Bearing surfaces requiring lubrication shall be thoroughly cleaned and lubricated with an approved lubricant before assembly and installation. Components to be field welded shall be in correct alignment before welding is commenced.

##### 3.1.1 Embedded Metals

Frames, bases, and other embedded metal items shall be accurately installed to the alignment and grade required to ensure accurate fitting and matching of components. Shims, jackbolts, or other supports required to align and hold components rigidly in place until embedment concrete has attained the specified strength shall be provided. Anchors shall be installed as shown. Embedded metals shall be given a primer coat of the required paint on all surfaces prior to installation in concrete forms. Items requiring two concrete pours for installation shall be attached to the embedded anchors after the initial pour, adjusted to the proper alignment, and concreted in place with the second pour.

### 3.1.2 Gate Frame and Guides

Gate frame and guides shall be connected to embedded anchors, aligned, and rigidly blocked in place prior to the placement of second-pour concrete. The sealing surfaces of the slide gate frame seal bars shall serve as the reference plane for the installation alignment. Alignment shall be to two theoretical control planes described as control plane "A" and control plane "B". Control plane "A" is a vertical plane that is normal to the water passageway and is located at the sealing surface of the gate frame seal bars. Control plane "B" is a vertical plane that is parallel to the water passageway and is located at the centerline of the water passageway. The gate frame shall be aligned to within 0.015 inch of control planes "A" and "B". A taut piano wire and an electric micrometer or some other approved method shall be used to measure the vertical alignment tolerances. The alignment of frame and guides shall be such that planes through the bearing surfaces of track plates and the sealing surfaces of seal plates shall be within 1/16 inch of the alignment shown. Gate frame and guides shall be tested for proper alignment and clearances prior to being embedded in concrete by lowering and raising the gate leaf through the full operating range.

### 3.1.3 Gate Leaf

Gate leaf shall be completely assembled, including the attachment of all components and accessories, prior to being placed in the gate frame. All necessary precautions shall be taken to avoid distortion of the gate leaf and attached components during installation. Rubber seals shall be fastened securely to metal retainers. Before operating the gate, a suitable lubricant shall be applied to the rubber seal rubbing plates to protect the rubber.

### 3.1.4 Operating Machinery

Operating machinery for the gate assembly and supporting components, shall be positioned and aligned to the installed location of the gate frame and guides and anchored in place. The location of the slide gate stem shall be projected to and scribed on the sill of the installed gate frame to serve as a reference point for the alignment of operating machinery and supporting components. Operating machinery and components shall be aligned to within 0.030 inch of the reference point.

### 3.1.5 Concrete and Concrete Grout Placement

The embedment of the gate frame and other components in concrete shall be performed in an approved manner to fill all voids, secure anchorage, prevent seepage, and provide uniform finish surfaces. After embedment concrete has cured for at least 7 days, any voids around embedded components shall be filled by pumping concrete grout around the components. After the pumped grout has cured for at least 7 days, hammer blows to the components shall be used to detect any remaining voids. Where remaining voids are located, 1 inch diameter grout holes shall be drilled in the components and the voids shall be filled by pressure grouting through the grout holes. Grout holes in the components shall be plugged by welding and shall be ground flush.

## 3.2 ACCEPTANCE TRIAL OPERATION AND TEST

After the gate assembly has been installed, including operating machinery, the Contracting Officer will examine the complete system for final

acceptance. Operation and test results shall be furnished to the Contracting Officer. The assembly will be examined first to determine whether or not the workmanship conforms to the specification requirements. Operate the gate throughout its full operating range a sufficient number of times to demonstrate proper operation. The operation of the gate assembly shall be conducted in the wet. The trial operation and testing of the gate assembly shall be conducted with the reservoir normal operating pool hydrostatic pressure. The workmanship in the fabrication and installation of the gate assembly shall be such that the gate leaf shall form a watertight barrier when lowered to the seated position. Adjustments shall be made to the operation and control apparatus until all components function as required. The handwheel/handcrank and other appurtenances will be inspected to assure proper operation. Required repairs or replacements to correct defects, as determined by the Contracting Officer, shall be made at no additional cost to the Government. The trial operation and testing shall be repeated after defects are corrected.

### 3.3 FINAL GATE POSITION

At S-291, the bottom gate shall be fully closed (seated on apron), while the top gate shall be lowered to a position where the crest (top of gate) is at Elevation 17.20 feet, NAVD88.

### 3.4 PROTECTION OF FINISHED WORK

Protection of finished work shall conform to the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

-- End of Section --

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SECTION 35 31 19

STONE PROTECTION FOR STRUCTURES

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all plant, labor, equipment, and materials, and performing all operations in connection with preparing submittals, conducting stone testing, and stone placement in accordance with the drawings and specifications, or as directed by the Contracting Officer. The Contractor shall also be responsible for obtaining copies of technical references, forms or documents referenced herein.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C127	(2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C295/C295M	(2012) Petrographic Examination of Aggregates for Concrete
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C535	(2012) Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D4992	(2007) Evaluation of Rock to be Used for Erosion Control
ASTM D5312/D5312M	(2012; R 2013) Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions
ASTM D5313/D5313M	(2012) Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions

ASTM D5519	(2007) Particle Size Analysis of Natural and Man-Made Riprap Materials
ASTM D6092	(2008) Standard Practice for Specifying Standard Sizes of Stone for Erosion Control
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates
U.S. ARMY CORPS OF ENGINEERS (USACE)	
COE CRD-C 144	(1992) Standard Test Method for Resistance of Rock to Freezing and Thawing
EM 1110-2-1100 Part VI	(2008) Engineering and Design -- Coastal Engineering Manual - Part VI
EM 1110-2-1601	(1991; 1994 Change 1) Engineering and Design -- Hydraulic Design of Flood Control Channels
EM 1110-2-2302	(1990) Engineering and Design -- Construction With Large Stone
ERDC/GL TR-81-8	(1981) Evaluation of Quality and Performance of Stone as Riprap or Armor

### 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

##### Stone Source; G|DO

For each individual source of stone (quarry) identified by the Contractor as a potential supplier of stone, the Contractor shall submit in report format, a Stone Source Submittal as specified in paragraph STONE SOURCE SUBMITTAL of this section. The Stone Source Submittal(s) shall be submitted a minimum of 21 calendar days before scheduling gradation testing or the Contracting Officer's demonstration stockpile and quarry site examination. The Contractor shall also designate a Quality Control (QC) Supervisor in the Stone Source Submittal who shall be responsible for all quality control functions for that proposed stone source. The QC Supervisor shall have at least three (3) years experience in assessing stone quality and quarry stone production. The QC Supervisor shall not be an employee of any subcontractor supplying stone. The QC Supervisor shall also be responsible for conducting gradation testing, and answering the Contracting Officer's questions concerning quality control. The Stone Source Submittal shall include the contact number for the QC Supervisor. The Stone Source Submittal shall be prepared, signed, and stamped by an independent state licensed Professional Geologist, licensed in any

U.S. State that issues a Professional Geologist License. The Stone Source Submittal and Test Reports consisting of Bulk Specific Gravity, Initial Gradation Testing, Evaluation Testing of Stone, and Weight Scale Certificates shall be submitted concurrently. Any of the above submittals submitted individually will be rejected as incomplete.

#### Construction Methods; G|DO

Submit the proposed method of construction, to include the sequence of Geotextile, Bedding Stone, and Import Riprap placement. Construction methods shall also include the planned method of material placement and equipment to be used during each construction phase. The Construction Methods shall be submitted to the Contracting Officer 30 calendar days prior to the scheduled start of work.

#### SD-05 Design Data

##### Survey; G, DO

The Contractor shall submit surveys for both field data and plotted cross sections, as required by paragraph SURVEYS below, for each prepared surface for bedding stone and riprap placement, and the final bedding stone and riprap surface in accordance with the Survey Section of these specifications.

#### SD-06 Test Reports

##### Bulk Specific Gravity; G, DO

At least 21 calendar days in advance of gradation testing at the project site, a copy of bulk specific gravity (SSD) test results shall be provided by the Contractor. Bulk specific gravity testing shall be completed for each lithology type from each proposed stone source planned for use in the project structure. Bulk specific gravity testing shall comply with requirements of paragraph EVALUATION TESTING OF STONE. The bulk specific gravity test results shall be furnished concurrently within the Stone Source Submittal.

##### Gradation Test; G, DO

Submit the gradation test results using the GRADATION TEST DATA SHEET (enclosed at the end of this section) and ENG FORM 4055 for riprap and bedding stone gradations, and in accordance with the requirements of paragraph QUALITY ASSURANCE. The initial gradation test shall be furnished concurrently within the Stone Source Submittal.

##### Evaluation Testing of Stone Report; G, DO

Prior to approval of any Stone Source, the Contractor shall submit laboratory testing results within the Stone Source Submittal. Tests shall be completed in accordance with requirements of paragraphs EVALUATION TESTING OF STONE. The stone tested shall be a representative sample of the stone material to be furnished for the project. Evaluation testing shall be conducted for each Stone Source (quarry) proposed by the

Contractor as a source of stone material. Evaluation testing shall also be conducted for each distinct lithologic type within each Stone Source that the Contractor proposes to supply as new stone material. Lithologic type is defined as rock with different characteristics of color, mineralogic composition, and grain size. Different lithologic types within each Stone Source (quarry) shall be discussed in the Stone Source Submittal. The Evaluation Testing of Stone report shall also list the name and contact information of the Professional Geologist supervising quarry sampling used in evaluation testing. Test sampling data such as date sampled, sample size, and sample volume (by weight) shall be compiled in table format for each lithologic type sampled within each Stone Source. Photographs of field test samples as well as before and after photographs of individual samples tested shall also be included. The Evaluation Testing of Stone Report shall be submitted within and concurrently with the Stone Source Submittal(s) for each Stone source proposed by the Contractor. The Stone Source Submittals and Test Reports consisting of Bulk Specific Gravity, Initial Gradation Testing, and Evaluation Testing of Stone shall be submitted concurrently.

#### SD-07 Certificates

##### Weight Scale Certification; G, RO

For all weight scales used to measure weight of stone material including the Stone Source(s), all transfer points, and work site, and prior to the use thereof, the Contractor shall submit pertinent details on the location, type, and construction of the scale, including a copy of the certification of the scale's accuracy from the local weights and measures regulatory agency. Weight Scale Certifications shall be submitted concurrently with the Stone Source Submittal.

#### 1.4 DEMONSTRATION STOCKPILES

Following the Contracting Officer's approval of the Stone Source Submittal(s) and all associated data and test results, but prior to approval of the Stone Source (quarry), the Contractor shall make arrangements to provide a pre-production demonstration stockpile for each of the stone gradations at each Stone Source. For each gradation class, the stockpiles shall be segregated by each type of lithology approved by the Contracting Officer after review and approval of the Stone Source Submittal and evaluation testing of stone results. The demonstration stockpiles shall be located at the source of the stone (i.e. within the proposed quarry). The stone material placed in the demonstrative stockpile shall be representative of the overall quality of each lithologic type produced in that source and meet all requirements of this specification. Additionally, stone placed in the demonstration stockpile shall not consist of the most perfect stone produced at the stone source unless it is reasonable to determine that the stone source will produce the required amount of stone of the specified gradation with a degree of quality no less than that existent in the demonstration stockpile. The stone material placed in the demonstrative stockpiles shall also be representative of the stone sizes and shapes intended for delivery to the project site. After Contractor's receipt of the Contracting Officer's approval of the Stone Source, the Contractor shall proceed with shipping stone to the project site.

#### 1.4.1 Duration of Demonstration Stockpiles

After the Contracting Officer's written approval of that Stone Source, the stone in each demonstration stockpile shall be split with one-half placed in a location adjacent to the work site. The split stockpiles placed at the work site will provide a basis for visual comparison during placement of the Import Riprap and Bedding Stone on the project structure. One-half of the demonstration stockpiles shall remain unchanged at each source area for each class of stone gradation for visual comparison during quarry production until shipped as the final quantities of that gradation class. The split demonstration stockpile's integrity shall be ensured by surrounding the stockpile by yellow caution tape secured on wooden or metal posts or by other similar method approved by the Contracting Officer.

#### 1.4.2 Quantity and Inspection

Demonstration stockpile quantities shall be provided as indicated below:

<u>STONE CLASS</u>	<u>DEMONSTRATION STOCKPILE QUANTITY</u>
Import Riprap	2 tons
Bedding Stone	500 pounds

#### 1.5 QUALITY ASSURANCE

Stone shall meet all quality, testing, and gradation requirements of this section. The stone shall be clean and reasonably free from soil, quarry fines, foreign material and shall contain no refuse. The stone material shall also be free from shell that is not physically cemented to rock ("free shell"). Any soil, quarry fines, dust, or foreign material adhering to or combined with the stone as a result of production, shipping, or stockpiling processes shall be removed prior to stockpile inspections, gradation testing or placement on the project structure. The Contractor shall clean the aforementioned soil, fines, or foreign material by any method such as water pressure wash or high pressure air that allows visual examination of the stone material. The Contractor shall be responsible for any expense to clean stone for quality control or quality assurance purposes. Inclusion of objectionable quantities (more than 1 percent by total volume) of dirt, sand, clay, chert, and/or rock flour/quarry fines shall not be permitted at the project site. The Contractor's QC Supervisor shall be responsible for all quality control issues.

##### 1.5.1 Gradation Testing

The Contractor's QC Supervisor shall perform gradation tests on each stone gradation class produced at each stone source. Failure on the gradation test sample and on one subsequent gradation test will be considered cause for rejection of the quarry and/or quarry production process if not corrected by the Contractor by the third re-test. All stones in each failed gradation test sample shall be set aside and removed from production stockpiles for reprocessing. All gradation tests shall be reported using the GRADATION TEST DATA SHEET, attached at end of this section. ENGINEERING (ENG) FORM 4055 shall also be prepared for Import Riprap gradations. ENG FORM 4055 shall likewise be prepared for Bedding Stone gradations. All points on individual stone grading curves obtained from representative samples of the gradation test shall lie between the boundary

limits as defined by smooth curves drawn through the tabulated gradation limits plotted on the specified form. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either gap grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the gradation tested.

The minimum test sample size and the number of tests required shall be as follows:

Gradation	Minimum Sample Weight	Number of Stone Source Tests
Import Riprap	2 tons	1
Bedding Stone	500 pounds	1

#### 1.5.1.1 Import Riprap Stone Source Gradation Testing

One gradation test shall be conducted at each proposed source for Import Riprap. Stone shall be tested in accordance with [ASTM D5519](#), Test Method A. The Initial Gradation Test shall be conducted in each proposed source prior to the Contracting Officer's examination of the demonstration stockpile. The Initial Gradation Test will be conducted by the Contractor for quality control (QC) purposes. The Contracting Officer will not be present during the Initial Gradation Test; however, all data collected during the initial gradation tests shall be recorded and reported using the GRADATION TEST DATA SHEET and ENG FORM 4055. The data test sheet along with ENG FORM 4055 shall be submitted to the Contracting Officer in the Stone Source Submittal.

#### 1.5.1.2 Bedding Stone Source Gradation Testing

One gradation test shall be conducted at each proposed source for Bedding Stone. Bedding Stone shall be tested in accordance with [ASTM C136](#) by a USACE validated laboratory. The Initial Gradation Test shall be conducted in each proposed source prior to the Contracting Officer's examination of the demonstration stockpile. The Initial Gradation Test will be conducted by the Contractor for quality control (QC) purposes, sampled according to [ASTM D75/D75M](#). The Contracting Officer will not be present during the Initial Gradation Test; however, all data collected during the initial gradation test shall be recorded and reported using the GRADATION TEST DATA SHEET and ENG FORM 2087. The data test sheet along with ENG FORM 2087 shall be submitted to the Contracting Officer in the Stone Source Submittal.

### 1.6 STONE SOURCE SUBMITTAL

For each individual source of stone (quarry) identified by the Contractor as a potential supplier of material for use in the project structure, the Contractor shall submit in report format, a Stone Source Submittal. The Stone Source Submittal for each source shall contain general quarry information, quarry location map, quarry quality control (QC) practices, proposed shipping methods, and the intended products obtained from that designated source (i.e. Import Riprap or Bedding Stone). The Stone Source submittal shall also include information on that source including the geological formations of the general quarry location, geological formations within the quarry, geologic structure of the formation(s), areas of the quarry producing stone for this project, and quarrying procedures and practices. The submittal shall also include information and discussion on the role and process of all subcontractors (by Company Name) involved in

stone material production. Different lithology types within the quarry as well as the lithostratigraphic(s) units proposed as the source of stone for this project shall be discussed. The Stone Source Submittal shall likewise include both a general map, site specific map, and geological map for each source. The general map shall show the local region of the quarry including major access and shipping routes. The site specific map shall fully define the area of operations within the quarry including the boundaries and working benches of the quarry. Evaluation Testing of Stone results (SD-06 Test Reports), Bulk Specific Gravity, and Initial Gradation Tests from that designated source shall also be submitted within the Stone Source Submittal. The Stone Source Submittal for each quarry so designated shall state that all stone (i.e. different lithologies) within each stone source proposed as a supply of material for this project has met all requirements stipulated herein. No stone shall be shipped from any proposed stone source(s) until the Contractor has received written approval of that source from the Contracting Officer.

#### 1.6.1 Quarry Quality Control Supervisor

The Contractor shall also designate a Quality Control (QC) Supervisor within the Stone Source Submittal who shall be responsible for all QC functions for that proposed stone source. The Contractor's QC Supervisor shall have at least three (3) years experience in assessing stone quality and quarry stone production. The Contractor's QC Supervisor shall also be responsible for preparing the Weekly Certificates for each gradation class specified herein, conducting gradation testing, and answering the Contracting Officer's questions concerning quality control and weekly certificates. The Stone Source Submittal shall include the contact number(s) for the QC Supervisor.

#### 1.6.2 Administrative Requirements

The Stone Source Submittal shall be prepared, signed, and stamped by an independent state licensed Professional Geologist, licensed in any U.S. State that issues a Professional Geologist License. The Professional Geologist shall also describe all deleterious or detrimental geologic features outlined in subparagraph "Stone Material Quality" that exists in the stone material quarried at that source. It is the Contractor's responsibility to complete all submittals and testing requirements to determine that the Stone Source or combination of sources proposed are capable of providing the specified quality, quantities, and gradation needed and at the rate needed to maintain the scheduled progress of the work.

#### 1.6.3 Schedule

The Stone Source Submittal and Test Reports consisting of bulk specific gravity, initial gradation testing, evaluation testing of stone, and weight scale certification shall be submitted concurrently 21 calendar days before scheduling gradation testing and visual examination of demonstration stockpiles at each proposed Stone Source. If the submittal has data omissions or is incomplete, it will be rejected and returned to the Contractor. The Contractor shall correct all errors, omissions, or deficiencies and resubmit the Stone Source Submittal(s) and Test Reports, which shall be submitted a minimum of 21 calendar days before scheduling gradation testing or the Contracting Officer's demonstration stockpile and quarry site examination. The Stone Source Submittal and Test Reports consisting of Bulk Specific Gravity, Initial Gradation Testing, and Evaluation Testing of Stone and weight scale certification shall be

submitted concurrently. Any of the above documents submitted individually will be rejected as incomplete. The Stone Source Submittal and Test Reports consisting of Bulk Specific Gravity, Gradation Testing, Evaluation Testing of Stone, and Weight Scale Certification shall be submitted in three (3) bound, hard copies and one (1) electronic pdf copy. Both the hard and electronic pdf copy shall be in color.

#### 1.6.4 Non-Acceptance

If a source for stone so designated by the Contractor is not accepted for use by the Contracting Officer, the Contractor shall propose other sources, and testing of other sources shall be performed at no additional cost to Government. It is the Contractor's responsibility to complete all submittals, bulk specific gravity test, initial gradation tests, and evaluation testing requirements to determine that the stone source or combination of sources selected are capable of providing the specified quality, shapes, quantities and gradation needed and at the rate necessary to maintain the scheduled progress of the work.

#### 1.7 CONSTRUCTION TOLERANCES

The finished surface and stone layer thickness shall not deviate from the lines and grades shown by more than the tolerances listed below. Tolerances are measured perpendicular to the indicated neatlines. Extreme limits of the tolerances given shall not be continuous in any direction for more than five (5) times the nominal stone dimension nor for an area greater than 50 square feet of the structure surface.

TABLE 1  
NEATLINE TOLERANCES

Material	Above Neatline	Below Neatline
Import Riprap	6 inches	0 inches
Bedding Stone	3 inches	0 inches

The intention is that the work shall be built generally to the required elevations, slope and grade and that the outer surfaces shall be even and present a neat appearance. Placed material not meeting these limits shall be removed or reworked as directed by the Contracting Officer. Payment will not be made for excess material which the Contracting Officer permits to remain in place.

#### PART 2 PRODUCTS

##### 2.1 STONE

All stone material furnished shall meet all requirements specified herein. Stone material shall be composed of hard, fresh, durable particles, adequately free from thin, flat and elongated pieces. Stone shall be separated-from bedrock by quarrying. Testing criteria is outlined in paragraph EVALUATION TESTING OF STONE. For details regarding the required size and shape of stone pieces, see paragraph SIZE AND SHAPE OF STONE. The use of broken concrete rubble or other non-natural non-stone material as riprap or bedding stones will not be permitted. The Contracting Officer will, at any time during the contract period, reject any stone material not meeting specification requirements at the source, transfer point(s), or project work site. Stone material which has been delivered to the project site and is rejected, whether in stockpile or in place in the structure,



shall be weighed, removed from the project site, and replaced at the Contractor's expense. The Contractor shall maintain records accumulating total weight of rejected stone material. When directed to do so by the Contracting Officer, rejected stones shall be returned to the stone's source at the Contractor's expense for the purpose of visually showing the quarry operators examples of stones which will not be acceptable, in lieu thereof, quarry operators may be brought to the project site at the Contractor's expense for the same purpose.

#### 2.1.1 Stone Material Quality

All stone material shall be free of any detrimental geologic features such as, but not limited to, clay seams, shale seams, argillaceous material, any stylolites, schistose seams, detrimental vugs zones or seams, zones of high foliation, and/or other adverse diagenetic features or seams. No schistose stone material or any highly foliated stone material will be acceptable. Sedimentary or metamorphic stone containing carbonaceous, coal, clay seams/lenses/joints or similar deleterious features will not be permitted or accepted. All stone material utilized shall be free of cracks, blast fractures, bedding seams, foliation seams, foliation joints, joints, any deleterious features such as splits, spalls, delaminations, disaggregations, disjuncture, shaly parting, or combination thereof of such features, and/or other defects that would tend to increase its deterioration from natural causes. An independent, state licensed Professional Geologist, licensed in any U.S. State that issues a Professional Geologist License, shall determine if the aforementioned features are present within stone material from any of the proposed Stone Source(s). Discussion of Stone Material Quality and any detrimental or deleterious features present within any source shall be included in Evaluation Testing of Stone and the Stone Source Submittal for that Stone Source. Examples of deleterious and detrimental features in stone can be viewed in [ERDC/GL TR-81-8](#). [EM 1110-2-1601](#), [EM 1110-2-1100 Part VI](#) and [EM 1110-2-2302](#) provide guidance on the stone properties, characteristics, and gradations specified herein.

#### 2.1.2 Cracked Stone Criteria

Criteria used by the Contracting Officer for a "fractured" or "cracked" stone is defined as "any stone which contains one visible and continuous crack or fracture and exposed on two or more faces of the stone, or any stone which contains two or more visible non-continuous cracks or one continuous fracture on any one face of the stone." A continuous crack or fracture is defined as "an exposed unbroken and uninterrupted visible crack or fracture with a length equal to or greater than one-half of the dimension of the face on which it is exposed". Evaluation of a crack or fracture along a stone face shall only be based upon length and not width (openness) of that crack or fracture.

### 2.2 GRADATION

#### 2.2.1 Bedding Stone

Bedding Stone quality must be as specified in Part 2. The maximum stone size allowed is 4.0 inches. The minimum stone size allowed shall not pass the No. 8 Sieve. The D85 of the gradation shall be 1.5 inches or greater. D85 is the size at which 85 percent of the gradation is finer. Available standard gradations that meet these requirements are [ASTM C33/C33M](#) size No. 357, No. 3, No. 2, and No. 1. Other physical characteristics of bedding stone are presented in paragraph EVALUATION TESTING OF STONE below.

### 2.2.2 Import Riprap Type 1

In place, Import Riprap shall meet the gradation requirements of [ASTM D6092](#) size R-60 shown below. Dimensions are approximated using equation (A1.4) provided in [ASTM D5519](#). Other physical characteristics are presented in paragraph EVALUATION TESTING OF STONE below.

Weight (Dimension)	Percent Passing
150 lb (13 in.)	100
60 lb (10 in.)	50 - 100
30 lb (8 in.)	15 - 50
10 lb (5 in.)	0 - 15

### 2.2.3 Import Riprap Type 2

In place, Import Riprap shall meet the gradation requirements of [ASTM D6092](#) size R-300 shown below. Dimensions are approximated using equation (A1.4) provided in [ASTM D5519](#). Other physical characteristics are presented in paragraph EVALUATION TESTING OF STONE below.

Weight (Dimension)	Percent Passing
700 lb (22 in.)	100
300 lb (16 in.)	50 - 100
150 lb (13 in.)	15 - 50
45 lb (9 in.)	0 - 15

## 2.3 EVALUATION TESTING OF STONE

All evaluation testing shall be completed by a USACE validated commercial testing laboratory unless otherwise specified herein.

### 2.3.1 Evaluation Tests

Testing for the purposes of evaluating the indexing quality of the stone material proposed for use on this project will be made at the Contractor's expense. Evaluation testing shall be completed on each lithologic type(s) listed in each Stone Source Submittal proposed for use as stone material in the project structures. Selection and preparation of stone evaluation test samples shall be made under the direct supervision of an independent, state licensed Professional Geologist, licensed in any U.S. State that issues a Professional Geologist License. Stone Evaluation Test samples shall be shipped and tested, at the Contractor's expense, to an independent, USACE validated commercial laboratory. The Professional Geologist shall determine proper sampling methods in accordance with ASTM technical references listed herein, record field examination information, oversee field evaluation testing sampling, and photograph field samples. Evaluation test field sampling data and field examination observations shall be recorded and discussed in the Evaluation Testing Of Stone Submittal. Information included in the Evaluation Testing of Stone Submittal shall also discuss that the tests and observations were performed by or under the direct supervision of the State Licensed Professional Geologist and that the results are representative of the materials or conditions being certified by the tests. The field examination shall include the information outlined in [ASTM D4992](#), paragraph 7.

### 2.3.2 Sample Selection

Samples for each lithology type proposed for use shall consist of at least five (5) pieces of stone, roughly cubical in shape and weighing not less than 150 pounds. The stone samples selected shall be prepared for testing by crushing or cutting samples to the required gradation or slab size as specified in each ASTM method. Selection and preparation of stone evaluation test samples shall be made under the supervision of a Professional Geologist. The samples shall be shipped at the Contractor's expense to USACE validated laboratory to perform the required tests at least 120 days before the production stone leaves the quarry.

### 2.3.3 Testing Criteria

All stone material shall meet or exceed the criteria specified in Table 2 below. The tests to which the stone material shall be subjected include unit weight, specific gravity, absorption, sulfate soundness, LA abrasion, freezing and thawing, wetting and drying, and petrographic analysis in order to demonstrate that the stone is of a satisfactory quality. The test method gradation used for L.A. Abrasion shall be in accordance with **ASTM C535**, Grading #1. Test samples used in testing methods measuring a percent loss of the parent sample shall have pre-test and post-test photographs taken and presented in the Evaluation Testing of Stone Submittal.

#### 2.3.3.1 Acceptance Criteria

Stone meeting criteria requirements for import riprap has no known source in South Florida and will need to be shipped from a location outside of Florida. See Table 2 below:

TABLE 2  
STONE ACCEPTANCE CRITERIA

TEST	ASTM STANDARD	TEST VALUE CRITERIA - IMPORT RIPRAP	TEST VALUE CRITERIA - BEDDING STONE
Unit Weight	<b>ASTM C127</b>	Greater than or equal to 165 pcf (Saturated Surface Dry) *	Greater than or equal to 135 pcf (Saturated Surface Dry)
Specific Gravity	<b>ASTM C127</b>	Greater than or equal to 2.65 (Saturated Surface Dry)	Greater than or equal to 2.16 (Saturated Surface Dry)
Absorption	<b>ASTM C127</b>	Less than 1%	Less than 5%
Sulfate Soundness	<b>ASTM C88</b>	Less than 5% loss	Less than 10% loss
LA Abrasion	<b>ASTM C535</b>	Less than 20% loss for 500 revolutions	Less than 35% loss for 500 revolutions

TEST	ASTM STANDARD	TEST VALUE CRITERIA - IMPORT RIPRAP	TEST VALUE CRITERIA - BEDDING STONE
Wetting and Drying	ASTM D5313/D5313M	Less than 1% loss for 30 cycles with no progressive cracking	Less than 2% loss for 30 cycles with no progressive cracking
Freezing and Thawing	COE CRD-C 144, ASTM D5312/D5312M	Less than 10% loss for 20 cycles	Less than 15% loss for 20 cycles
Petrography	ASTM C295/C295M	Fresh, interlocking crystalline, no clay minerals, and no soluble materials	Not applicable

\* No known local source for 165 pcf stone.

#### 2.3.3.2 Freezing and Thawing and Wetting and Drying

Stone material shall be subjected to freezing and thawing, and wetting and drying testing in accordance with ASTM D5312/D5312M and ASTM D5313/D5313M, respectively. Photographs for freezing and thawing and wetting and drying testing shall be taken for each sample tested both before after testing. Any changes observed in the testing specimen including, but not limited to, cracking, spalling, rock popping, or dissolving shall be recorded and photographed at the completion of next test cycle.

#### 2.3.3.3 Petrography

Stone material shall be subjected to comprehensive petrographic evaluation in accordance with ASTM C295/C295M. Stone material shall be fresh (no signs of weathering), with interlocking crystalline structure, and free of material such as expansive clays or any detrimental or deleterious features discussed in subparagraph "Stone Material Quality". Crystalline structure refers to igneous, metamorphic, or sedimentary rock texture consisting of interlocking, crystalline grains. Matrices of any stone consisting of argillite, sericite, smectite, talc, chloritic, soft material, or highly weathered material shall be identified and noted. Examination shall include description of any seams, veins, or joints and an estimate of alteration, degree of weathering, and probable rock durability. The comprehensive petrographic examination shall also include description of dominant, accessory and alteration minerals. The petrographic examination shall be conducted by a State Licensed Professional Geologist specializing in the field of Mineralogy or Petrography. Photographs of stone material examined shall accompany the petrography testing results. Petrography may be completed at a laboratory other than an approved USACE validated commercial testing laboratory; however, certification proving that a State Licensed Professional Geologist specializing in the field of Mineralogy or Petrography will be completing this evaluation must be included in the Evaluation Testing of Stone Submittal for review and approval.

## 2.4 SIZE AND SHAPE OF STONE

Stone delivered under this contract shall be blocky in shape with sharp angular edges. The term blocky shall be understood to mean cuboidal (roughly cubical in shape). The term angular shall be understood to mean that the blocky stone shall have sharp, clean, angular to sub-angular edges at the intersections of relatively flat faces. All boulders and parts of boulders will be rejected, with a boulder being defined as any rounded stone not having sharp, clean, angular to sub-angular edges. All stone deemed unacceptable shall be set aside and will not be used for this contract. Stones having a length to thickness ratio greater than 3:1 are considered flat, elongated or flat, and elongated and will be rejected.

## 2.5 ACCEPTANCE OF STONE MATERIAL

Prior to shipment of any stone material from the quarry, the Contractor shall have received the Contracting Officer's final written approval on all submittals and final written approval for each Stone Source designated by the Contractor as a potential supplier of stone material for this project.

### 2.5.1 Acceptance Exclusions

Acceptance of a source of stone is not to be construed as acceptance of all material from that source. The Contracting Officer reserves the right to reject materials from certain localized areas, zones, strata, or channels, when such materials do not meet specified requirements for stone as determined by the Contracting Officer. The Contracting Officer also reserves the right to reject individual units of stone materials in stockpiles at the quarry, all transfer points, and at the project construction site when such materials are determined to not meet the requirements of the project specifications or are questionable. Stone material shipped to the project site that is of a different lithologic type (mineral composition) than those identified in submittals and submitted for evaluation testing and approval may likewise be rejected. Stone material produced from all sources shall meet all the requirements of this section. All costs of submittal preparation and testing will be at the Contractor's expense.

### 2.5.2 Stone Material Not Meeting Specifications

If, during the progress of work, it is found that the stone material being furnished and/or placed by the Contractor does not fully meet all the requirements of these specifications, the Contractor shall furnish other stone material that meets the requirements specified herein. Any stone rejected at the site of work, as not meeting the requirements of these specifications for quality, size, shape, weights, or gradation shall be removed from the site by and at the expense of the Contractor, and stone meeting the requirements shall be furnished and placed by the Contractor at no additional cost to the Government. All stone material will be subject to inspection during loading at the source or at any other point in the delivery and construction process including after material has been placed into the project structure.

### 2.5.3 Resampling Due to Quality Issues

During the contract period, both prior to and after materials are delivered to the job site, visual inspections and measurements of the stone materials may be performed by the Contracting Officer at any point in the production, transportation, or construction process. If the Contracting Officer,

during these inspections, finds that the stone quality, gradation or weights of stone being furnished are not as specified or are questionable, re-sampling and re-testing by the Contractor shall be performed. Sampling of the stone for testing and the manner in which the testing is performed will be as directed by the Contracting Officer. The Contractor will be required to obtain, under the supervision of the Contracting Officer, samples of at least five (5) pieces of 150-pound stone, and deliver them at his own expense to the Government approved testing laboratory in the states of Florida or Georgia. This additional sampling and testing will be performed at the Contractor's expense when test results indicate that the materials do not meet specified requirements. No time extension or claim for costs will be allowed for the time or cost required to approve or reject alternate stone sources. When test results indicate that materials meet specified requirements, an equitable adjustment in the contract price will be made for the sampling and testing. Any material rejected is the responsibility of the Contractor and shall be removed from the stockpile, project site, etc. at the Contractor's expense. The Contracting Officer reserves the right to collect samples at any of the above production or transfer points for independent QA testing.

## 2.6 SITE STAGING OR STOCKPILING

Stockpiling/staging may be performed at the project site within the work limits. However, stockpiling of Existing Riprap shall be within the location indicated on the drawings. It is the responsibility of the Contractor to locate, investigate, and obtain any additional work areas/spaces that may be necessary for construction operations. If the Contractor elects to provide off-site stockpiling or staging areas, the Contracting Officer shall be notified by the Contractor of all such areas. All proposed offsite stockpile and staging areas are subject to the Contracting Officer's approval. After being stockpiled, any stone which has become contaminated with soil or refuse shall not be put into the work unless the contaminating material has been removed from the stone prior to placement in accordance of paragraph QUALITY ASSURANCE of this section.

## PART 3 EXECUTION

### 3.1 BASE PREPARATION

#### 3.1.1 Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation. The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated on the contract drawings and as specified. Where such areas are below the allowable minus tolerance limit they shall be brought to grade by fill with earth similar to the adjacent material and then compacted to a density equal to the adjacent in place material. Immediately prior to placing the geotextile, bedding stone and riprap, the prepared base will be inspected by the Contracting Officer and no material will be placed thereon until that area has been approved. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING.

#### 3.1.2 Removal of Existing Riprap

Existing Riprap located within the construction limits shall be removed in areas shown on the contract drawings. This stone shall be stockpiled in accordance with paragraph SITE STAGING OR STOCKPILING above, and not

disposed of.

### 3.1.3 Finishing

The surface of excavations and subgrades shall be finished to the lines, grades, and cross sections or elevations shown on the contract drawings. The degree of finish for graded areas shall be within plus 2 inches or minus zero inches of the grades and elevations indicated.

## 3.2 PLACEMENT

### 3.2.1 Geotextile

Geotextile conforming to the requirements of Section 31 05 19 GEOTEXTILE shall be placed along the prepared ground surface, to the lines and grades indicated on the contract drawings, prior to placement of bedding stone and riprap.

### 3.2.2 Bedding Stone

Bedding Stone shall be spread uniformly to the lines and grades as indicated in the drawings and within tolerances indicated in paragraph CONSTRUCTION TOLERANCES, and shall be placed in such manner as to avoid damage to the geotextile. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Placing of bedding stone by methods which tend to segregate the particle sizes within the layer will not be permitted. Any damage to the geotextile during placement of bedding stone shall be repaired and approved by the Contracting Officer before proceeding with the work. Compaction of bedding stone will not be required, but shall be finished to present an adequately even surface, free from mounds or windrows

### 3.2.3 Import Riprap

Import Riprap shall be spread uniformly on the respective bedding stone to the lines and grades as indicated on the contract drawings and tolerances indicated in paragraph CONSTRUCTION TOLERANCES and in such manner as to avoid damage or displacement to the bedding stone. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively well graded mass with the minimum practicable percent of voids. The stones shall be well distributed and the entire mass of stones shall be roughly graded to conform to the gradation specified in paragraph GRADATION above. Riprap shall be placed to its full course thickness in one operation. The finished layer shall be free from pockets of small stones, clusters of larger stones, or large voids. Placing of riprap by methods which tend to segregate the particle sizes within the layer will not be permitted. Placing riprap in layers will not be permitted. Dumping riprap material will not be permitted. Riprap shall not be dropped from a height greater than one foot. The desired distribution of the various sizes of stones throughout the mass shall be obtained, at the option of the Contractor, either by selective loading at the quarry or stone source, by controlled placement of successive loads, or by a combination of these methods. Placing stone by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. Rearranging of individual stone will be required to the extent necessary to obtain a well-graded distribution of stone sizes as specified above. However, manipulating stone by means of a dozer or other blade equipment will not be permitted. Compaction of riprap will not be

required, but shall be finished to present an adequately even surface, free from mounds or windrows with adequate rock to rock contact ensuring that each stone is firmly set and supported by underlying materials and adjacent stones.

#### 3.2.4 Re-use of Existing Riprap

The Contractor may elect to re-use existing riprap for interior cofferdam and landside cofferdam berm slopes and/or in the abandonment of the old IP-3 culvert, but not on the exterior cofferdam slopes or any other post-construction embankment. The Government will not guarantee the quantity or quality of existing riprap should the Contractor choose to use it. Evaluation or Bulk Specific Gravity testing of existing riprap will not be required; however, after existing riprap removal and before being stockpiled, all contaminating materials adhering to or contained with the stone such as soil, foreign material, organic material or refuse shall be removed. Also, after being stockpiled, any stone which has become contaminated with soil or refuse shall not be put into the work unless the contaminating material has been removed from the stone prior to placement. Stone shall be handled in such a manner as to reduce splitting, cracking, spalling or other degradation to the stone.

### 3.3 LIMITATIONS OF PLACEMENT PROCEDURES

Stone construction in advance of completed permanent protection except as specified herein shall be at the Contractor's risk. The Contractor shall keep the Contracting Officer informed as to any and all situations that may result in a possible interruption of work.

#### 3.3.1 Interruptions

If the Government can anticipate that the stone construction will be interrupted for more than four (4) continuous days, including weekends and holidays, the Contractor may be required to complete the placement of the geotextile, bedding stone, and riprap, and provide protection of the exposed ends prior to the start of the interruption. All material used for protecting the exposed ends shall be removed after the need has ended, and shall be incorporated into the required permanent construction as required herein. All materials which are removed and placed in the permanent construction, in accordance with the provisions of this section, will be measured and paid for only once. When temporary protection of exposed ends of construction in progress is ordered or directed by the Contracting Officer, an equitable adjustment will be made for the work of temporarily placing and removing the stone materials. The Government has no obligation to order that exposed ends be protected. If the Government takes no action to have exposed ends protected, then the provisions of the subparagraph "Material Placement in Advance" (below) shall apply.

#### 3.3.2 Material Placement in Advance

In the event an unprotected section of any length is left during a non-work period, and is damaged or causes damage to a completed section, the damaged portion(s) shall be replaced or reshaped as approved by the Contracting Officer at no additional cost to the Government.

### 3.4 SURVEYS

The Contractor shall establish and maintain quality control for all work performed at the job site under this section to assure compliance with



contract requirements. He shall maintain records of his quality control tests, inspections and corrective actions. Quality control measures shall cover all construction operations including, but not limited to, the placement of all materials to the slope and grade lines shown and in accordance with this section.

#### 3.4.1 Placement Surveys

Surveys made by the Contractor are required on each material placed for determining that the material layers are acceptably placed in the work. The Contractor shall make survey checks as the work progresses to verify lines, grades thicknesses, and tolerances are established for completed work. At least one (1) placement-control survey every 50 linear feet shall be made for each of Bedding Stone and Import Riprap placed, and shall be measured along the embankment centerline. The cross section determined by the pre-placement and post-placement survey shall be approved by the Contracting Officer before proceeding with the next 50-foot length of stone placement. Cross sections shall be taken on lines 50 feet apart measured along the embankment centerline. Elevations shall be taken on 5-foot intervals and at breaks along each cross section. Approval of cross sections based upon placement surveys shall not constitute final acceptance of the work. However, other cross section spacing and reading intervals may be used if determined appropriate and approved by the Contracting Officer. Additional elevations shall be taken as the Contracting Officer may deem necessary or advisable. The surveys shall be conducted in the presence of an authorized representative of the Contracting Officer, unless this requirement is waived by the Contracting Officer.

#### 3.5 GRADATION TEST DATA SHEET AND EXAMPLES

See next page.

Date of Test \_\_\_\_\_ Testing Rate \_\_\_\_\_

Contract No.	District	Tons
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	TOTAL	

Stone Size (lbs)	Weight Retained	Individual % Retained	Cumulative % Ret. % Pass	Specification % Finer by wt
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Total Weight					
Max Size Stone =					

Remarks:

I certify that the above stone sample is representative of the total tonnage covered by this test report.

Contractor Representative \_\_\_\_\_  
Government Representative \_\_\_\_\_

EXAMPLES ONLY

EXAMPLE GRADATION SPECIFICATIONS	
PERCENT LIGHTER BY WEIGHT	STONE WEIGHT IN LBS
100	400 - 160
50	160 - 80
15	80 - 30

EXAMPLE WORKSHEET				
STONE SIZE LBS	INDIVIDUAL WT. RETAINED	INDIVIDUAL PERCENT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT PASSING
400	0	0	0	100
160	9,600	30	30	70
80	11,200	35	65	35
30	8,000	25	90	10
<30	3,200	10	100	0
TOTAL	32,000 pounds			
NOTE: Largest stone 351 pounds.				

-- End of Section --

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EMBANKMENT CONSTRUCTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2010) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C294	(2012) Standard Descriptive Nomenclature for Constituents of Concrete Aggregates
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2700 kN-m/m <sup>3</sup> )
ASTM D2216	(2010) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2974	(2007a) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D4253	(2000; R 2006) Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and

#### Plasticity Index of Soils

ASTM D4373	(2014) Standard Test Method for Rapid Determination of Carbonate Content of Soils
ASTM D4643	(2008) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

#### U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	Safety and Health Requirements Manual
ER 1110-1-1807	(2014) Engineering and Design -- Drilling in Earth Embankment Dams and Levees

The most recent USACE EM 385-1-1 can be viewed at the web site indicated in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

## 1.2 DEFINITIONS

### 1.2.1 Clearing

Clearing consists of the removal and satisfactory disposal of all trees, downed timber, snags, slash, brush, garbage, trash, debris, fencing, rock larger than 3 inches in diameter and other items occurring in the designated areas to be cleared.

### 1.2.2 Stripping

Stripping consists of the removal and satisfactory disposal of crops, weeds, grass, and other vegetative materials to the ground surface and topsoil to a depth of at least 6 inches.

### 1.2.3 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches 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 18 inches 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 embankment fill and compacted to make the surface conform with the original adjacent surface of the ground.

### 1.2.4 Topsoil

Topsoil is defined in Section 32 92 23 SODDING.

### 1.2.5 Embankment Fill

Satisfactory materials for Embankment Fill shall consist of materials



classified in accordance with ASTM D2487 as SP-SM, SW-SM, SP-SC, SW-SC, or SM, with a Uniformity Coefficient ( $C_u$ ) greater than 2 (ASTM D422), and shall have a gradation grade no finer than as shown in the table below. Embankment fill shall be free from contamination from hazardous, toxic or radiological substances; trash, and debris. Not all satisfactory materials can be used in embankment or backfill construction. Only the satisfactory materials stated above, meeting the additional requirements of paragraph TYPES OF FILL MATERIALS and subparagraph "Embankment and Backfill Materials" below, can be used for embankment construction. SM soils may retain excess moisture and may be difficult to compact unless proper measures to control moisture are taken. Embankment Fill shall not contain particle sizes greater than 3 inches in any direction. Organic content shall be less than 3 percent in accordance with ASTM D2974. In no case shall the proportion of gravel (material larger than the U.S. No. 4 Standard Sieve) exceed 20 percent by weight of the embankment or backfill material.

U.S. Standard Sieve Size	Maximum Percent Passing
50	90
70	65
100	35
200	20

#### 1.2.6 Select Fill

Select fill consists of satisfactory materials classified in accordance with ASTM D2487 as SP or SW, and with a Uniformity Coefficient greater than 3 (ASTM D422).

#### 1.2.7 Filter Soil

Filter Soil, composed of the material silica sand, in-place shall meet the quality requirements of ASTM C33/C33M grading for fine aggregate with additional limits on the allowable percentage passing the No. 200 sieve as specified in TYPES OF FILL MATERIALS. Silica minerals (quartz) are defined in ASTM C294 (Section 5.1), a referenced document in ASTM C33/C33M. The provided Filter Soil shall contain no calcareous and/or carbonaceous materials. Particle shapes must be angular, and must not be well rounded, rounded or sub-rounded. Friable particle content must be no greater than 3 percent per ASTM C33/C33M, Table 1. The percentage of friable particles must be determined per ASTM C142/C142M. Therefore, the provided fine aggregate material must be composed of at least 95 percent silica sand, with no more than 2 percent silica fines (particles passing the No. 200 sieve) and 3 percent friable particles, to meet the project specification requirements. Laboratory testing must be performed as outlined in ASTM C33/C33M, Sections 5 through 8, and must include, but is not limited to, particle size distribution (ASTM C136), test method for soundness (ASTM C 88), standard test method for rapid determination of carbonate content of soils (ASTM D4373), and percent of friable particles (ASTM C142/C142M). All testing must be representative of the materials delivered to the project site. Test results must be signed and sealed by a licensed Professional Engineer or Geologist, licensed in the state from which the material is tested, and must clearly state that the fine aggregate to be furnished is silica sand (per this specification).

#### 1.2.8 Soil Bentonite Fill

Soil Bentonite Fill shall be in accordance with Section 35 42 00  
SOIL-BENTONITE FILL

#### 1.2.9 Unsatisfactory Materials

Unsatisfactory materials shall not be used in any embankment or other required fill and shall not be allowed to remain beneath embankment or structures. Unsatisfactory materials includes all other materials that are not defined as satisfactory materials.

#### 1.2.10 Satisfactory Materials

Satisfactory materials shall consist of all fill and soil needed for the embankment construction which includes Embankment Fill, Select Fill, Soil Bentonite Fill, Filter Soil, Filter Gravel, Bedding Stone and Riprap.

#### 1.2.11 Embankment

The terms "levee" or "embankment" as used in these specifications are defined as the earth fill portions of the embankment structure or other fills, including the temporary earthen plugs and earthen cofferdam, related to the embankment structure.

#### 1.2.12 Backfill

Backfill as used in this section is defined as that fill material which cannot be placed around or adjacent to a structure until the structure is completed or until a specified time interval has elapsed after completion.

#### 1.2.13 Excavation

Excavation consists of removal of material to the lines and grades shown on the drawings, or as otherwise directed or approved by the Contracting Officer and as described in the paragraph EXCAVATION in PART 3 EXECUTION.

#### 1.2.14 Classification of Soils

Materials used to construct the embankments and for backfills shall be classified in accordance with ASTM D2487 (Unified Soil Classification System). Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, SP-SM, SP-SC and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

#### 1.2.15 Degree of Compaction

Degree of compaction for all fill types except Filter Soil is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D1557, abbreviated hereinafter as percent of the maximum dry density. Degree of compaction for Filter Soil is expressed as a percentage of the maximum dry density obtained in accordance with ASTM D4253, abbreviated hereinafter as relative compaction.

#### 1.2.16 Hard/Unyielding Materials

Hard unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials with stones greater than 8 inches in

any dimension. These materials usually require the use of heavy excavation equipment, ripper teeth or jack hammers for removal.

### 1.3 SYSTEM DESCRIPTION

The work covered by this section consists of furnishing all equipment, labor, materials, and incidentals, and performing all operations necessary for the clearing, grubbing, and stripping of the areas specified herein or indicated on the drawings, and for the removal and disposal of cleared, grubbed, and stripped materials, removal of existing drainage structures, and refilling of holes resulting from grubbing; excavation of existing levees, and for all other excavations incidental to the construction of levees as specified and shown; foundation preparation and the construction of levee embankments, including new levee, enlargement of existing levee, backfill of berms, road crossings, backfill at drainage structures, and other incidental earthwork as may be necessary to complete the construction as specified herein and as shown on the drawings. All work under this section shall comply with the requirements of COE EM 385-1-1.

#### 1.3.1 Embankment and Backfill Materials

Materials for embankment and backfill construction shall be obtained from offsite sources provided by the Contractor. Onsite materials obtained from excavations will require processing to meet the requirements for Embankment Fill. The Government will not be responsible for assumptions made by the Contractor regarding the suitability of materials obtained nor the quantity of suitable materials available after processing. No additional compensation over the bid price for imported borrow material from offsite sources will be given for processing or transportation of onsite materials from required excavations.

#### 1.3.2 Haul Roads

Haul roads shall be located and constructed as approved by the Contracting Officer within the project boundaries shown on the drawings. Prior to the commencement of construction submit for approval a site plan detailing the location of all haul roads within the project limits. Haul roads shall be constructed to maintain the intended traffic, be free draining, and be maintained in good condition throughout the contract period. Any haul road which crosses any creek or drainage channel shall be constructed, and maintained so as to not flood either upstream areas by restricting stream flows or flood downstream areas by the release of any stored water in the event that the crossing fails for any cause. Haul roads constructed during the contract duration shall be removed after work is completed and the impacted area restored to its preconstruction conditions. All costs associated with these haul roads shall be considered as a subsidiary obligation of the Contractor.

#### 1.3.3 Stockpiling

Any on-site stockpiling of embankment materials shall be in accordance with paragraph STOCKPILES below. No payment will be made for such stockpiling nor for the reloading and hauling of these materials to their final position.

#### 1.3.4 Slides and Foundation Failures

When sliding occurs in any part of the embankment and backfills prescribed in this section after they have been placed, but prior to final acceptance

of all work under the contract, repair the slide as directed by the Contracting Officer. When the slide is caused through the fault of the Contractor, the repair shall be made at no cost to the Government. When the slide is not the fault of the Contractor, an equitable adjustment in the contract price shall be made pursuant to the Contract Clause CHANGES to cover the cost of the repairs.

#### 1.3.5 Drainage Requirements

The Contractor shall not block or restrict the flow in a natural drain, existing culvert, ditch or channel at any time without obtaining prior written approval from the Contracting Officer. This approval will not relieve the Contractor from responsibility for any damage caused by the operation. Diversion ditches, dikes, and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

#### 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 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

##### Dewatering Work Plan; G, DO

A Dewatering Work Plan detailing how surface and groundwater will be controlled throughout construction shall be submitted within 30 calendar days after receiving Notice to Proceed. The Contractor shall demonstrate a minimum of ten (10) years experience in the construction of dewatering systems including, but not limited to, sheet pile, pumping, well point installation and extraction, and earthen cofferdams. For proposed drilling work, the Contractor shall submit a Drilling Program Plan as required in Section 01 57 50 DRILLING PROGRAM PLAN. The dewatering system design engineer shall be a Florida licensed professional engineer with a minimum of ten (10) years experience in performing similar work. Surface and/or groundwater control will require as a minimum the use of a single stage or multistage well point or deep well system. The use of temporary diversion ditches, containment berms, sloping the subgrade, and dewatering by the use of pumping and sumps may also be required to maintain a dry excavation. All wells shall be decommissioned in accordance with Section 33 29 00 DECOMMISSIONING WELLS. The information submitted in the dewatering plan shall be in accordance with Federal, State and local laws and regulations, F.A.C. Rule Chapters 40E-2 and 40E-20, and the Florida Department of Environmental Protection (FDEP) permit indicated in Section 01 57 20 ENVIRONMENTAL PROTECTION.

The following information shall be included in the Dewatering Work Plan:

- a. Qualifications of the design professional(s) responsible for design and operation of the dewatering system and safety inspection procedures. The dewatering plans and calculations for the dewatering system shall be signed and sealed by a registered professional engineer licensed in the State of Florida.
- b. Site plan of the project component with a description of the dewatering system and equipment, layout including the location of sumps, wells, well points, backup pumps, temporary containment berms, cofferdams, or diversion ditches as necessary; installation methods; description and layout of the onsite water detention system; location of the proposed discharge point(s), discharge rate flow meters, and the associated water quality monitoring locations; and re-watering procedures. All effluent generated during dewatering operations shall be discharged into Canal 40.
- c. A detailed description of the sequence of construction and dewatering, including a description of control elevations during cofferdam/stability berm construction, and control elevations during construction.
- d. The location and type of turbidity control devices and methods necessary to ensure State Water Quality will be met.
- e. Calculations estimating the area of influence of dewatering, depth of dewatering, pumpage rates, duration and volumes, and stability of system, consistent with planned construction activities.
- f. A plan for construction of each temporary cofferdam system. The plan shall contain a description of the type of cofferdam, a list of materials to be used, and a detailed installation and removal sequence.
- g. An operational plan, which demonstrates that the discharge to the receiving water body meets all applicable State Water Quality standards prior to discharge, and also contains the proposed sampling locations and daily turbidity measurements.
- h. A contingency plan, which includes procedures for ceasing dewatering operations and corrective actions (to include a contingency plan in the event proper dewatering as per the Contractor's own design is not achieved) until water quality standards are met.
- i. A plan for rewatering the site so that no adverse impacts to the structure occur. At a minimum, include the proposed rate of groundwater level rise.

Earthwork operations shall not commence until the Dewatering Work Plan is approved. The Contractor shall allow 45 calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittal of the Dewatering Work Plan is required due to deficiencies in the plan.

#### Shoring, Sheeting, and Bracing; G, DO

Submit a detailed shoring, sheeting and bracing plan 30 days prior to the beginning of installation of such features or any

excavation so supported, whichever occurs first. The plan for shoring, sheeting and bracing shall be prepared and certified by a Florida licensed professional engineer. Include in the plan drawings and design computations of the proposed shoring, sheeting, and bracing, and documentation, showing details of the coordination and approval of shoring, sheeting, and bracing by the applicable parties. Approval of the detailed plan shall be obtained from the Contracting Officer prior to starting the work. If necessary, modify the plan as required to meet field conditions, and the modifications shall be approved prior to use.

#### Excavation; G, DO

Submit a written excavation plan 30 days prior to the beginning of any excavation. Approval of the detailed plan shall be obtained from the Contracting Officer prior to starting the work. If necessary, modify the plan as required to meet field conditions, and the modifications shall be approved prior to use. As a minimum, the plan shall contain, the following:

- a. Proposed methods for preventing interference with, or damage to, existing underground or overhead utility lines, trees designated to remain and other man-made facilities or natural features designated to remain within or adjacent to the construction rights-of-way.
- b. Provision for coordinating the work with other Contractors working in the construction rights-of-way or on facilities crossing or adjacent to this work.
- c. Stockpiling plan for reusable excavated soil on site (meeting the criteria for Embankment Fill) showing locations, stockpile heights, slopes, limits, and drainage around the stockpile areas.
- d. Stockpiling plan for Embankment Fill before it is transported to the project site showing locations, stockpile heights, slopes, limits, and drainage around the stockpile areas.
- e. A complete listing of equipment used for excavation and to transport the excavated material.
- f. The Contractor's proposed road pattern, and plan for implementing dust control measures.

#### Plan of Operations; G, DO

Thirty (30) days prior to commencement of haul road construction or placing embankment and backfill which ever is earlier, submit for approval a Plan of Operations for accomplishing all embankment and backfill construction and for the location and construction of haul roads. This plan shall include, but not be limited to, the proposed sequence of construction for embankment and backfill items, and methods and types of equipment to be utilized for all embankment and backfill operations, including transporting, placing, and compaction. This plan shall also include the names and addresses of the commercial testing labs which will perform the soil testing and inspection and describe how all required soils testing will be performed.

**Embankment and Backfill Materials; G, DO**

At least 30 days prior to delivery of any Contractor-furnished material to the site of the work, submit soil classification test results, moisture-density curves, gradation curves, and laboratory results of the required tests of the proposed material.

**Survey of Restored Embankment; G, DO**

After placement of fill to required grades and prior to placement of sod and other surface treatment, perform a topographic survey of the restored embankment. Submit the topographic survey (drawings) for approval by the Government prior to removal of the cofferdam system.

**SD-06 Test Reports**

**Foundation Inspection Checklist; G, RO**

Submit a Foundation Inspection Checklist notifying the Government that the foundation is ready for inspection. Approval of this checklist by the Contracting Officer will serve as notification from the Contractor that the foundation is ready for mapping and inspection. Notify the Contracting Officer at least seven (7) days before foundation preparation will be completed and ready for inspection by the Government. The checklist shall include, but is not limited to the following:

- a. Excavation bottom and side slopes are to the lines and grades indicated on the drawings.
- b. Dewatering system is fully installed and operational and all dewatering requirements outlined in these specifications are met. Surfaces of excavation bottom and side slopes shall be dry and free from standing water, seepage, sloughing, boils, uplift or heave. Groundwater monitoring via open pipe piezometers shall be ongoing.
- c. Temporary ramps covering excavated side slopes are removed such that the excavated side slopes can be documented and mapped.
- d. Equipment for foundation excavation and mapping are on site and provisions for equipment operating personnel have been coordinated.

**Nuclear Density; G, RO**

Use nuclear density testing equipment in accordance with **ASTM D6938**. In addition, the following condition shall apply:

- a. Prior to using the nuclear density testing equipment on the site, submit to the Contracting Officer a certification that the operator has completed a training course approved by the nuclear density testing equipment manufacturer, the most recent data sheet from the manufacturer's calibration, and a copy of the most recent statistical check of the standard count precision.
- b. The nuclear density testing equipment shall be capable of extending a probe a minimum of **12 inches** down into a hole.

Measurement of Fill Material; G, RO

Submit a copy of the records of each compliance survey the next work day following the survey.

Testing

Within 24 hours of conclusion of physical tests, 3 copies of test results, including calibration curves and results of calibration tests.

SD-07 Certificates

Testing; G, RO

Qualifications of the Contractor's COE validated commercial testing laboratory.

1.5 REGULATORY REQUIREMENTS

The state statutory and regulatory requirements are indicated in Section 01 57 20 ENVIRONMENTAL PROTECTION.

1.6 PERMITS

In accordance with Contract Clause PERMITS AND RESPONSIBILITIES, obtain all necessary permits required for disposal, hauling, erosion control, burning, and pay all fees associated with permitting and compliance.

1.7 BLASTING

Blasting will not be permitted.

1.8 PROJECT SITE CONDITIONS

1.8.1 Protection of Cultural and Natural Resources

All work and operations shall comply with the requirements of Section 01 57 20 ENVIRONMENTAL PROTECTION and with the requirements of this section.

1.8.2 Protection of Man-Made Facilities and Natural Features

Trees within the clearing area shall be felled in such a manner as to avoid damage to trees left standing and trees outside the clearing area, existing buildings, man-made facilities and natural features, with due regard to the safety of employees and others, and in compliance with COE EM 385-1-1. Excavation shall follow the same requirements specified above for felling trees and shall be in compliance with COE EM 385-1-1.

1.8.3 Subsurface Data

Subsurface soil boring logs are included in these specifications. Subsurface investigation reports and samples of materials obtained from subsurface investigations may be examined at the Jacksonville District Office as indicated in Section 00 31 32 GEOTECHNICAL DATA REPORT. These data represent subsurface information at the boring locations; however, variations may exist in the subsurface between boring locations. Groundwater levels indicated on the soil boring logs were levels found at



the time of exploration. The groundwater table can vary significantly depending on time of year, variation from normal precipitation, and river stage, lake stage or tide level.

## PART 2 PRODUCTS

### 2.1 TYPES OF FILL MATERIALS

#### 2.1.1 Embankment Fill

The embankment fill material shall consist of satisfactory materials classified in accordance with subparagraph "Embankment Fill" of paragraph DEFINITIONS, and subparagraph "Embankment and Backfill Materials" of paragraph SYSTEM DESCRIPTION above.

#### 2.1.2 Filter Soil

Filter soil material shall consist of material classified in accordance with subparagraph "Filter Soil" of paragraph DEFINITIONS above, and shall meet gradation requirements listed below.

##### 2.1.2.1 Gradation

Furnish following gradation:

Sieve	Percent Passing
3/8"	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10
#200	0-2 when measured at the source and 0-5 when measured as fill in the embankment after proper compaction.

##### 2.1.2.2 Characteristics

Provide silica minerals (quartz) as defined in [ASTM C294](#) (Section 5.1), a referenced document in [ASTM C33/C33M](#). The provided fine aggregate shall contain no calcareous and/or carbonaceous materials. Friable particle content shall be no greater than 3 percent per [ASTM C33/C33M](#), Table 1. The percentage of friable particles shall be determined per [ASTM C142/C142M](#). Therefore, the provided fine aggregate material shall be composed of at least 95 percent silica sand, with no more than 2 percent silica fines (particles passing the No. 200 sieve), and no more than 3 percent friable particles to meet the project specification requirements.

##### 2.1.2.3 Contamination

Filter soil shall be protected from contamination from equipment traffic, runoff or any other source throughout construction. Any filter soil contaminated by other soil types or debris shall be wasted and replaced at no expense to the Government.

### 2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide metallic core or metallic-faced, acid- and alkali-resistant,

polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

#### Warning Tape Color Codes

Red: Electric  
Yellow: Gas, Propane, Dangerous Materials  
Orange: Telephone and Other Communications

#### 2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

#### 2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

#### 2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

### PART 3 EXECUTION

#### 3.1 CONSTRUCTION

##### 3.1.1 Lines and Grades

The embankment and backfill shall be constructed to the lines, grades, and cross sections indicated on the drawings, unless otherwise directed by the Contracting Officer. The Government reserves the right to increase or decrease the foundation widths and embankment slopes or to make such other changes in the embankment or backfill sections as may be deemed necessary to produce a safe structure. Increases in height of section, made to compensate for settlement or consolidation of the embankment material subsequent to the completion of the embankment, shall not exceed 24 inches or 5 percent (whichever is less) of the height above the foundation at the centerline of the project feature indicated on the drawings.

##### 3.1.2 Conduct of the Work

Maintain and protect the embankment and backfill in a satisfactory condition at all times until final completion and acceptance of all work under the Contract. If, in the opinion of the Contracting Officer, the hauling equipment causes horizontal shear planes or slicken sides, rutting,

quaking, heaving, cracking, or excessive deformation of the embankment or backfill, limit the type, load, or travel speed of the hauling equipment on the embankment or backfill and repair any damaged areas at no additional cost to the Government. The Contractor may be required to remove, at no additional payment, any embankment material placed outside of prescribed slope lines. Any approved embankment or backfill material which is lost in transit or rendered unsuitable after being placed in the embankment or backfill and before final acceptance of the work shall be replaced in a satisfactory manner and no additional payment will be made therefor. Excavate and remove from the embankment or backfill any material which is unsatisfactory, dispose of such material, and refill the excavated area as directed, all at no cost to the Government.

### 3.2 CLEARING AND GRUBBING

All clearing, including any grubbing work, shall be completed prior to embankment construction. If regrowth of vegetation or trees occurs after clearing and grubbing and before placement of embankment, the Contractor shall clear again prior to embankment construction. Clearing and grubbing shall be accomplished in all areas requiring earthwork and any others necessary to complete construction. Trees and vegetation designated to be left standing or to remain shall be protected from damage from construction operations. Clear all riprap rock greater than 3 inches and stockpile for reuse. Clear all remaining debris including gabions, remove from the site, and dispose in accordance with paragraph DISPOSITION OF CLEARED, GRUBBED, AND STRIPPED MATERIAL below.

### 3.3 STRIPPING

After inspection and acceptance of cleared and grubbed areas, stripping shall proceed. All stripping work shall be completed not more than 250 feet in advance of embankment construction. The entire area within the limits of existing ground to receive embankment fill shown on the drawing shall be stripped to remove weeds, grass, and other vegetative materials to the ground surface and topsoil to a depth of at least 6 inches. Topsoil shall be completely stripped where greater depths are encountered.

### 3.4 DISPOSITION OF CLEARED, GRUBBED, AND STRIPPED MATERIAL

Except as otherwise specified or indicated on the drawings, all materials resulting from clearing and grubbing operations shall, at the Contractor's option, be disposed of either by windrowing or stockpiling within construction limits, chipping, removal from the site, or a combination thereof. In no case shall any material resulting from clearing and grubbing operations be buried or permanently placed within any embankment or levee foundation or any structural foundation. Make a reasonable effort to channel merchantable material into the commercial market and to make beneficial use of the materials resulting from clearing and grubbing. The topsoil material resulting from the stripping operations shall be temporarily stockpiled within the rights-of-way. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter and other materials that would interfere with planting and maintenance operations.

#### 3.4.1 Windrows

Cleared, grubbed and stripped material shall be placed in a neat windrow or in piles with tree limbs trimmed sufficiently to make the windrow as small as practicable. No cleared, grubbed or stripped material shall extend

beyond the construction limits.

#### 3.4.2 Removal from Site

The Contractor may elect to remove all or part of the cleared and grubbed materials from the site in accordance with Section 01 57 20 ENVIRONMENTAL PROTECTION. The Contractor may opt either to retain any such materials of value or dispose of them by sale or otherwise. The Contractor shall not sell such material on site. The Government is not responsible for the protection and safekeeping of any materials retained by the Contractor. Such materials shall be removed from the site before the date of completion of the work.

#### 3.5 REMOVAL OR PLUGGING OF ABANDONED PIPE AND CONDUITS

The old existing culvert barrels for IP-3 shall be abandoned in place by grouting them full. See Section 31 23 24 CONTROLLED LOW STRENGTH MATERIAL (CLSM, FLOWABLE FILL) for information on grouting with CLSM. The existing canals adjacent to the landside culvert headwalls shall be de-mucked and backfilled as shown. The headwalls shall be partially demolished as needed to backfill the canals and allow reconstruction of the embankment up to the crest elevation indicated on the drawings.

#### 3.6 DEWATERING AND DIVERSION

The Contractor is responsible for the design, construction, installation and operation of the dewatering system. The Contractor shall dewater the coffered area to a minimum of 24 inches below the bottom of excavation, at least one foot below localized excavations, and a minimum of 36 inches below side slopes. At all locations within the coffered area, surface or groundwater flowing toward or into the excavation shall be controlled to prevent seepage, sloughing, boils, uplift or heave, sediment transport, ground pumping, standing water or areas weakened by seepage forces, and to prevent interference with the orderly progress of construction. The presence of any of these conditions is not acceptable. The dewatering system shall be designed and constructed to prevent such conditions. Should these situations occur, the Government shall be notified immediately and the Contractor shall take immediate measures to correct the issues, so as to not jeopardize dam safety. The area shall remain dewatered until at least 2 feet of compacted fill is placed above native groundwater level. Surface and groundwater control shall be accomplished in coordination with the required excavation and embankment construction. Groundwater and surface water control may necessitate the use of deep wells, well points, temporary diversion ditches, cofferdams, sumps, and any other practical means that would meet the requirements. All wells, well points, sumps, ditches and all water collection features shall include properly designed filter materials that will prevent the movement of soil particles into the dewatering system components. Given that Herbert Hoover Dike is a dam, penetrations of dewatering features into the excavation shall be kept to a minimum; similarly the Contractor shall not install piling within the footprint of Herbert Hoover Dike, except as shown on drawings. Methods for care and control of surface and groundwater levels shall be subject to Contracting Officer approval. It shall be understood that the steel sheetpile cofferdam will not be water tight, unless the Contractor takes measures to that effect. Therefore, the Contractor's [dewatering work plan](#) shall accommodate or consider all possible sources of seepage, including water seeping through any and all joints or the sheetpile cofferdam, whether above or below the level of the excavation. Any and all borings, wells, well points, monitoring wells or piezometers, or similar

penetrations into the embankment or its foundation shall first be authorized by the Contracting Officer (refer to Section 01 57 50 DRILLING PROGRAM PLAN), and shall be in accordance with ER 1110-1-1807. Well installation with the aid of a water jetting is not allowed within 20 feet of proposed or newly constructed structural features, excluding temporary sheet piling. Use of this method is limited to a depth of 10 feet below excavation subgrade. Wells installed into the dam foundation with the aid of water jetting cannot be abandoned in place and must be extracted to allow for grout permeation into the adjacent soils during well abandonment. Also, any rim ditches used for dewatering shall be limited to 2 feet in depth, and shall be maintained at that depth.

### 3.6.1 Diversion Ditches

Rim ditches, diversion ditches, trenches or swales; known as diversion ditches in this section, can be used to collect and divert rainwater runoff from the excavation bottom and side slopes only and shall not be used for groundwater lowering. Groundwater seepage into these diversion ditches is not permitted. The invert of all diversion ditches shall not exceed 24 inches in depth, as measured from the bottom of proposed permanent concrete foundations. Prior to backfilling and compacting the diversion ditches, prepare slopes to 3H: 1V, maximum. Diversion ditches are localized excavations that require ground water to be maintained a minimum of one foot below the ditch invert in order to facilitate placement and compaction of Embankment Fill in the dry. Diversion ditches shall not be continuous transverse to the embankment centerline (upstream to downstream) so as to minimize potential creation of a preferential seepage path.

### 3.6.2 Groundwater Level Monitoring in Coffered Area

Groundwater levels shall be monitored via the use of open pipe piezometers. A minimum of 5 piezometers shall be installed at such locations as to permit the measurement near the ends of the excavation (e.g. headwalls areas, the center of excavation and side slope(s)). Additional piezometers may be required at the discretion of the Contracting Officer.

### 3.6.3 Inspection of Cofferdam and Coffered Area

The Contractor shall inspect the excavation bottom and side slopes and dewatering system each morning and immediately following any rain event. This inspection shall be made by a qualified individual experienced in dewatering, soil classification and slope stability. The Contractor's inspector shall have the authority to stop work and direct remedial action.

### 3.6.4 Dewatering Equipment and Equipment Capacity

All dewatering equipment shall be in prime condition and shall at all times be maintained and operated at the efficiency and capacity necessary for maintaining the coffered area free from standing water or wet conditions. The Contractor shall provide dewatering facilities with stand-by pumps for 25 percent stand-by capacity. Contractor shall also provide 100 percent backup power so that pumping operation may continue in the event of loss of the primary power system. The backup pumping and backup power systems shall be tested and proven fully operational prior to starting excavation. Once excavation and dewatering operations begin, the system will operate continuously, without interruption; until backfill is complete to a point that dewatering is no longer needed. No power source will be provided by the Government for dewatering. Provide backup pumping and backup power

systems configured to automatically start upon failing of the primary system. Dewatering pumps shall not be used for bypass pumping until dewatering operations cease.

### 3.6.5 Removal of Dewatering System and Cofferdams

All wells shall be decommissioned in accordance with Section 33 29 00 DECOMMISSIONING WELLS. The Contractor shall remove the dewatering system in such a manner as to allow groundwater to slowly return to natural elevations. The Contractor shall slowly flood the dewatered area to establish water surface elevations upstream of the structure and equal to tailwater downstream of the structure prior to removal of temporary cofferdam. Rewatering shall be addressed as part of the [Dewatering Work Plan](#).

## 3.7 EXCAVATION

Excavation shall consist of removal of material in preparing the foundations to the lines and grades shown on the drawings, removal of material from ditches and channels to the lines and grades shown on the drawings, removal of objectionable materials and obtaining required fill materials from the borrow areas. Over excavation outside the limits of embankment foundations or structures shall be backfilled to grade with similar over excavated material that are free of organics or satisfactory material and compacted to a density of at least that of the surrounding material.

### 3.7.1 Over Excavation

#### 3.7.1.1 Within Limits of Embankment Foundations or Structures

Over excavation within the limits of the foundations of embankments or structures shall be backfilled to grade in accordance with paragraph PREPARATION OF FOUNDATION, PARTIAL FILL SURFACES AND ABUTMENTS.

### 3.7.2 Structures

Excavations for structures shall conform to the dimensions and elevations indicated for each structure, except as specified herein, and shall include trenching for utility and foundation drainage systems, and all incidental work. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government and filled in accordance with the subparagraph "Over Excavation" above. It is anticipated that excessively wet (exceeding moisture tolerances) and/or soft (not meeting minimum specified density or pumping/yielding soil) materials may be present at the final excavation for structures. When determined by the Contracting Officer, the material shall be excavated to a minimum depth of 24 inches and a minimum of 5 feet from the foundation footprint and replaced with an initial 6-inch thick bridging lift (above the water table) of select fill and the remaining lifts compacted in accordance with paragraph COMPACTION (subparagraphs "Compaction Below Structures" and "Compaction Adjacent to Structures") below until elevation matches with the surrounding grades.

### 3.7.3 Slopes and Surcharges

Temporary excavation slopes for any channel, structure excavation, or other

required excavation shall not be steeper than the specified finished slope or the specified construction slope, as applicable, and subject to the approval of the Contracting Officer. Where undefined, slopes shall be no steeper than 1V on 3H, and height shall be no greater than 5 feet. This may be accomplished by benching the temporary slope so that the average slope is not steeper than the specified slope. In addition, no temporary, permanent, or construction slope shall be surcharged with excavated or stockpiled material or with heavy construction equipment which would have the same effect as the surcharge material. The toe of stockpiled material shall be maintained a minimum distance back from the top of the finished excavation equal to the depth of the excavation. Determine the maximum height of such stockpile without causing instability of the excavation slope. Any slide or other adverse conditions caused by failure of the Contractor to maintain these conditions shall be considered the responsibility of the Contractor and remedial measures shall be at the Contractor's expense.

#### 3.7.4 Existing Embankments and Spoil Banks

Existing embankment shall be removed as shown on the drawings. Existing embankment located within the rights-of-way landward of the embankment and berms to be constructed, may be utilized as borrow material if satisfactory, but only after equal protection has been provided by construction of the cofferdams. When excavated for borrow material, the existing embankment shall be removed to the adjacent ground surface in a uniform manner, and shaped to maintain drainage.

#### 3.7.5 Riprap and Bedding

Excavations for riprap and bedding shall be performed at the locations and to the lines and grades shown. Riprap and bedding shall be placed as specified in Section 35 31 19 STONE PROTECTION FOR STRUCTURES.

#### 3.8 TOLERANCES

Finish the surface of excavations, embankments, and backfills to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded embankment areas with plus 4 inches and minus 0 inches of the grades and elevations indicated, prior to the placement of surface treatments (sod, limerock base, asphalt, etc.). The degree of finish for underwater excavation shall be plus 0 feet and minus 1 foot of the grades and elevations indicated on the drawings. The degree of finish for temporary excavation surfaces shall be plus 0 inches and minus 6 inches. The degree of finish for filter soil and soil bentonite fill shall be plus 3 inches and minus 0 inches. Finish embankment fill in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Contractor shall repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes at no additional cost to the Government.

#### 3.9 SLIDES

In case sliding occurs in any part of the excavations prescribed in this section after they have been excavated, but prior to final acceptance of all work under the contract, repair the slide as directed by the Contracting Officer. In case the slide is caused through the fault of the

Contractor, it shall be repaired at no cost to the Government. In case the slide is due to no fault of the Contractor, an equitable adjustment in the contract price will be made for the repairs in accordance with the Contract Clause CHANGES.

### 3.10 STOCKPILES

Provisions of paragraph SLOPES AND SURCHARGES are applicable to all stockpiled materials. Upon completion of construction operations, all remaining stockpiled material shall be removed and disposed of by the disposal methods specified in paragraph DISPOSITION OF EXCAVATED MATERIALS.

### 3.11 SURFACE DRAINAGE OF COMPLETED AREAS

The areas shown on the drawings designated as "GRADE FOR SURFACE DRAINAGE", the borrow areas, and the finished embankment areas shall be graded to the lines and grades shown on the drawings. The surface shall be free from sharp ridges, gullies, potholes, sinkholes, and any other surface irregularities. A tolerance of 4 inches above the prescribed grade will be allowed provided that the surface drains in the direction as indicated on the drawings.

### 3.12 MAINTENANCE OF WORK

#### 3.12.1 Debris Removal

Maintain all ditch and channel excavations free from leaves, brush, sticks, trash, and other debris until final acceptance of all work under the contract at no additional cost to the Government.

#### 3.12.2 Sediment Removal

Prior to final acceptance of all work under this contract, the removal of sediments from ditch or channel excavations shall be required to restore design grade and section at no additional cost to the Government.

### 3.13 DISPOSITION OF EXCAVATED MATERIALS

#### 3.13.1 Satisfactory Materials

Satisfactory materials in excess of the quantity necessary to construct backfills and embankments, shall remain the property of the Government.

#### 3.13.2 Unsatisfactory Materials

Unsatisfactory materials shall be temporarily stockpiled during construction and uniformly spread over the Contractor's staging area upon completion of work. The side slopes shall not exceed 1V:5H, and the maximum height of the spread unsatisfactory materials shall not exceed 2 feet above existing grade. The final spread area shall be sodded.

### 3.14 PREPARATION OF FOUNDATION, PARTIAL FILL SURFACES AND ABUTMENTS

#### 3.14.1 Earth

After clearing, grubbing, stripping and excavation of the embankment foundation to the extent indicated or otherwise required, the sides of stump holes, test pits, and other similar cavities or depressions shall be broken down so as to flatten out the slopes, and the sides of the cut or



hole shall be scarified to provide bond between the foundation material and the fill. Any lift of fill placed adjacent to slopes 4 horizontal on 1 vertical or steeper shall be benched into the existing slope. Unless otherwise directed, any depression shall be filled with the same material type that is to be placed immediately above the foundation. The fill shall be placed in layers, moistened, and compacted in accordance with the applicable provisions of paragraphs PLACEMENT, MOISTURE CONTROL, and COMPACTION for the specific material type. Materials which cannot be compacted by roller equipment because of inadequate clearances shall be compacted with power tampers in accordance with the paragraph COMPACTION for the specific material type. After filling of depressions and immediately prior to placement of compacted fill in any section of the embankment, the foundation of such section shall be loosened thoroughly by scarifying, plowing, discing or harrowing to a minimum depth of 6 inches, and the moisture content shall be adjusted to the amount specified in paragraph MOISTURE CONTROL for the appropriate type of material. Immediately prior to placement of compacted fill on or against the surfaces of any partial fill section, all soft or loose material, all material containing cracks or gullies, and all material that does not conform with the specified zoning of the embankment shall be removed. The remaining surface of the partial fill shall be loosened by scarifying, plowing, discing or harrowing to a minimum depth of 6 inches, and the moisture content shall be adjusted as specified in paragraph MOISTURE CONTROL for the appropriate type of material. The surface of the partial fill section upon which fill is to be placed shall then be compacted as hereinafter specified for the appropriate type of fill. No separate payment will be made for loosening and rolling the foundation area, the abutment area, or the surfaces of partial fill sections, but the entire cost thereof shall be included in the applicable contract price for fill.

### 3.14.2 Settlement of Embankment Foundation

The Contractor may elect to furnish and install settlement gages for determination of settlement of the embankment foundation during construction. The Contractor shall monitor settlement of the concrete structures' foundations as required in Section 13 51 00 INSTRUMENTATION. A written description shall be included in the Plan of Operations submittal showing location of gages, settlement gage details, placement procedures and surveys.

### 3.14.3 Hard/Unyielding Materials Below Structures

#### 3.14.3.1 Preliminary Cleanup

When hard/unyielding material is found at the excavation bottom, the Contracting Officer will require that the excavation be continued until a satisfactory foundation surface is reached free of uneven surfaces so that a uniform lift of fill material can be placed.

### 3.15 FOUNDATION INSPECTION AND GEOLOGIC MAPPING

Notify the Contracting Officer at least seven (7) days before foundation preparation will be completed and ready for evaluation by the Government. As used in this section, evaluation shall mean inspection, testing, geologic mapping, exploratory test pits, interpretation, and decision making. Maintain the foundation in a cleaned condition for Government evaluation. Allow 5 working days for Government evaluation.

Foundation shall mean any area of the excavation to receive concrete, fill

or backfill, including the entire excavation bottom and side slopes. Inspections to determine the adequacy of the foundations will be performed by the Contracting Officer in all foundation areas prior to placement of any fill or concrete. The Contractor will cooperate to the extent necessary to assist in the inspection. This will include having equipment and personnel available to assist excavating, compacting, proof rolling, etc. The Contractor shall coordinate his schedule for foundation preparation and inspection and mapping with the Contracting Officer to ensure that the preparation and inspection proceed in an orderly manner.

Foundation mapping will require excavated surfaces to be closely inspected and documented. The Government will require surfaces to be cleaned by the Contractor to facilitate mapping. Cleaning will require cutting of fresh surface on the excavation bottom and on excavated slopes to expose in-situ material. Areas that have been overexcavated shall remain overexcavated until foundation mapping is complete. During evaluation, any temporary ramps covering side slopes shall be removed such that the excavation side slopes can be documented and mapped by the Government. The Contractor shall provide equipment to perform test pits as deemed necessary by the Government geologist and engineers performing the evaluation.

The Contractor will not be entitled to any compensation for delays, standby time, reduced efficiencies, or other similar costs due to the time required for foundation inspection and mapping.

Immediately following the foundation inspection and mapping period, the Contracting Officer will either approve the foundation section for permanent construction or will direct the Contractor to perform additional excavation.

- a. Government will conduct an evaluation of foundation surfaces to receive backfill or structures.
- b. Permit and facilitate safe access to the excavation by Government personnel for evaluation.
- c. The foundation shall be proof rolled by a fully loaded dump truck or approved roller to detect and eliminate soft spots in the foundation.
- d. During evaluation, if the Contracting Officer determines that additional excavation is required to improve foundation conditions, perform additional excavation as directed. Clean the areas of additional excavation. The Government will evaluate the surfaces of additional excavation.

### 3.15.1 Equipment for Foundation Excavation and Mapping

The Contractor shall have on site and make available to Government personnel performing mapping and inspection the following equipment with equipment operators to aid in performing excavations for test pits, sampling, inspection and cutting fresh surfaces for inspection and mapping:

- a. Excavating equipment - Backhoe with smooth edge bucket and bulldozer.
- b. Proof roller - Fully loaded dump truck or approved roller.
- c. Hand tools - Shovels, bars, picks, wedges, marking paint, and brooms.

### 3.16 PLACEMENT AND SPREADING

Prior to beginning embankment placement on the embankment foundation, notify the Contracting Officer that the foundation is ready to receive fill. No embankment or backfill shall be placed on or against concrete until the concrete has reached design strength without prior approval by the Contracting Officer. Fill shall be brought up in lifts evenly on both sides of culvert and headwall structures with no more than 2 feet difference in elevation on opposing sides of the structure.

#### 3.16.1 Gradation and Distributions

The gradation and distribution of materials throughout each zone of the embankment shall be such that the embankment will be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material of the same class. If lenses, pockets, or layers of materials differing substantially in texture or gradation from surrounding material occur in the spread material, the layer shall be mixed by harrowing or any other approved method to blend the materials. During the placing and spreading process, maintain at all times a force of workers adequate to remove all roots, debris, and oversize stone from all embankment materials. All stones and rock fragments larger than 3 inches in any dimension shall be removed from the fill.

#### 3.16.2 Foundations and Partial Embankment Fills

The foundations and all partial embankment receiving fills shall be kept thoroughly drained. Placing operations will be such as to avoid mixing of materials from adjacent sections as much as practicable.

##### 3.16.2.1 Fill in Wet Areas

Where fill is required in the wet, place Select Fill first by end-dumping and advancing with a V-shaped leading edge such that the center of fill is most advanced, thereby displacing silt material to both sides. Refer to the applicable Geotechnical Data Report (referenced in Section 01 11 00 SUMMARY OF WORK) for silt/muck thickness at each of the boring and muck probe locations. Select Fill shall be placed by this method to a height of 2 feet above the water level existing at the time of construction. Proof rolling shall then be performed using safe methods, after which Embankment Fill shall be placed and compacted as described herein. No fill shall be placed in the wet within the excavation area inside the limits of the cofferdam, unless it is an overexcavated, isolated zone or area and the Contractor has implemented the required dewatering within the excavation.

##### 3.16.3 Equipment Traffic

Equipment traffic on any embankment zone shall be routed to distribute the compactive effort as much as practicable. Ruts formed in the surface of any layer of spread material will be filled before that material is compacted. If, in the opinion of the Contracting officer, the compacted surface of any layer of material is too smooth to bond properly with the succeeding layer, the surface shall be loosened by scarifying or other approved methods before material from the succeeding layer is placed. No equipment except approved compaction equipment shall operate on filter soil or filter gravel.

#### 3.16.4 Fill

Fill material shall be placed and spread in layers not more than 12 inches in uncompacted thickness when compacted with a vibratory roller with a minimum weight of 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at a minimum frequency of 1,200 times per minute or by equivalent approved method. Uncompacted lift thickness shall not exceed 6 inches when a hand operated (walk behind) plate compactor is used or in areas where such is required. Walk behind compactors shall only be used in confined spaces not accessible by vibratory roller or restricted near steel cofferdam. Layers should be started full out to the slope stakes and shall be carried substantially horizontal and parallel to the embankment centerline with sufficient crown or slope to provide satisfactory drainage during construction. Contractor may have to decrease the loose lift thickness or use different equipment to attain the required degree of compaction.

#### 3.17 MOISTURE CONTROL

##### 3.17.1 General

Satisfactory subgrade and fill materials shall contain the amount of moisture, within the limits specified below or as directed by the Contracting Officer, necessary to obtain the required compaction. Material that is not within the specified moisture content limits or is observed to be pumping after compaction shall be reworked to obtain the specified moisture content, regardless of density.

##### 3.17.1.1 Insufficient Moisture for Suitable Bond

If the top or contact surfaces of a partial fill section becomes too dry to permit suitable bond between these surfaces and the additional fill to be placed thereon, the Contractor shall loosen the dried materials by scarifying or discing to such depths as may be directed by the Contracting Officer, shall dampen the loosened material to an acceptable moisture content, and shall compact this layer in accordance with the applicable requirements of paragraph COMPACTION.

##### 3.17.1.2 Excessive Moisture for Suitable Bond

If the top or contact surfaces of a partial fill section becomes too wet to permit suitable bond between these surfaces and the additional fill to be placed thereon, the wet material shall be scarified and permitted to dry, assisted by discing or harrowing, if necessary, to such depths as may be directed by the contracting officer. The material shall be dried to an acceptable moisture content, and shall be compacted in accordance with the applicable requirements of paragraph COMPACTION.

##### 3.17.1.3 Drying Wet Material

Material that is too wet shall be permitted to dry, be assisted by discing or harrowing, if necessary, until the moisture content is reduced to an amount within the specified limits. Material with high fines content may be difficult to dry or require additional time to dry and compact if excessively wet due to close proximity to the water table, wetted from rainfall or surface water control is inadequate.

#### 3.17.1.4 Increasing Moisture in Dry Material

The moisture content of material that is too dry, will be adjusted on the embankment. The Contractor shall add water to the fill material and by harrowing, or other approved methods, work the moisture into the material until a uniform distribution of moisture within the specified limits is obtained. Water applied on a layer of fill on the embankment shall be accurately controlled in amount so that free water will not appear on the surface during or subsequent to rolling. Should too much water be added to any part of the embankment, the rolling on that section of the embankment shall be delayed until the moisture content of the materials is reduced to an amount within the specified limits. If it is impracticable to obtain the specified moisture content by wetting or drying the fill material, the Contractor may be required to pre-wet or dry back the material at the source of excavation or in the borrow area.

#### 3.17.2 Moisture Tolerance of Fill and Subgrade Material

a. The moisture content of embankment fill and subgrade material during compaction shall be within the limits of 3 percentage points above optimum to 2 percentage points below optimum moisture content as determined by [ASTM D1557](#). Material that is not within the specified moisture content limits or is observed to be pumping shall be reworked to obtain the moisture content appropriate for that material type, regardless of density.

b. Filter soil shall be wet during compaction. Each lift of filter soil shall be saturated immediately prior to compaction.

### 3.18 COMPACTION

Lift thickness shall be in accordance with subparagraph "Fill" of paragraph PLACEMENT AND SPREADING above. Compaction equipment shall be operated such that the strip being traversed by the vibratory roller shall overlap the rolled adjacent strip by not less than [3 feet](#). In areas which are not accessible by roller, the fill shall be compacted with an approved hand operated compactor to a density equal to that obtained in other areas which are accessible to rollers.

#### 3.18.1 Compaction of Filter Gravel

Compaction of Filter Gravel shall be in accordance with Section [35 42 35](#) FILTER GRAVEL.

#### 3.18.2 Compaction of Embankment Fill

After a layer of material has been dumped and spread, it shall be harrowed to break up and blend the fill materials and to obtain uniform moisture distribution. Harrowing shall be performed with a heavy disk plow, or other approved harrow, to the full depth of the layer. If one pass of the harrow does not accomplish the breaking up and blending of the materials, additional passes of the harrow shall be required, but in no case will more than three passes of the harrow on any one layer be required for this purpose. When the moisture content and the condition of the layer are satisfactory, the lift shall be compacted by use of vibratory roller to a minimum of 95 percent of the maximum dry density as determined by the Contractor in accordance with [ASTM D1557](#). Dumping, spreading, sprinkling, and compacting may be performed at the same time at different points along a section when there is sufficient area to permit these operations to

proceed simultaneously.

When placing embankment fill against highly organic material, such as peat, that material shall be cut vertically, creating a bench within the suitable underlying material. The vertical cut, or near-vertical cut if required for safety reasons, within the peat shall itself be benched if it exceeds 3 feet in height.

### 3.18.3 Compaction of Filter Soil

For the areas outside the limits of concrete placement, such as the chimney drain, the drainage blanket and portions of the Filter Collar and the ditch backfill at the IP-3 abandonment, compaction of Filter Soil shall be accomplished using the compaction equipment described in subparagraph FILL of paragraph PLACEMENT AND SPREADING above using a smooth drum vibratory roller. The roller shall make a minimum of two (2) passes, acting in vibratory mode, across the initial lift of Filter Soil. Upon completion of these first two passes, the density of the Filter Soil shall be checked in accordance with [ASTM D1556](#). Additional passes of the vibratory roller shall be made until a relative compaction between 90 and 96% is attained. The number of passes required to achieve a relative compaction of 90% shall be the minimum required number of passes on subsequent lifts of Filter Soil. Additional density tests shall be conducted on intervals as required in subparagraph MATERIALS TESTING of paragraph FIELD QUALITY CONTROL.

For the areas under concrete, compaction of Filter Soil shall be such as to attain a minimum relative compaction of 95% of the maximum dry density obtained in accordance with [ASTM D4253](#).

Compaction equipment shall be clean and free from other fill types or debris and shall not result in contamination of the Filter Soil.

Adjacent lifts of other fill types shall be sloped slightly to drain away from the Filter Soil. Any contaminated Filter Soil shall be removed and replaced by the contractor at no additional cost. Placement methods shall not result in segregation of the Filter Soil (such as but not limited to placement via conveyor or chute).

### 3.18.4 Compaction Above and Adjacent to Internal HDPE Drain Pipe

Within 3 feet of the perforated internal drainage pipe and up to 3 feet of cover above the pipe, compaction shall be made with walk behind plate compactor. Uncompacted lift thickness within this area shall be restricted to 6 inches. A minimum of 2 complete passes of this compaction equipment will be required for each lift of material within this area. Contractor shall ensure that compaction equipment used does not result in excessive deformation or collapse of the drainage pipe.

### 3.18.5 Subgrade Compaction

Upon completion of excavation, removal of unsatisfactory materials and preparation of subgrade, compact the top 12 inches of subgrade below the excavation limit to 95 percent of the maximum dry density as determined by the Contractor in accordance with [ASTM D1557](#). Unsuitable material encountered within the excavation side slope shall be cut vertical and will not require compaction. The vertical cut on unsuitable material shall not exceed 2 feet in height per cut.

### 3.18.6 Compaction Adjacent to Structures

Crawler-type tractors, vibratory roller equipment and other similar compaction equipment shall not be used within 10 feet of the temporary sheet pile cofferdam. Compaction within this zone shall be accomplished by the use of mechanical hand tampers, vibrating plates or other approved methods and equipment. The Contractor shall ensure that compaction operations do not damage any existing utilities or structures. Any damage caused by the Contractor's operation shall be repaired at no additional expense to the Government. Backfill shall not be placed adjacent to any concrete prior to reaching 80 percent of its design strength. All fill placed adjacent to the culvert (within an area not less than two times the width of the compaction equipment) shall be placed on a 6-horizontal to 1-vertical (6:1) slope, sloping downward away from the culvert.

### 3.19 PLACING TOPSOIL

Place topsoil in accordance with Section 32 92 23 SODDING.

### 3.20 FIELD QUALITY CONTROL

#### 3.20.1 Clearing, Grubbing, and Stripping

Establish and maintain quality control for clearing, grubbing, and stripping operations to assure compliance with contract requirements, and maintain records of the quality control for all construction operations including but not limited to the items indicated below. These records, as well as the records of corrective actions taken, shall be furnished to the Government in accordance with Section 01 45 04 CONTRACTOR QUALITY CONTROL.

##### 3.20.1.1 Clearing

Station to station limits, transverse clearing limits from applicable centerline; percentage of area complete; types of materials cleared.

##### 3.20.1.2 Grubbing

Station to station limits, transverse grubbing limits from applicable centerline; percentage of area complete; type of material; filling of grubbed holes.

##### 3.20.1.3 Stripping

Station to station limits, transverse stripping limits from applicable centerline; percentage of area complete; type of material; depth of stripping.

#### 3.20.2 Excavation

Establish and maintain quality control for excavation operations to assure compliance with contract requirements, and maintain records of the Contractor's quality control for all construction operations including but not limited to the following:

- a. Lines, grades and tolerances,
- b. Segregation of materials,
- c. Disposal and/or stockpiling of materials,

- d. Unsatisfactory materials,
- e. Conditions that may induce seepage or weaken the foundation or embankment,
- f. Stability of excavations.

Records of inspections and tests, as well as the records of corrective actions taken, shall be furnished to the Government in accordance with Section 01 45 04 CONTRACTOR QUALITY CONTROL.

### 3.20.3 Embankment

#### 3.20.3.1 General

As a part of the Contractor Quality Control (CQC) system required by Section 01 45 04 CONTRACTOR QUALITY CONTROL, establish and maintain field quality control for foundation preparation, embankment and backfill operations to ensure compliance with contract requirements and maintain detailed records of field quality control for all operations including but not limited to the following:

- a. Earthwork Equipment

Type, size, number of units and suitability for construction of the prescribed work.

- b. Foundation Preparation

Methods of preparing the foundations in advance of embankment and backfill construction and methods for providing drainage of the foundation and partially completed fills.

#### 3.20.3.2 Materials Testing

The Contractor shall perform sufficient testing to ensure that the fill is being constructed as specified. The testing program specified below shall be considered the minimum acceptable frequency of testing. This does not relieve the Contractor from the responsibility of performing additional testing, if required to ensure compliance with these specifications.

- a. Soil Classification Tests for Fill Material

Soil classification tests shall be performed in accordance with ASTM D2487. One initial classification test shall be required for each different classification of material to be utilized as embankment fill or backfill. As prescribed in ASTM D2487, grain size analyses in accordance with ASTM D422 and Atterberg limits in accordance with ASTM D4318 shall be performed on each different classification. The Contractor shall submit additional tests for every 2,500 cubic yards of embankment or backfill material as well as compaction tests, as described below in subparagraph "Compaction Testing". Soil classification tests shall be performed on foundation material as required to determine the acceptability of the in-situ soils. Additional tests will be required if noticeable changes in the material occur.

- b. Soil Classification Tests for Filter Soil



Soil classification tests shall be performed in accordance with [ASTM C33/C33M](#), Sections 5 through 8, and shall include, but is not limited to, particle size distribution ([ASTM C136](#)), test method for soundness ([ASTM C88](#)), and percentage of friable particles ([ASTM C142/C142M](#)). Testing shall be performed by a testing laboratory validated by the U.S. Army Corps of Engineers (USACE) within the last 12 months, and results shall be provided to the Contracting Officer. During delivery, subsequent testing shall be performed, by an USACE validated lab, for every 250 tons (or fraction thereof) of aggregate to be delivered. All testing shall be representative of the materials delivered to the project site. Test results shall be signed and sealed by a licensed Professional Engineer or Geologist, licensed in the state from which the material is tested, and shall clearly state that the fine aggregate to be furnished is silica sand (per this specification).

c. Compaction Testing

(1) Compaction Tests. Run not less than one modified proctor test ([ASTM D1557](#)) for every 2,500 cubic yards of Embankment Fill or whenever a new source or soil type is used. Run not less than three vibratory table tests ([ASTM D4253](#)) per source or per culvert location for Filter Soil.

(2) In-Place Density Tests. The in-place density of the Embankment Fill shall be determined in accordance with [ASTM D1556](#) or [ASTM D6938](#). Run not less than four (4) field in-place density test on each lift of material or every 250 cubic yards of completed embankment fill or backfill, whichever is more stringent, evenly distributed along the open excavation area. As a minimum, at least 3 density tests shall be performed per lift below each culvert headwall structure, at least 5 density tests shall be performed per lift along the alignment of the culvert barrels, and at least 2 density tests shall be performed per lift below the wing wall structures. Horizontal locations shall be randomly staggered in the fill. When nuclear method is used for in-place density testing according to [ASTM D6938](#), the first daily test and every tenth test thereafter for each material type shall include a sand cone correlation test in accordance with [ASTM D1556](#). The sand cone test shall be performed adjacent to the location of the nuclear test, and shall include a nominal 6 inch diameter sand cone, and shall include a minimum wet soil weight of 6 pounds extracted from the hole. The density correlations shall be submitted with test results. The in-place density of Filter Soil shall be determined in accordance with [ASTM D1556](#). Perform at least one Sand Cone test per lift on Filter Soil. In-place density using the nuclear method will not be allowed in Filter Soil. Each transmittal including density test data shall include a summary of all density correlations for the job neatly prepared on a summary sheet including at a minimum:

- (i) Meter serial number and operators initials.
- (ii) Standard count for each test.
- (iii) Material description (including USCS classification and color description).
- (iv) Probe depth.
- (v) Moisture content by each test method and the deviation.
- (vi) Wet and dry density by each test method and the deviation.

- (vii) Test location and date.
- (viii) Corresponding Laboratory Density and Moisture Test (e.g. Mod. Proctor) for field density test results included w/ the submittal.
- (ix) Whether material passed or failed.

(3) Water (Moisture) Content Tests. Determination of water content shall be performed in accordance with ASTM D6938 when nuclear density test method is used. When nuclear method is used for in-place moisture content, the first and every tenth test thereafter for each material type shall include determination of moisture content based on ASTM D2216. ASTM D4643 may be used when rapid moisture content results are needed or as a substitute to ASTM D6938 or if it is determined that the latter is not reliable. All rapid results obtained by ASTM D4643 shall be confirmed by a test on a duplicate sample performed in accordance with ASTM D2216. In the event of significant disagreement (more than 2%) between the ASTM D6938 and ASTM D2216 tests, ASTM D2216 shall govern and ASTM D6938 shall no longer be used until calibration tests show agreement between methods. In the event that ASTM D6938 can not be calibrated to provide accurate results, ASTM D4643 and ASTM D2216 shall be used exclusively to determine moisture. One (1) moisture content test will be performed each time a density test is performed on any given lift.

d. Additional Testing

The Contracting Officer may request additional tests if there is reason to doubt the adequacy of the compaction, or special compaction procedures are being used, or materials change or if the Contracting Officer determines that the Contractor's testing is inadequate or the Contractor is concentrating backfill and fill operations in a relatively small area.

3.20.3.3 Testing by the Government

During the life of this contract, the Government or its QA Contractor(s) will perform quality assurance tests. The Contractor shall make materials available for testing and expose materials for testing at the request of the Contracting Officer for the duration of this contract. Provide safe access at no additional time or cost to the Government.

3.20.3.4 Reporting

On a daily basis, furnish the inspection records and all material testing results, the quantity of fill placed, as well as the records of corrective action taken, in accordance with Section 01 45 04 CONTRACTOR QUALITY CONTROL. Also, provide monthly summary of all density/compaction tests.

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SOIL-BENTONITE FILL

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 PETROLEUM INSTITUTE (API)

API Spec 13A (2010) Specification for Drilling-Fluid  
Materials

ASTM INTERNATIONAL (ASTM)

ASTM D1556 (2007) Density and Unit Weight of Soil in  
Place by the Sand-Cone Method

ASTM D1557 (2012) Standard Test Methods for  
Laboratory Compaction Characteristics of  
Soil Using Modified Effort (56,000  
ft-lbf/ft<sup>3</sup>) (2700 kN-m/m<sup>3</sup>)

ASTM D2216 (2010) Laboratory Determination of Water  
(Moisture) Content of Soil and Rock by Mass

ASTM D2487 (2011) Soils for Engineering Purposes  
(Unified Soil Classification System)

ASTM D422 (1963; R 2007) Particle-Size Analysis of  
Soils

ASTM D4318 (2010) Liquid Limit, Plastic Limit, and  
Plasticity Index of Soils

ASTM D4643 (2008) Determination of Water (Moisture)  
Content of Soil by the Microwave Oven  
Method

ASTM D5084 (2010) Measurement of Hydraulic  
Conductivity of Saturated Porous Materials  
Using a Flexible Wall Permeameter

ASTM D6938 (2010) Standard Test Method for In-Place  
Density and Water Content of Soil and  
Soil-Aggregate by Nuclear Methods (Shallow  
Depth)

## 1.2 DEFINITIONS

### 1.2.1 Soil-Bentonite Fill

Soil-Bentonite Fill is a mixture of Embankment Fill, referred to as Base Soil, and dry powdered Bentonite materials uniformly blended and thoroughly compacted to produce a low permeability fill zone which meets the criteria set forth in the drawings and specifications. The Soil-Bentonite Fill shall contain Bentonite by dry weight of the Base Soil, as determined in the table below.

Table 1: Minimum Percent Bentonite of Soil-Bentonite Fill  
Based on Percent Fines of the Base Soil

Base Soil Percent Fines	Minimum Percent Bentonite*
$\leq 2$	15
> 2 to 5	12
> 5 to 10	9
> 10	6

\*Tolerance of -1 percent allowed.

### 1.2.2 Embankment Fill

Embankment Fill shall meet the properties defined in Section 35 41 00 EMBANKMENT CONSTRUCTION, subparagraph "Embankment Fill" of paragraph DEFINITIONS.

### 1.2.3 Unsatisfactory Materials

Unsatisfactory Materials are defined in Section 35 41 00, subparagraph "Unsatisfactory Materials" of paragraph DEFINITIONS.

### 1.2.4 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure in ASTM D1557.

### 1.2.5 Bentonite

The Bentonite shall be a sodium cation base montmorillonite powder (Premium Grade Wyoming-type Bentonite) that conforms to the standards set forth in API Spec 13A, Section 9.

### 1.2.6 Water

Clean, potable quality water, free of oils, acids, alkali, chlorides, organic matter, and other deleterious substances.

## 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 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

#### Equipment and Plans; G, DO

At least 30 days prior to plant assembly, submit details, plans (including the location of mixing plant and material storage areas), and data on the pug mill-type mixing plant, including the manufacturer's literature on feed equipment used to deliver the Bentonite and Base Soil, water controls, stockpiling procedures, and monitoring procedures. Prior to mobilization to the site, submit details on compaction equipment and placement procedures.

#### SD-06 Test Reports

##### Soil-Bentonite Fill Mix Design and Laboratory Test Results; G, DO

At least 30 days prior to Soil-Bentonite Fill construction, submit a report summarizing the procedures and results of the preconstruction Soil-Bentonite Fill mix design and tests, including sieve analysis, moisture-density relationship, liquid limit, plasticity index, and permeability.

##### Calibration Curves; G, RO

Calibration curves and related test results, prior to using any device or equipment being calibrated.

##### Soil Classification Test; G, DO

At least 30 days prior to delivery of any Contractor-furnished material to the site of the work, submit soil classification test results, moisture-density curves, gradation curves, and laboratory results of the required tests of the proposed material.

##### Field Density; G, RO

##### Laboratory Density; G, RO

##### Nuclear Density; G, RO

Use nuclear density testing equipment in accordance with **ASTM D6938**. In addition, the following condition shall apply:

- a. Prior to using the nuclear density testing equipment on the site, submit to the Contracting Officer a certification that the operator has completed a training course approved by the nuclear density testing equipment manufacturer, the most recent data sheet from the manufacturer's calibration, and a copy of the most recent statistical check of the standard count precision.
- b. The nuclear density testing equipment shall be capable of extending a probe a minimum of **12 inches** down into a hole.

#### SD-07 Certificates

##### Certificates of Compliance; G, RO

The Contractor shall furnish to the Contracting Officer a certificate of compliance and a copy of the test reports from the Bentonite manufacturer for each lot of Bentonite shipped to the site stating that the Bentonite complies with all applicable standards. All Bentonite will be subject to inspection, sampling,

and verification of quality by Contractor Quality Control testing and Government Quality Assurance testing. No Bentonite from the Bentonite manufacturer shall be used prior to acceptance by the Contracting Officer. Bentonite not meeting the specifications shall be promptly removed from the site and replaced with Bentonite conforming to specification requirements at the Contractor's expense. Bentonite shall be protected from moisture during transit and storage

## PART 2 PRODUCTS

### 2.1 PLANT, EQUIPMENT, MACHINES, AND TOOLS

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required mix proportions, compaction, meeting grade controls, and thickness.

The central plant (pugmill operation) shall be capable of producing a uniform mixture of Soil-Bentonite Fill at the required Bentonite percentage and moisture content. Soil and Bentonite shall be dry-mixed sufficiently to prevent Bentonite lumps from forming when water is added. Blending and mixing of Bentonite and Base Soil on a lift at the site (in-place mixing) will not be allowed.

## PART 3 EXECUTION

### 3.1 MIXING

Embankment Fill and dry powdered Bentonite shall be fed into a pugmill-type mixer at a uniform rate. The feed rate shall be predetermined by the Contractor prior to mixing Soil-Bentonite Fill for placement in the embankment. The mixture of Soil-Bentonite Fill produced by the central mixing process shall meet the requirements of Table 1. The mixing process shall be continuously monitored as part of the Contractor's quality control process. Hoppers delivering ingredients to the pugmill shall have features that prevent clogging of the hoppers.

Soil-Bentonite Fill not meeting the above prescribed tolerance will be rejected. Water shall be added to the mixture of Soil-Bentonite Fill such that the moisture content of the mixture produced by the central mixing process will be in the range of -2 to +2 percent of the optimum moisture content as determined by [ASTM D1557](#). The Embankment Fill, Bentonite, and Water shall be thoroughly mixed in the pugmill-type mixer such that each component of the mixture is uniformly distributed and the mixture is homogeneous.

### 3.2 STOCKPILING MATERIALS

Base Soil, including approved material available from excavation and grading, shall be stockpiled in a manner that does not result in segregation of these materials (such as by conveyor or by chute) and at the locations designated. Before stockpiling of material, the storage sites shall be cleared, drained, and leveled. When Base Soil is provided from more than one source, material from each source shall meet the specified requirements and shall be stockpiled separately.

### 3.3 PREPARATION OF AREA TO BE FILLED

Adequate drainage shall be provided during the entire construction period to prevent water from collecting or ponding on the areas to be filled. No Soil-Bentonite Fill shall be placed in any area of the embankment until the foundation has been dewatered, compacted, and approved by the Contracting Officer. Line and grade stakes shall be located and placed by the Contractor as necessary for control. The area to be filled shall be prepared as described in Section 35 41 00.

### 3.4 INSTALLATION

#### 3.4.1 Lift Thickness

The Soil-Bentonite Fill shall be placed in maximum 9-inch thick loose lifts. Horizontal placement area tolerance is 0 inches inside to 12 inches outside the lines shown on the drawings.

#### 3.4.2 Compaction

After placing each lift of Soil-Bentonite Fill, compaction shall be started within a maximum of 30 minutes. Density of compacted Soil-Bentonite Fill shall be at least 95 percent of the Modified Proctor maximum dry density, determined in accordance with ASTM D1557. Loose lifts shall be uniformly and continuously compacted until the entire depth and width of the area are compacted to the density specified. Each pass of the compaction equipment shall overlap previous passes by at least one-half the width of the roller. A sheep's foot or pneumatic roller may be required. Alternate trips of the roller shall be slightly different lengths. Displacement of the mixture shall not occur due to the speed of the roller. The Soil-Bentonite Fill shall be placed such that the surface of the fill slopes downward away from the culvert barrels on a 6 horizontal to 1 vertical (6:1) slope; once fill reaches an elevation above the top of the barrels, the Soil-Bentonite Fill shall be brought to a level plane before receiving additional lifts. Loose lift thickness shall not exceed 9 inches throughout this process. Each lift shall be compacted such that no slicken sides are found between compacted lifts. Scarify foundation and previously placed lifts to remove smooth surfaces prior to placement of additional lifts.

The moisture content at the surface shall be maintained within the prescribed percent range of the optimum moisture content (discussed in MIXING) at all times throughout the compaction operations. If any in-place lift of Soil-Bentonite Fill is too wet (exceeding the tolerances stated above) for proper compaction of the next lift, the non-compliant material shall be allowed to dry to within moisture tolerance, by disking, aerating, or other method or removed from the excavation at the Contractor's expense.

### 3.5 FIELD QUALITY CONTROL

#### 3.5.1 Test Reports

Field and laboratory tests shall be performed in sufficient numbers to assure that the specifications are being met. Testing shall be the responsibility of the Contractor and shall be performed by a USACE validated commercial laboratory. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The Contracting Officer may specify the time and location of the test. Testing reports shall be furnished to the Contracting Officer within 24



hours of conclusion of all field and laboratory test, as well as on a monthly basis.

### 3.5.2 Test Results

Results shall verify that materials comply with the specification. When a material source is changed, the new material shall be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place material deemed unacceptable shall be replaced or repaired to conform to the contract requirements at no additional cost to the Government.

### 3.5.3 Permeability Test

One permeability test shall be performed in accordance with [ASTM D5084](#) Method C for every 100 cubic yards of Soil Bentonite Fill produced, or at least three tests shall be performed overall, one from near the bottom of the core, one from near the center and one from near the top, whichever is more stringent. The test sample shall be collected in the field from the same batch as the GRAIN SIZE ANALYSIS mixed soil sample, prior to its compaction so that the samples are representative of each other.

### 3.5.4 Laboratory Density

One moisture density test shall be conducted in accordance with the procedure contained in [ASTM D1557](#). An additional test shall be performed for any change in Base Soil source or classification (as determined by [ASTM D2487](#)), or at the direction of the Contracting Officer.

### 3.5.5 Field Density

Field in-place density tests shall be performed in accordance with [ASTM D1556](#) and/or [ASTM D6938](#). Perform not less than one in-place density test for each lift of Soil-Bentonite Fill per side of the culvert barrels. When nuclear method is used for in-place density testing according to [ASTM D6938](#), the first daily test and every tenth test thereafter or the first daily test and once every third lift thereafter, whichever is more frequent, for each material type shall include a sand cone correlation test in accordance with [ASTM D1556](#). The sand cone test shall be performed adjacent to the location of the nuclear test, and shall include a nominal 6-inch diameter sand cone, and shall include a minimum wet soil weight of 6 pounds extracted from the hole. The density correlations shall be submitted with test results. Each transmittal including density test data shall include a summary of all density correlations for the job neatly prepared on a summary sheet including at a minimum:

- a. Meter serial number and operator's initials
- b. Standard count for each test
- c. Description of material type, including USCS classification and color
- d. Probe depth
- e. Moisture content by each test method and the deviation
- f. Wet density by each test method and the deviation
- g. Detailed test location
- h. Date of last calibration of meter including certification
- i. Corresponding Laboratory Density Tests
- j. Whether test passed or failed

### 3.5.6 Moisture Content

Determination of moisture content shall be performed in accordance with ASTM D2216. ASTM D4643 may be used when rapid moisture content results are needed. All rapid results obtained by ASTM D4643 shall be confirmed by a test on a duplicate sample performed in accordance with ASTM D2216. In the event of disagreement between the results, ASTM D2216 shall govern. One moisture content test shall be performed for each lift of material placed.

### 3.5.7 Grain Size Analysis

Grain size analysis tests shall be performed in accordance with ASTM D422. One series of tests shall be conducted at the beginning of each work shift where Soil-Bentonite Fill is to be produced. A series of tests shall include a grain size analysis on representative samples of the stockpiled Base Soil and one grain size analysis on representative samples of the mixed Soil-Bentonite Fill, as placed.

### 3.5.8 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed on the Soil-Bentonite Fill for each grain size analysis conducted. Liquid limit and plasticity index shall be in accordance with ASTM D4318.

### 3.5.9 Additional Testing

The Contracting Officer may request additional tests if there is reason to doubt the adequacy of the compaction, special compaction procedures are being used, materials change, if the Contracting Officer determines that the Contractor's testing is inadequate, or the Contractor is concentrating backfill and fill operations in a relatively small area.

### 3.5.10 Testing By The Government

During the life of this contract, the Government or its subcontracted lab will perform quality assurance tests. The Contractor shall make materials available for testing and expose materials for testing at the request of the Contracting Officer for the duration of this contract.

### 3.5.11 Reporting

On a daily basis, furnish the inspection records and all material testing results, the quantity of fill placed, as well as the records of corrective action taken, in accordance with Section 01 45 04 CONTRACTOR QUALITY CONTROL.

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SECTION 35 42 35

FILTER GRAVEL

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all plant, labor, equipment, and materials, and performing all operations in connection with the construction of stone protection for the structures and elsewhere as shown on the drawings or as directed by the Contracting Officer in accordance with these specifications and applicable drawings.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C127	(2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C295/C295M	(2012) Petrographic Examination of Aggregates for Concrete
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C535	(2012) Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D5312/D5312M	(2012; R 2013) Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions
ASTM D5313/D5313M	(2012) Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions
ASTM D75/D75M	(2009) Standard Practice for Sampling Aggregates

### 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

##### Stone Source; G|DO

For each individual source of stone (quarry) identified by the Contractor as a potential supplier of filter gravel, the Contractor shall submit in report format, a Stone Source Submittal as specified in paragraph STONE SOURCE SUBMITTAL of this section. The Stone Source Submittal shall be prepared, signed, and stamped by an independent, state licensed Professional Geologist. The stone source submittal and test reports consisting of bulk specific gravity, initial gradation testing, and evaluation testing of stone shall be submitted concurrently. Any of the above submitted individually will be rejected as incomplete.

##### Filter Gravel (No. 89); G|DO

Submit data indicated on paragraph STONE SOURCE SUBMITTAL for each designation. This data shall be submitted concurrently and within the Stone Source Submittal(s).

#### SD-06 Test Reports

##### Bulk Specific Gravity; G|DO

Submit the results of bulk specific gravity (SSD) tests for each gravel designation from each proposed source. The information shall be furnished concurrently with the Stone Source Submittal.

##### Gradation Test; G|DO

Submit the gradation tests using the GRADATION TEST DATA SHEET enclosed at end of this section and ENG FORM 2087, and in accordance with requirements of paragraph GRADATION TEST.

##### Evaluation Testing of Stone Report; G|DO

Prior to approval of any Stone Source, the Contractor shall submit laboratory testing results in the Stone Source Submittal. Tests shall be completed in accordance with requirements of paragraph EVALUATION TESTING OF STONE. Evaluation testing shall be conducted for each Stone Source (quarry) proposed by the Contractor as a source of stone material. For Filter Gravel (No. 89), evaluation testing shall also be conducted for each distinct lithostratigraphic facies (i.e. rock with different mineralogic composition) within each Stone Source that the Contractor proposes to supply stone material from. Different lithostratigraphic facies within the quarry as well as the lithostratigraphic(s) facies proposed as the source of stone material should be discussed in the Stone Source Submittal. The Evaluation Testing of Stone Report for all gravel types shall be submitted within and

concurrently with the Stone Source Submittal(s) for each stone source proposed by the Contractor supplying those gradations.

#### 1.4 QUALITY ASSURANCE

All gravel types shall meet all quality, testing, and gradation requirements of this section. The stone shall be clean and free from soil, quarry fines, foreign material and shall contain no refuse. Filter gravel (No. 89) shall contain no calcareous and/or carbonaceous materials. The stone material shall also be free from shell that is not physically cemented to rock ("free shell"). Any soil, quarry fines, dust, or foreign material adhering to or combined with the stone as a result of production, shipping, or stockpiling processes shall be removed prior to stockpile inspections, gradation testing or placement on the project structure. The Contractor shall clean the aforementioned soil, fines, or foreign material by any method such as water pressure wash or high pressure air that allows visual examination of the stone material. The Contractor shall be responsible for any expense to clean stone for quality control or quality assurance purposes. Inclusion of objectionable quantities (more than 1 percent by total volume) of dirt, sand, clay, chert, and/or rock flour/quarry fines shall not be permitted.

##### 1.4.1 Gradation Test

The Contractor shall perform gradation tests on all gravel types produced at each stone source. All gradation tests shall be reported using the GRADATION TEST DATA SHEET attached at end of this section and ENG FORM 2087. An example gradation test is also attached to the end of this section. The Contractor shall notify the Contracting Officer not less than 21 calendar days in advance of each gradation test, except the initial gradation test which requires no notification. Failure on the initial gradation test sample and on subsequent gradation testing will be considered cause for rejection of the quarry and/or quarry production process if not corrected by the Contractor by the third re-test. All stone in the each failed gradation test sample shall be set aside and removed from production stockpiles for reprocessing. Any additional gradation tests required due to the failure of a gradation test sample will not be considered as one of the pre-planned tests. All points on individual grading curves obtained from representative samples of any gradation test shall lie between the boundary limits as defined by smooth curves drawn through the tabulated gradation limits plotted on ENG FORM 2087 or similar form. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either gap grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the gradation tested. The minimum sample size and the minimum number of tests required shall be as follows:

Gradation	Minimum Sample Weight	Number of Tests
Filter Gravel (No. 89)	100 pounds	4

##### 1.4.1.1 Filter Gravel Gradation Testing

Filter Gravel shall be sampled in accordance with ASTM D75/D75M and tested in accordance with ASTM C136 with one initial gradation test completed at a USACE validated laboratory and submitted with the Stone Source Submittal for each proposed source of gravel material. Additional random gradation tests, also completed at a USACE validated laboratory, will be conducted on the Filter Gravel from stockpile and placed locations when directed by the

Contracting Officer. Any test not meeting the required gradation will result in rejection of the failing stone. Additional tests will be required by the Contracting Officer at no cost to the Government to delineate the limits of out-of-spec stone. Any failing test will not be counted as one of the minimum number of tests stated above. All samples to be tested shall be collected in the presence of the Contracting Officer. The Contracting Officer shall be notified a minimum of 15 days prior to any scheduled gradation test/sample collection at the proposed source.

#### 1.5 STONE SOURCE SUBMITTAL

For each individual source of stone (quarry) identified by the Contractor as a potential supplier of material for use on the project structure, the Contractor shall submit, in report format, a Stone Source Submittal. The stone source submittal shall be prepared, signed, and stamped by an independent Professional Geologist, licensed in any U.S. State that issues a Professional Geologist license. The Stone Source Submittal for each source shall contain general quarry information, quarry location map, geologic name of formation mined, and the intended products obtained from the designated source - (i.e. Product Data listed in subparagraph SD-03). Different lithostratigraphic facies within the quarry as well as the lithostratigraphic(s) facies proposed as the source of stone material should be discussed in the Stone Source Submittal. The Evaluation Testing of Stone Report and test reports consisting of Bulk Specific Gravity and Initial Gradation Testing shall also be submitted within and concurrently with the Stone Source Submittal. The Stone Source Submittal from each quarry so designated shall state that the stone has met all specified requirements stipulated herein. It is the Contractor's responsibility to complete all submittals, product data, and testing requirements to determine that the stone source or combination of sources selected are capable of providing the specified quality, quantities, and gradation needed and at the rate needed to maintain the scheduled progress of the work. No stone shall be shipped from any proposed stone source(s) until the Contractor has received written approval of that source from the Contracting Officer.

##### 1.5.1 Stone Source Submittal Schedule

The Stone Source Submittal and Test Reports consisting of Bulk Specific Gravity, Initial Gradation Testing, and Evaluation Testing of Stone shall be submitted concurrently. Any of the above documents submitted individually will be rejected as incomplete. Any of the above documents submitted individually will be rejected as incomplete. If the submittal has data omissions or is incomplete, it will be rejected and returned to the Contractor. The Contractor shall correct all errors, omissions, or deficiencies and resubmit. No stone material shall be shipped from any proposed source until the Contractor has received written approval of that source from the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 EVALUATION TESTING OF STONE

#### 2.1.1 Filter Gravel

##### 2.1.1.1 Bulk Specific Gravity

Filter Gravel (No. 89) shall have a minimum bulk specific gravity, saturated surface dry (SSD), of 2.65 based upon water having a unit weight

of 62.4 pounds per cubic foot. (There is no known local source of Filter Gravel No. 89). The method of test for bulk specific gravity (SSD) shall be ASTM C127.

#### 2.1.1.2 Gradation

No. 89 Filter Gravel shall meet the gradation requirements of ASTM C33/C33M No. 89 stone. Stockpiling and placement shall not cause segregation of gravels (such as but not limited to placing by conveyor or chute).

#### 2.1.1.3 Evaluation Tests

Testing for the purpose of evaluation the proposed stone source or combination of stone sources shall be made at the Contractor's expense. Selection of stone evaluation samples in each source proposed as a supplier of stone for this contract shall be made under the supervision of the Contracting Officer and shipped to an independent, USACE validated laboratory. The samples shall be shipped at the Contractor's expense to a laboratory validated by the government to perform the required tests. All stone shall meet or exceed the specified properties listed in Table 1, except gradation width shall be within the gradation band specified. Additional tests to which the stone shall be subjected will include unit weight, absorption, specific gravity, sulfate soundness, LA abrasion, freezing and thawing, wetting and drying, carbonate content and petrographic analysis in order to demonstrate that the stone is of a satisfactory quality. Filter gravel shall be non-calcareous aggregate. Stone shall meet the following criteria:

TABLE 1  
FILTER GRAVEL  
ACCEPTANCE CRITERIA

TEST	ASTM STANDARD	TEST VALUE
Gradation	ASTM C33/C33M	ASTM No. 89 Stone
Minimum Specific Gravity	ASTM C127	2.65 (saturated surface dry)
Absorption	ASTM C127	Less than 2 percent
Sulfate Soundness	ASTM C88	Less than 5 percent loss
LA Abrasion	ASTM C535	Less than 20 percent loss for 500 revolutions
Freeze and Thaw	ASTM D5312/D5312M	Less than 10 percent loss for 20 cycles
Wetting and Drying	ASTM D5313/D5313M	Less than 1 percent loss for 30 cycles
Petrography	ASTM C295/C295M	Fresh, interlocking crystalline, no clay minerals, and no soluble materials



## 2.2 ACCEPTANCE OF STONE MATERIAL

Acceptance of a source of stone is not to be construed as acceptance of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for stone as determined by the Contracting Officer. Different lithostratigraphic material shipped to the project site than that specified in the Stone Source Submittal and approved by the Contracting Officer shall likewise be rejected. During the contract period, both prior to and after materials are delivered to the job site, visual inspections and measurements of stone materials may be performed by the Contracting Officer. The Contracting Officer reserves the right to reject individual units of produced specified materials in stockpiles at the quarry, all transfer points, in stockpile at the project construction site or in the project structure when such materials are determined to be unsuitable. The Contracting Officer also reserves the right to collect samples at any of the above production or transfer points for independent QA testing.

### 2.2.1 Stone Material Not Meeting Specifications

If the Contracting Officer, during the inspections, finds that the stone quality, size, shape, gradation, or weights of the stone being furnished are not as specified or are questionable in quality, re-sampling and re-testing by the Contractor shall be required. Sampling of the delivered stone for testing and the manner in which the testing is to be performed shall be as directed by the Contracting Officer. This additional sampling and testing shall be performed at the Contractor's expense when test results indicate that the materials do not meet specified requirements. When test results indicate that materials meet specified requirements, an equitable adjustment in the contract price will be made for the sampling and testing. Any material rejected shall be removed or disposed of as specified and at the Contractor's expense. If a source for stone so designated by the Contractor is not accepted for use by the Contracting Officer, the Contractor shall propose other sources and testing of other sources shall be performed at no additional cost to Government.

## PART 3 EXECUTION

### 3.1 BASE PREPARATION

Areas on which Filter Gravel are to be placed shall be graded and/or dressed to conform to cross sections shown on the contract drawings. The prepared base shall be approved by the Contracting Officer. Where such areas are below the allowable minus tolerance limit they shall be brought to grade by fill with earth similar to the adjacent material and then compacted to a density equal to the adjacent in place material. Immediately prior to placing Filter Gravel, the prepared base will be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved.

### 3.2 PLACEMENT

#### 3.2.1 Placement of Gravel on Prepared Base

Filter Gravel shall be spread uniformly on the prepared base to the slope lines and grades as indicated on the contract drawings and in such manner as to avoid damage to the prepared base. The degree of finish for Filter Gravel shall be plus 3 inches and minus 0 inches. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent

loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Stone placement which segregates the particle sizes within the gravel layers or cause mixing of the gravel layers will not be permitted (such as but not limited to stockpiling from conveyor or chute). Filter Gravel shall be kept free from contamination with soil or other debris. Any Filter Gravel that becomes contaminated shall be removed from the site and replaced at no additional cost to the Government. Lifts of soil placed adjacent to Filter Gravel shall be sloped away from the exposed Filter Gravel. Any damage to the surface of the prepared base during placement of the material shall be repaired before proceeding with the work.

### 3.2.2 Compaction

Filter Gravel shall be compacted using an approved vibratory roller or plate compactor. Loose lifts of gravel shall not exceed 8 inches in thickness when compacted by a roller or 4 inches when compacted by plate compactor. A minimum of 2 full passes shall be made by the compaction equipment across each lift. The compaction shall continue until the lift achieves an unyielding condition and is approved by the Contracting Officer. The compaction equipment and methods shall not cause degradation of the gravel such that it no longer meets the required ASTM gradation. The thickness of the Filter Gravel shall be approved by the Contracting Officer.

### 3.3 GRADATION TEST DATA AND STONE SOURCES REPORTING SHEETS

See next page.

Date of Test \_\_\_\_\_ Testing Rate \_\_\_\_\_

Contract No.	District	Tons
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	TOTAL	

Stone Size (lbs)	Weight Retained	Individual % Retained	Cumulative % Ret.	% Pass	Specification % Finer by wt
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Total Weight					
Max Size Stone =					

Remarks:

I certify that the above stone sample is representative of the total tonnage covered by this test report.

Contractor Representative \_\_\_\_\_  
Government Representative \_\_\_\_\_

STONE SOURCES

LATITUDE/ LONGITUDE	QUARRY LOCATION, ADDRESS, & TELEPHONE NUMBER	MAIN OFFICE ADDRESS & TELEPHONE NUMBER
	STATE	
_____	_____	_____
	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____
	_____	_____
	STATE	
_____	_____	_____
	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____
	_____	_____
	_____	_____

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