GUAM WATERWORKS AUTHORITY
Gloria B. Nelson Public Service Building | 688 Route 15, Mangilao, Guam 96913
P.O. Box 3010, Hagåtña, Guam 96932
Tel. No. (671) 300-6846/48 Fax No. (671) 648-3290

Invitation For Bid:	IFB-04-ENG-2026
Project:	Asbestos Cement Pipe (ACP) Waterline Replacement-Construction, GWA Project No. 12310
Addendum No.:	**02**
Date:	June 2, 2026

All Potential Bidders:

This addendum is issued to modify the previously issued bid documents and/or given for informational purposes and is hereby made a part of the bid documents. Failure to acknowledge receipt of this addendum shall be grounds for the bidder's disqualification and rejection of the bidder's proposal.

1. **Section 00410 Bid Form** supersedes the previously issued Bid Form. See revised Bid Form attached.

2. The following sheets of the **Conceptual Drawings** supersede all previously issued drawings. The drawings are design revisions:
   T-002, CV-001, CV-103, CV-111, CV-112, C-001, C-101, C-102, C-103, C-104, C-105, C-106, C-107, C-108, C-109, C-110, C-111, C-112, C-501, C-502, C-503, C-504, C-505, C-506, C-507, C-508, C-509

3. The following sheets of the **Specifications** supersede all previously issued Specifications. The Specifications were changed to reflect the design revisions:
   SECTION 330507.13 - UTILITY DIRECTIONAL DRILLING, 2.1 HORIZONTAL DIRECTIONAL DRILLING, (F. Casing End Seal) SECTION 330507.33 - CLOSE TOLERANCE PIPE SLURRIFICATION WITH FUSIBLE POLYVINYL CHLORIDE (FPVC) PIPE, 3.03 PIPE INSTALLATION, (A. General)

Bidders are also notified to visit GWA website: http://guamwaterworks.org/bids/ to ensure that all addenda to the bid, answers to questions, and reminders communicated are received by all bidders throughout the solicitation process.

Miguel C. Bordallo, P.E.
General Manager

MCB; eq
Attachment: Revised Bid Form—Addendum No. 2
Conceptual Drawings—Addendum No. 2
Specifications—Addendum No. 2

Attachment 1 – Unit Price Bid Form

Asbestos Cement Pipe (ACP) Waterline Replacement- Construction
GWA Project No.12310

Base Bid - Description of Work:
The base bid items consist of but not specifically limited to the construction of new water lines and the removal of existing asbestos cement water line pipes. The installation of fiber optic conduits will also be performed. Work consists of replacement of asbestos cement pipe with PVC pipe by Close Tolerance Pipe Slurrification and Horizontal Directional Drilling methods, including pipe fittings, valves, fire hydrants, manholes, disconnection and re-connection of existing customer service lines, disposal of asbestos material, installation of fiber optic conduits and handholes, and providing temporary bypass and traffic control as necessary to complete the work.

Bidders will complete the work for the following price(s) as broken down per scope item:

Item No.	Description	Unit	Unit Price	Qty	Bid Amount
0.0 - General Conditions					
0.1	Building Permit	LS		1	
0.2	Mobilization/Demobilization	LS		1	
0.3	Insurance and Bonds	LS		1	
0.4	Permits	LS		1	
0.5	Traffic Control	LS		1	
0.6	Erosion Control	LS		1	
0.7	Archaeological monitoring	LS		1	
1.0 – Civil					
1.1	Installation of 12” diameter PVC pipe, installed by Close Tolerance Pipe Slurrification (CTPS), including installation of PVC pipe, testing, and all incidentals, in place complete.	LF		4159	
1.2	Pre-pipeline inspection	LS		1	
1.3	Stop, dig, removal of repair coupling, and restart CTPS	EA		10	
1.4	8” by-pass line, including testing, disinfection, location and connection of services, and excavation and restoration for driveway and roadway crossings. Service saddles turned over to GWA.	LS		1	
1.5	Installation of 12” diameter	LF		1388	

Item No.	Description	Unit	Unit Price	Qty	Bid Amount
	PVC pipe and two 4” fiber optic conduit, installed by Horizontal Directional Drilling (HDD) in one 20” casing, including installation and removal of by-pass system, installation of PVC pipe, casing end seals, testing, and all incidentals, in place complete.				
1.6	Fire hydrant assembly	EA		9	
1.7	12" gate valve	EA		15	
1.8	Combination air release/vacuum valve	EA		6	
1.9	12" 11.25 bend	EA		4	
1.10	Service connections	EA		9	
1.11	12x6 tee	EA		2	
1.12	6" gate valve	EA		2	
1.13	12x8 tee	EA		4	
1.14	8” gate valve	EA		4	
1.15	Testing manhole	EA		2	
1.16	Installation of 4" diameter PVC fiber optic duct bank, installed by open trench, concrete encased, and all incidentals, in place complete.	LF		4159	
1.17	Fiber optic handholes	EA		4	
1.18	Disposal of asbestos containing material	TON		48	
1.19	Connections to existing pipe	EA		4	
1.20	Disinfection and testing	LS		1	
1.21	Pavement restoration, full lane	LS		1	
TOTAL BASE BID (TOTAL of items 0 through 1.21, inclusive)					
(Please write out total bid amount in words below)					

This Contract will be awarded to the lowest responsive and responsible bidder based on the total Base Bid Schedule. Determination of the lowest responsive and responsible bidder will be in accordance with the provisions of the Bid Documents.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents. Bidder also acknowledges that each unit price includes an amount considered by Bidder to be adequate to cover Bidder's overhead and profit for each separately identified item.

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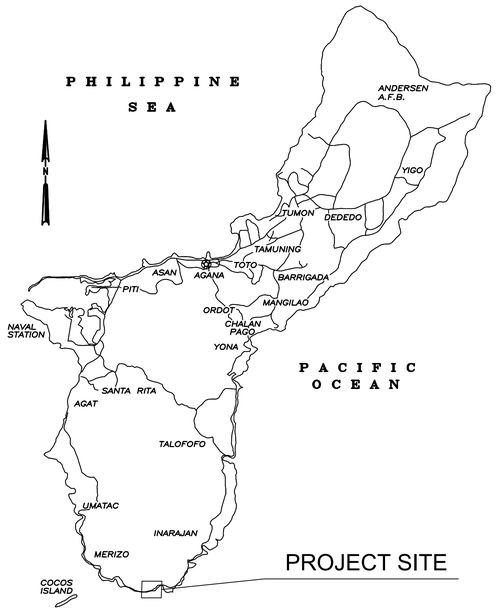
ACP WATERLINE REPLACEMENT - AJAYAN

GWA PROJECT NO. 12310



VICINITY MAP

LOCATION MAP

GUAM, U.S.A.

FOR CONSTRUCTION

No.	Issue		Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS

Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

Seal: AARON C. SUTTON, No 1469 (CIVIL), CERTIFICATE, EXP. 04/30/2027, PROFESSIONAL ENGINEER
4/24/26
THIS WORK WAS PREPARED BY ME OR DONE UNDER MY DIRECT SUPERVISION

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

Title TITLE SHEET, LOCATION MAP, VICINITY MAP

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

Sheet No T-001 | Sheet 1 of 38

Plot Date: 20 May 2026 - 8:28 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-T-001.dwg

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ACP WATERLINE REPLACEMENT - AJAYAN
GWA PROJECT NO. 12310

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38	C-509	TRAFFIC CONTROL PLAN

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV INDEX OF DRAWING	ACS	ACS	05.05.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

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Title INDEX OF DRAWINGS
Size ANSI D
Project No. 12582394
Date 04/24/2026
Scale
Sheet No. T-002
Sheet 2 of 38

Plot Date: 20 May 2026 - 8:28 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-T-002.dwg

GENERAL NOTES

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE OSHA REGULATIONS.

2. THE TYPES, LOCATIONS, SIZES AND OR DEPTHS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THE IMPROVEMENT PLANS WERE OBTAINED FROM SOURCES OF VARYING RELIABILITY. THE CONTRACTOR IS CAUTIONED THAT ONLY ACTUAL EXCAVATION WILL REVEAL THE TYPES, LOCATIONS, EXTENT, SIZES, AND DEPTHS OF SUCH UNDERGROUND UTILITIES. (A REASONABLE EFFORT HAS BEEN MADE TO LOCATE AND DELINEATE ALL KNOWN UNDERGROUND UTILITIES.) HOWEVER, THE ENGINEER CAN ASSUME NO RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF THE DELINEATION OF SUCH UNDER-GROUND UTILITIES WHICH MAY BE ENCOUNTERED, BUT WHICH ARE NOT SHOWN ON THESE DRAWINGS.

3. SHOULD DISCREPANCIES EXIST BETWEEN ANY ACTUAL LOCATION OR ELEVATIONS ON THESE PLANS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE CONTRACTING OFFICER BEFORE ADJUSTING THE DESIGN.

4. CONTRACTOR SHALL UNCOVER AND EXPOSE ALL EXISTING UTILITY LINES WHERE THEY ARE TO BE CROSSED ABOVE OR BELOW BY THE NEW UTILITIES BEING CONSTRUCTED USING EXCAVATION IN ORDER TO VERIFY THE GRADE AND TO ASSURE THAT THERE IS SUFFICIENT CLEARANCE. PIPE SHALL NOT BE STRUNG NOR TRENCHING COMMENCED UNTIL ALL CROSSINGS HAVE BEEN VERIFIED FOR CLEARANCE. IF THE CONTRACTOR FAILS TO FOLLOW THIS PROCEDURE, HE WILL BE SOLELY RESPONSIBLE FOR ANY EXTRA WORK OR MATERIAL REQUIRED IF MODIFICATIONS TO THE DESIGN ARE NECESSARY.

5. ALL DRAINAGE STRUCTURES AND UTILITIES THAT LIE WITHIN AREAS AFFECTED BY WORK ON THIS PROJECT SHALL BE REMOVED AS INDICATED. ALL STRUCTURES TO REMAIN INCLUDING BUT NOT LIMITED TO MANHOLES, CATCH BASINS, WATER VALVES, FIRE HYDRANTS, TELEPHONE, ELECTRIC VAULTS AND PULL BOXES SHALL BE ADJUSTED TO GRADE BY THE CONTRACTOR, UNLESS NOTED OTHERWISE.

6. THE CONTRACTOR SHALL MAINTAIN THE STREETS, SIDEWALKS AND ANY OTHER PUBLIC RIGHT OF WAY IN A CLEAN SAFE AND USABLE CONDITION. ALL SPILLS OF SOIL, ROCK OR CONSTRUCTION DEBRIS MUST BE REMOVED IMMEDIATELY FROM THE PUBLICLY OWNED PROPERTY DURING CONSTRUCTION AND UPON COMPLETION OF THE PROJECT. ALL ADJACENT PROPERTY, PRIVATE OR PUBLIC, SHALL BE MAINTAINED IN A CLEAN, SAFE AND USABLE CONDITION.

7. CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR THE JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

8. EXISTING FACILITIES TO REMAIN INCLUDING, BUT NOT LIMITED TO ROADS, WALLS, FENCE AND STRUCTURES DAMAGED BY CONTRACTOR'S OPERATIONS, SHALL BE RESTORED TO MATCH ORIGINAL CONDITION AND TO THE SATISFACTION OF OWNER'S REPRESENTATIVE WITHOUT ADDITIONAL COST TO THE OWNER.

9. THE CONTRACTOR SHALL END PLACEMENT OF ALL SURFACE CONCRETE WORK AT EITHER EXPANSION OR CONSTRUCTION JOINTS.

10. GOVERNMENT DISPOSAL AREAS WILL NOT BE AVAILABLE FOR THE DISPOSAL OF WASTE MATERIALS. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR DISPOSAL OF THEIR WASTE MATERIALS IN ACCORDANCE WITH GSWA AND GEPA REGULATIONS.

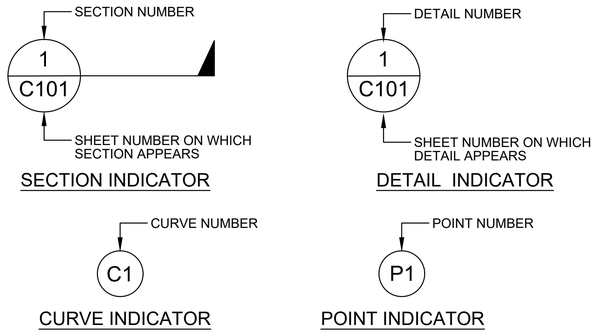
11. CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING CONSTRUCTION STAGING AREA(S) AND COORDINATING WITH APPROPRIATE AGENCIES AND/OR LAND OWNERS.

△

LEGEND & SYMBOLS

EXISTING	NEW
CONCRETE POWER POLE	WATER MAIN
WOODEN POWER POLE	FIBER OPTIC
UTILITY POLE	WATER VALVE
GUY WIRE	FIRE HYDRANT
FIRE HYDRANT	AIR RELEASE VALVE
FENCE	CTPS STAND PIPE
VEGETATION LINE	HDD INSTALLATION EXCAVATION
STREET SIGN/POST	CTPS INSTALLATION EXCAVATION
CONTOUR & ELEVATION	NEW INSTALLATION OR RECONNECT EXCAVATION
PROPERTY LINE	
RIGHT OF WAY LINE	
PUBLIC & UTILITY EASEMENT LINE	REMOVE OR ABANDON IN PLACE
EDGE OF PAVEMENT	
ROAD STRIPING	COMMUNICATIONS HANDHOLE
CENTER OF ROAD	
APPROXIMATE RIVER LIMITS	MULTIHOLE TYPE ASTM CASING END SEAL
COMMUNICATIONS	
GUARDRAIL	
WATER VALVE	
WATER METER	
WATER MAIN	
1993 GGN CONTROL MONUMENTS	
SURVEY STATIONS	
TREES	
CONCRETE BARRIER	
CONCRETE PAD/ROAD WAY PATCHWORK/CONCRETE SWALE	
COMMUNICATIONS BOX	
BUS STOP	
LANDMARKS	
EXISTING PAVEMENT	

ANNOTATION



ABBREVIATIONS

@	AT	E	EAST, EASTING	#, NO.	NUMBER
&	AND	(E)	EXISTING	N	NORTH, NORTHING
AC	ASPHALT CONCRETE	EC	END CURVE	(N)	NEW
ACP	ASPHALT CONCRETE PIPE	EG	EXISTING GRADE	NEG	NEGATIVE
AG	ABOVE GROUND	EL, ELEV	ELEVATION	N.I.C.	NOT IN CONTRACT
AGG	AGGREGATE	ENGR(S)	ENGINEER(S)	NSF	NATIONAL SANITATION FOUNDATION
ALT.	ALTERNATE	EP OR EOP	EDGE OF PAVEMENT	NTS	NOT TO SCALE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	EQ	EQUAL	OC	ON CENTER
		EX	EXISTING	OD	OUTSIDE DIAMETER
AP	ANGLE POINT	E.W.	EACH WAY	OS	OUTLET STRUCTURE
APPROX.	APPROXIMATE			OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
ARV	AIR RELEASE/VACCUM VALVE	FFE	FINISHED FLOOR ELEVATION		
		FG	FINISH GRADE		
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	FH	FIRE HYDRANT	%	PERCENT
		FIN	FINISH	±	PLUS OR MINUS
AWWA	AMERICAN WASTEWATER ASSOCIATION	FLG	FLANGE	PC	POINT OF CURVE
		FLR	FLOOR	POB	POINT OF BEGINNING
BC	BEGIN CURVE	FO	FIBER OPTIC	PCC	POINT OF COMPOUND CURVE
BM	BEAM	FOC	FACE OF CURB	PERF	PERFORATED
BEG.	BEGINNING	FRP	FIBER-REINFORCED PLASTIC	PI	POINT OF INTERSECTION
BK	BACK	FT OR '	FOOT OR FEET	POC	POINT ON CURVE
BOT	BOTTOM			POT	POINT OF TANGENT
BP	BALANCE POINT	GA	GAUGE	PP	POWER POLE
BR.	BRIDGE	GAL(S)	GALLON/GALLONS	PSF	POUNDS PER SQUARE FOOT
BRG.	BEARING	GALV	GALVANIZED	PSI	POUNDS PER SQUARE INCH
BSW	BACK OF SIDEWALK	GB	GRADE BREAK	PT	POINT OF TANGENT
		GPA	GUAM POWER AUTHORITY	PVC	POLYVINYL CHLORIDE
CATV	CABLE TELEVISION	GEPA	GUAM ENVIRONMENTAL PROTECTION AGENCY	PVMT	PAVEMENT
C	CHORD LENGTH	GSWA	GUAM SOLID WASTE AUTHORITY	R	RADIUS
CB	CATCH BASIN	GWA	GUAM WATERWORKS AUTHORITY	RCP	REINFORCED CONCRETE PIPE
CC	CENTER TO CENTER	GV	GATE VALVE	RD	ROAD/ROOF DRAIN
C&G	CURB AND GUTTER			REINF	REINFORCEMENT
CHB	CHORD BEARING	HB	HOSE BIBB	REQD	REQUIRED
CJ	CONSTRUCTION JOINT	HC	HORIZONTAL CURVE	RET	RETAINING
C/L	CHAIN LINK	HDD	HORIZONTAL DIRECTIONAL DRILLING	ROW	RIGHT-OF-WAY
℄, CL	CENTERLINE	HH	HAND HOLE	RT	RIGHT
CLR	CLEAR	HHW	HOUSEHOLD HAZARDOUS WASTE	S	SLOPE/SOUTH
CLFG	COUPLING	HORIZ.	HORIZONTAL	SCH	SCHEDULE
CMP	CORRUGATED METAL PIPE	HP	HIGH POINT	SD	STORM DRAIN
CMU	CONCRETE MASONRY UNIT	HT	HEIGHT	SDDI	STORM DRAIN DROP INLET
CNMI	COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS	HDPE	HIGH-DENSITY POLYETHYLENE	SDMH	STORM DRAIN MAN HOLE
		HDWL	HEADWALL	SDO	STORM DRAIN OUTLET
CO	CONTRACTING OFFICER	HW	HIGH WATER	SDR	STANDARD DIMENSION RATIO
COL	COLUMN			SF	SQUARE FEET/FOOT
COMM.	CONCRETE	IN OR "	INCHES	SMH, SSMH	SANITARY SEWER MANHOLE
CONC.	CONCRETE	ID	INSIDE DIAMETER	SS	SANITARY SEWER
CONN	CONNECTION	INV	PIPE INVERT	SSC, SCO	SANITARY SEWER CLEANOUT
CONT	CONTINUOUS			SQ.	SQUARE
CONST	CONSTRUCTION	JT	JOINT	SSTL	STAINLESS STEEL
CP	CONTROL POINT			STA	STATION
CPP	CONCRETE POWER POLE	L	LENGTH	STD	STANDARD
CTPS	CLOSE TOLERANCE PIPE SLURRIFICATION	LAT	LATITUDE	S/W	SIDEWALK
		LB	POUND		
CTRS	CENTERS	LT	LEFT	T	TANGENT
CU	COPPER WIRE	LF	LINEAR FOOT (FEET)	TB	TELEPHONE BOX
CUIN	CUBIC INCH(ES)	LONG	LONGITUDINAL	TBM	TEMPORARY BENCH MARK
CUFT	CUBIC FOOT	LP	LIGHT POLE, LOW POINT	T&B	TOP AND BOTTOM
CUYD	CUBIC YARD(S)	LW	LOW WATER	THK	THICKNESS
CULV	CULVERT			TE	TOP ELEVATION (RIM ELEVATION)
		M/MH	MANHOLE	TYP	TYPICAL
△c, DELTA	CURVE CENTRAL ANGLE	MAX	MAXIMUM	TC/TOC	TOP OF CURB
° OR DEG	DEGREE	ME	MATCH EXISTING	UG	UNDERGROUND
° F	DEGREE FAHRENHEIT	MLO	MATCH LINE OFFSET	UNO	UNLESS NOTED OTHERWISE
DET	DETAIL	MATL	MATERIAL		
Ø, DIA	DIAMETER	MH	MANHOLE	VC	VERTICAL CURVE
DHV	DESIGN HOURLY VOLUME	MI	MILE	VERT	VERTICAL
DI	DROP INLET	MISC	MISCELLANEOUS	VIF	VERIFY IN FIELD
DIP	DUCTILE IRON	MIN.	MINIMUM	VPI	VERTICAL POINT OF INTERSECTION
DIAG	DIAGONAL	MJ	MECHANICAL JOINT		
DIST	DISTANCE	MON	MONUMENT	W	WEST, WATERLINE
DN	DOWN	MM	MILLIMETER	W/	WITH
DPW	DEPARTMENT OF PUBLIC WORKS	MPH	MILE PER HOUR	WL	WATERLINE
		'	MINUTE(S) (ANGULAR)	WM	WATER METER
DR	DIMENSION RATIO			W/O	WITHOUT
DS	DOWNSPOUT			WV	WATER VALVE
DWG	DRAWING				
D/W, DWY	DRIVEWAY				

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
△	REV GENERAL NOTES AND LEGENDS	ACS	ACS	05.13.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

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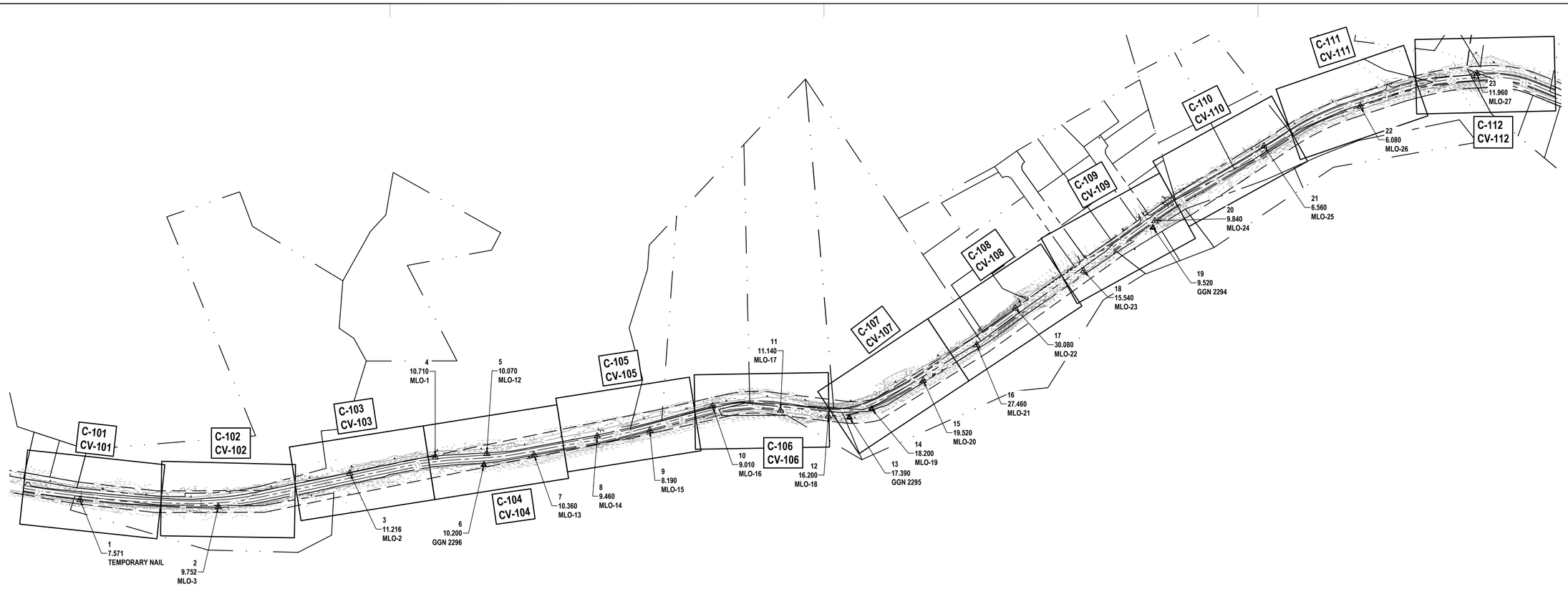
Project No. 12582394 Date 04/24/2026 Scale
Sheet No. T-003 Sheet 3 of 38

Plot Date: 20 May 2026 - 8:28 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-T-003.dwg



1 SURVEY CONTROL PLAN

SCALE: 1" = 200'

POINT TABLE						POINT TABLE						POINT TABLE					
POINT #	POINT NAME	ELEVATION	NORTHING	EASTING	DESCRIPTION	POINT #	POINT NAME	ELEVATION	NORTHING	EASTING	DESCRIPTION	POINT #	POINT NAME	ELEVATION	NORTHING	EASTING	DESCRIPTION
1	MLO-4	7.571	564305.3940	311997.8729	TEMPORARY NAIL	11	MLO-17	11.140	564635.1302	314580.5434	TEMPORARY NAIL	21	MLO-25	6.560	565609.4303	316363.4777	TEMPORARY NAIL
2	MLO-3	9.752	564279.4626	312507.8485	TEMPORARY NAIL	12	MLO-18	16.200	564613.9069	314757.0529	TEMPORARY NAIL	22	MLO-26	6.080	565756.3266	316718.2716	TEMPORARY NAIL
3	MLO-2	11.216	564403.0612	312992.8353	TEMPORARY NAIL	13	GGN 2295	17.390	564609.0350	314834.6834		23	MLO-27	11.960	565877.3463	317148.6032	TEMPORARY NAIL
4	MLO-1	10.710	564462.7154	313307.7449	TEMPORARY NAIL	14	MLO-19	18.200	564640.3806	314916.9948	TEMPORARY NAIL						
5	MLO-12	10.070	564475.3697	313498.0464	TEMPORARY NAIL	15	MLO-20	19.520	564744.8592	315106.7977	TEMPORARY NAIL						
6	GGN 2296	10.200	564434.0186	313487.2642		16	MLO-21	27.460	564876.5661	315303.8063	TEMPORARY NAIL						
7	MLO-13	10.360	564471.4814	313671.6774	TEMPORARY NAIL	17	MLO-22	30.080	565011.8518	315446.2943	TEMPORARY NAIL						
8	MLO-14	9.460	564540.1615	313905.2734	TEMPORARY NAIL	18	MLO-23	15.540	565149.4561	315698.0268	TEMPORARY NAIL						
9	MLO-15	8.190	564561.2802	314098.9368	TEMPORARY NAIL	19	GGN 2294	9.520	565309.2094	315953.6818							
10	MLO-16	9.010	564650.7847	314329.9311	TEMPORARY NAIL	20	MLO-24	9.840	565334.1997	315961.2325	TEMPORARY NAIL						

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS, AND 1993 GGN CONTROL MONUMENT ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024

SHEET LEGEND

- RIGHT OF WAY LINE
- PROPERTY LINE
- PUBLIC & UTILITY EASEMENT LINE
- SURVEY STATION
- 1993 GGN CONTROL MONUMENT

GRAPHIC SCALE

0 200' 400'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV POINT TABLE	ACS	ACS	05.19.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

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4/24/26
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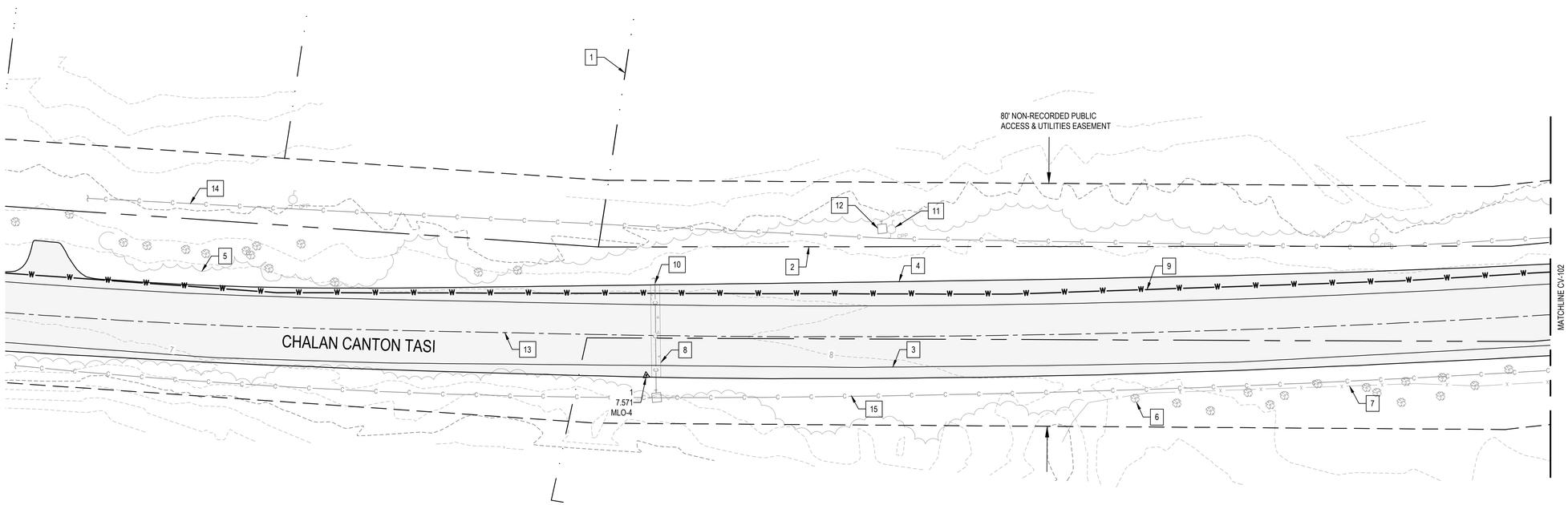
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title SURVEY CONTROL PLAN
Size ANSI D
Project No. 12582394 Date 04/24/2026 Scale AS SHOWN
Sheet No. CV-001 Sheet 4 of 38

Plot Date: 20 May 2026 - 8:38 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-001.dwg



1 **SITE CONDITIONS PLAN 1**
SCALE: 1" = 20'

N

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES

1. (E) PROPERTY LINE
2. (E) RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) FENCE
8. (E) AC PATCHWORK
9. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
10. (E) COMM. LINE, CONTRACTOR TO VERIFY
11. (E) TYP. CONCRETE POWER POLE
12. (E) TYP. COMMUNICATIONS BOX
13. (E) CENTER OF ROAD
14. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
15. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' 0 10' 20' 40'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

Seal

AARON C. SUTTON
No 1489
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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

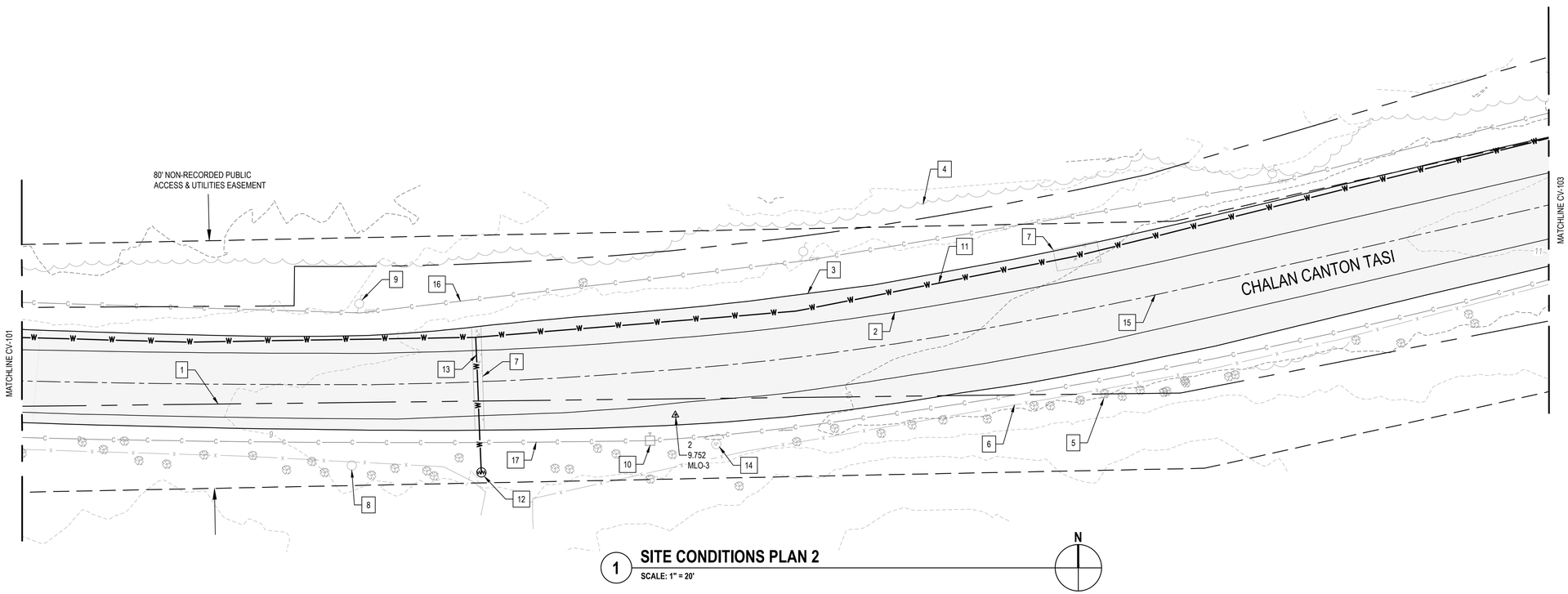
Title SITE CONDITIONS 1

Size ANSI D

Project No. 12582394 Date 04/24/2026 Scale AS SHOWN

Sheet No CV-101 Sheet 5 of 38

Plot Date: 20 May 2026 - 8:29 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 **SITE CONDITIONS PLAN 2**
SCALE: 1" = 20'

N

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES

1. (E) RIGHT OF WAY
2. (E) ROAD STRIPING
3. (E) EDGE OF PAVEMENT
4. (E) TYP. TREELINE
5. (E) TYP. TREES
6. (E) FENCE
7. (E) AC PATCHWORK
8. (E) UTILITY POLE
9. (E) TYP. CONCRETE POWER POLE
10. (E) TYP. COMMUNICATIONS BOX
11. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
12. (E) WATER METER
13. (E) WATER SERVICE LATERAL, CONTRACTOR TO VERIFY
14. (E) POWER SERVICE PEDESTAL
15. (E) CENTER OF ROAD
16. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
17. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

0 10' 20' 40'
1" = 20'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.
GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

Seal
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PROFESSIONAL ENGINEER
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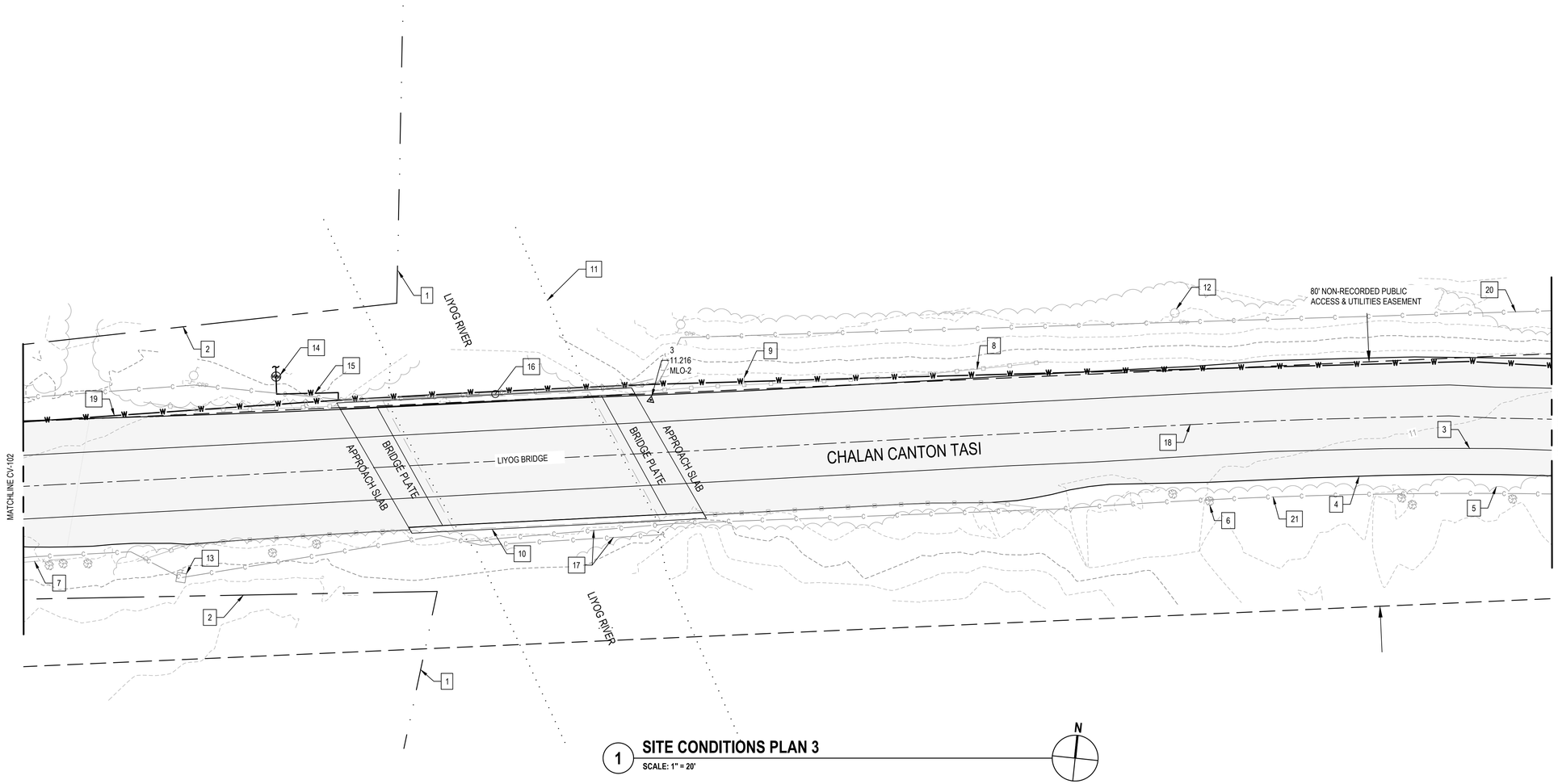
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title SITE CONDITIONS 2
Size ANSI D

Project No. 12582394 Date 04/24/2026 Scale AS SHOWN
Sheet No. CV-102 Sheet 6 of 38

Plot Date: 20 May 2026 - 8:29 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 **SITE CONDITIONS PLAN 3**
SCALE: 1" = 20'

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES

1. (E) PROPERTY LINE
2. (E) RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) FENCE
8. (E) GUARDRAIL
9. (E) STREET SIGN
10. (E) CONCRETE BARRIER
11. APPROX. RIVER LIMITS AT TOP OF BANK △1
12. (E) TYP. CONCRETE POWER POLE
13. (E) TYP. COMMUNICATIONS BOX
14. (E) WATER SERVICE LATERAL
15. (E) WATER METER
16. (E) 12" DIP WL & CONDUITS
17. (E) CONDUITS
18. (E) CENTER OF ROAD
19. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
20. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
21. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' 0 10' 20' 40'

FOR CONSTRUCTION

No.	Issue	Drafting Check	Checked	Approved	Date
△	REV KEYNOTE		ACS	ACS	05.14.26
	Author ---	Drafting Check JB	Project Manager ACS		
	Designer ACS	Design Check NK	Project Director MGK		

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

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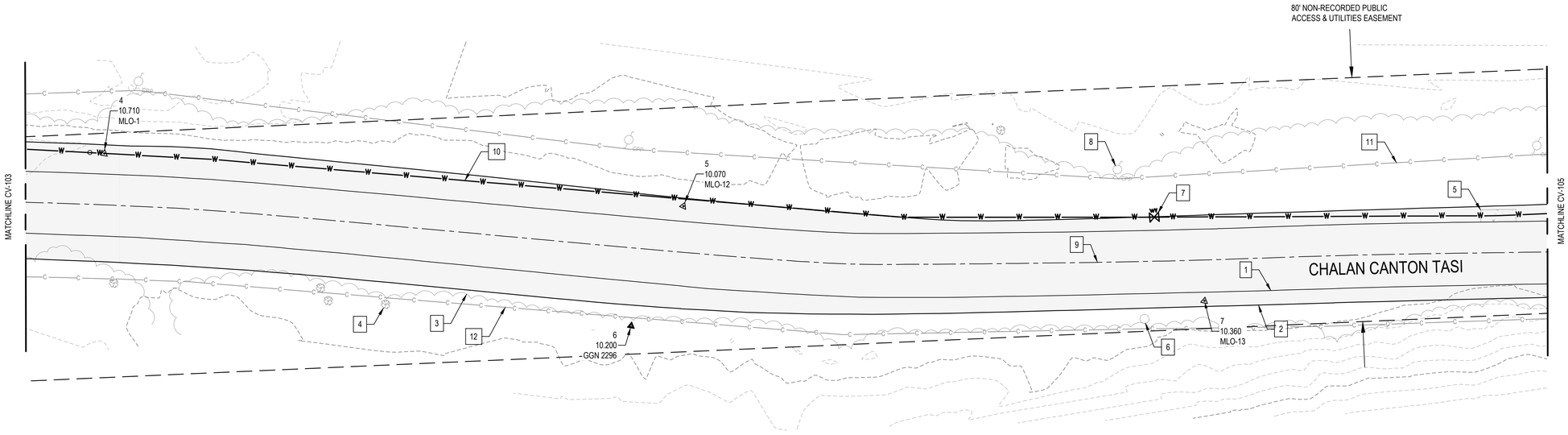
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title SITE CONDITIONS 3
Size ANSI D

Project No.	Date	Scale	Sheet No.	Sheet
12582394	04/24/2026	AS SHOWN	CV-103	7 of 38

Plot Date: 20 May 2026 - 8:55 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 **SITE CONDITIONS PLAN 4**
SCALE: 1" = 20'

N

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES [#]

1. (E) ROAD STRIPING
2. (E) EDGE OF PAVEMENT
3. (E) TYP. TREELINE
4. (E) TYP. TREES
5. (E) AC PATCHWORK
6. (E) UTILITY POLE
7. (E) WATER VALVE
8. (E) TYP. CONCRETE POWER POLE
9. (E) CENTER OF ROAD
10. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
11. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
12. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' 0 10' 20' 40'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

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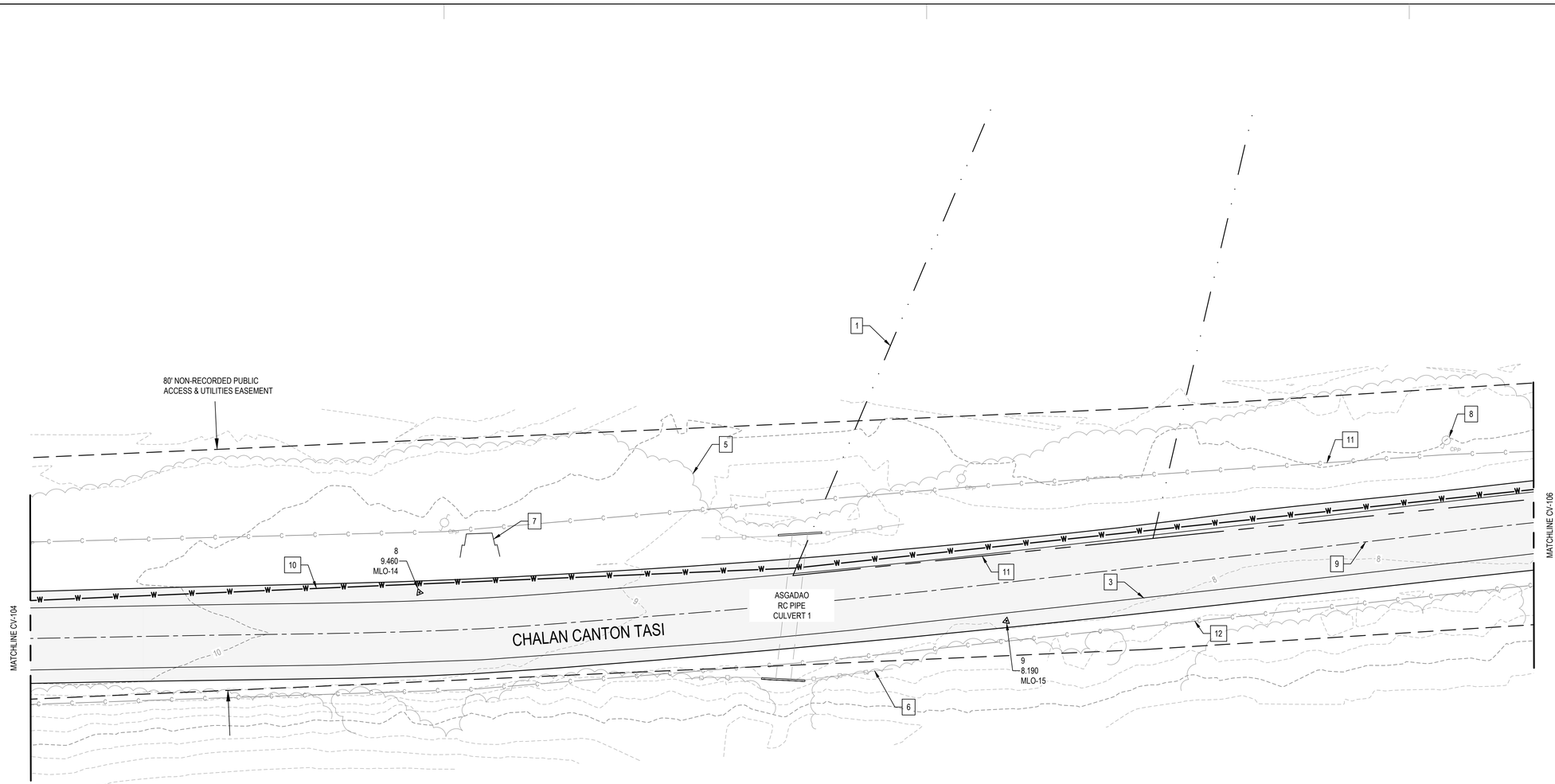
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title SITE CONDITIONS 4
Size ANSI D

Project No. 12582394 Date 04/24/2026 Scale AS SHOWN
Sheet No. CV-104 Sheet 8 of 38

Plot Date: 20 May 2026 - 8:29 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 **SITE CONDITIONS PLAN 5**
SCALE: 1" = 20'

N

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES [#]

1. (E) PROPERTY LINE
2. (E) RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) GUARDRAIL
7. (E) BUS STOP
8. (E) TYP. CONCRETE POWER POLE
9. (E) CENTER OF ROAD
10. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
11. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
12. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' (0, 10', 20', 40')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

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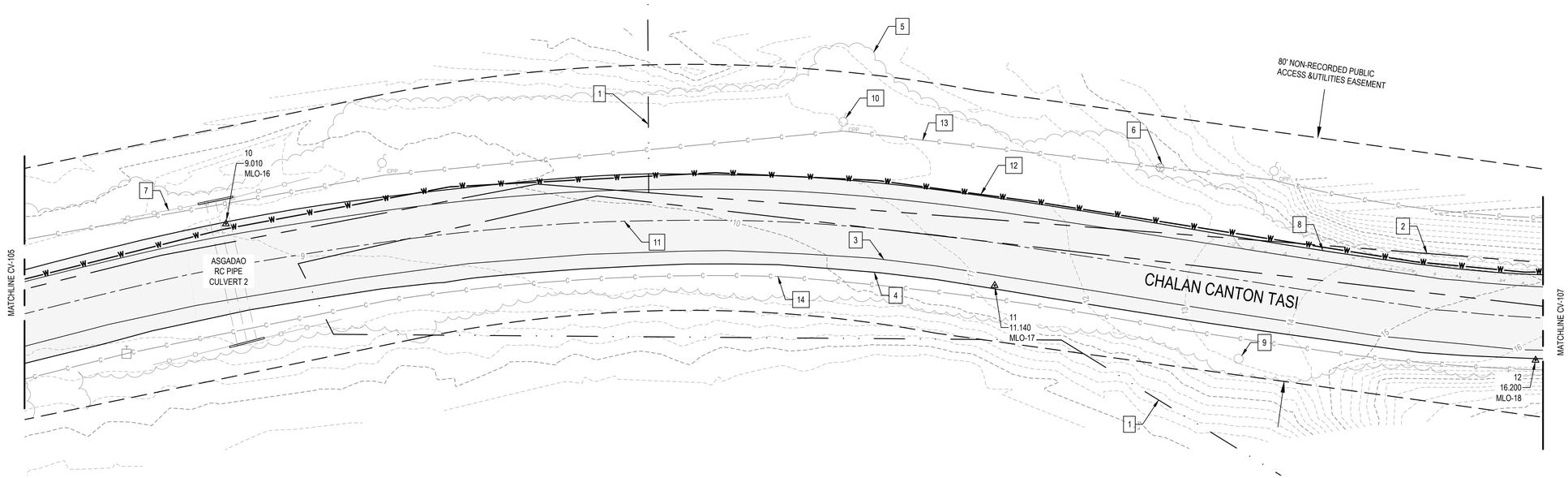
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title SITE CONDITIONS 5
Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN
Sheet No. CV-105 | Sheet 9 of 38

Plot Date: 20 May 2026 - 8:56 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 **SITE CONDITIONS PLAN 6**
SCALE: 1" = 20'

N

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES [#]

1. (E) PROPERTY LINE
2. (E) RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) GUARDRAIL
8. (E) CONCRETE SWALE
9. (E) UTILITY POLE
10. (E) TYP. CONCRETE POWER POLE
11. (E) CENTER OF ROAD
12. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
13. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
14. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' 0 10' 20' 40'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

Seal

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(CIVIL)
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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

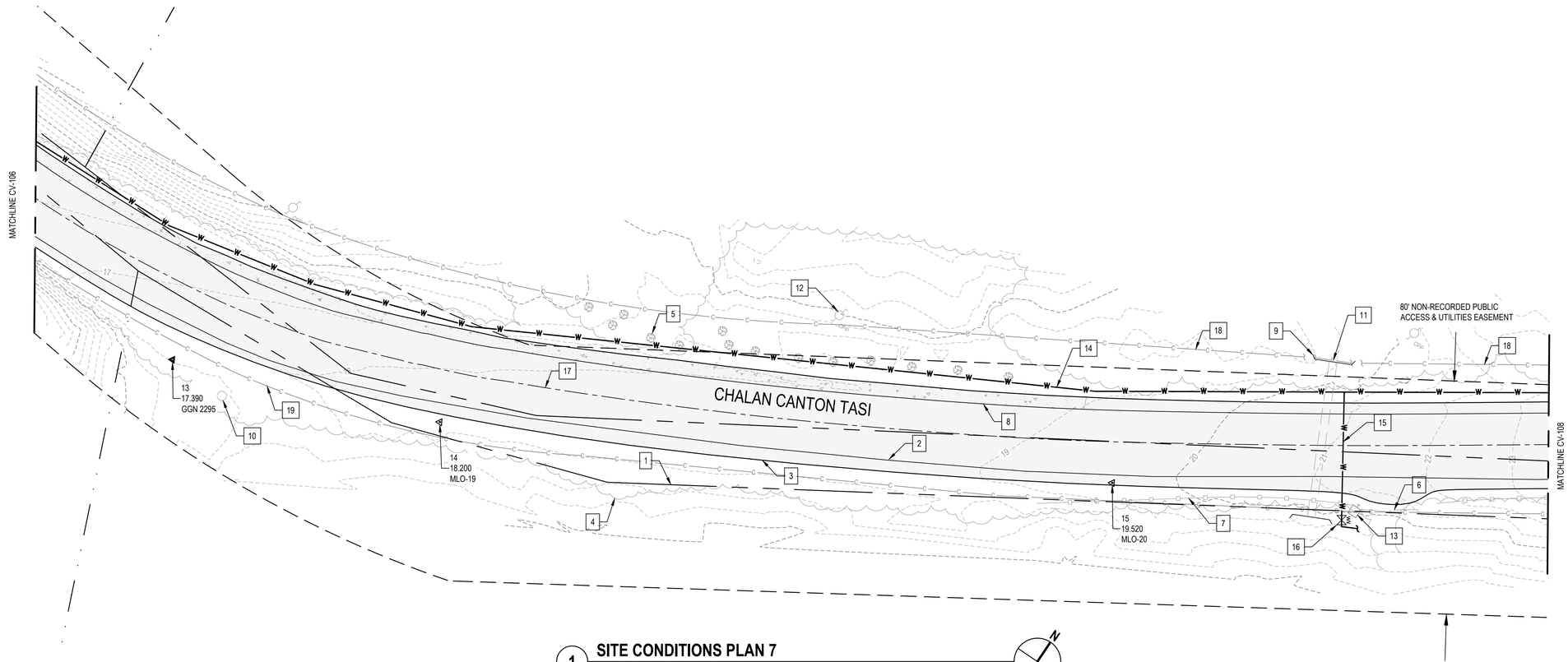
Title SITE CONDITIONS 6

Size ANSI D

Project No. 12582394 Date 04/24/2026 Scale AS SHOWN

Sheet No. CV-106 Sheet 10 of 38

Plot Date: 20 May 2026 - 8:56 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 SITE CONDITIONS PLAN 7

SCALE: 1" = 20'

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES

1. (E) RIGHT OF WAY
2. (E) ROAD STRIPING
3. (E) EDGE OF PAVEMENT
4. (E) TYP. TREELINE
5. (E) TYP. TREES
6. (E) FENCE
7. (E) GUARD RAIL
8. (E) CONCRETE SWALE
9. (E) CULVERT
10. (E) UTILITY POLE
11. (E) ABANDONED 2" PIPE
12. (E) TYP. CONCRETE POWER POLE
13. (E) TYP. COMMUNICATIONS BOX
14. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
15. (E) WATER SERVICE LATERAL, CONTRACTOR TO VERIFY
16. (E) SHUTOFF VALVE
17. (E) CENTER OF ROAD
18. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
19. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' — 0, 10', 20', 40'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 — 1"

Seal

AARON C. SUTTON — CERTIFICATE — NO. 1489 (CIVIL) — EXP. 04/30/2027 — GUAM — PROFESSIONAL ENGINEER

4/24/26

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

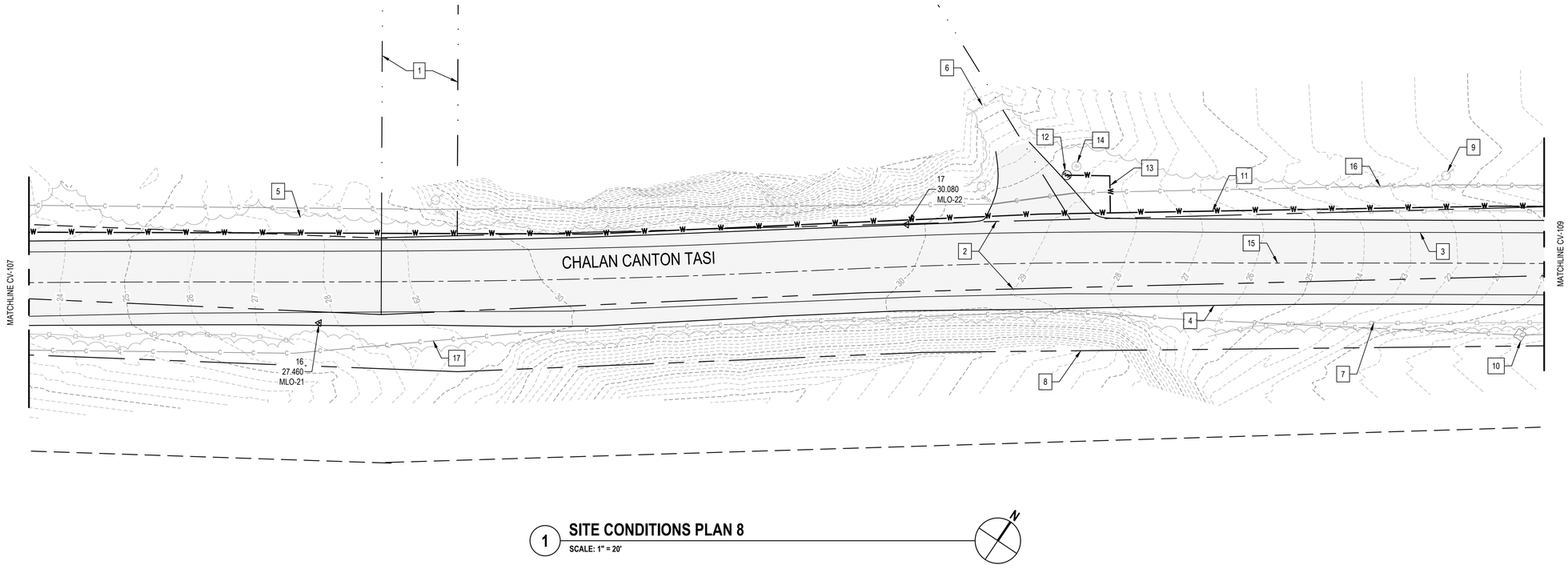
Title SITE CONDITIONS 7

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

Sheet No. CV-107 | Sheet 11 of 38

Plot Date: 20 May 2026 - 8:56 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 SITE CONDITIONS PLAN 8

SCALE: 1" = 20'

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES [#]

1. (E) PROPERTY LINE
2. (E) LOT 316-6, RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) FENCE
7. (E) GUARDRAIL
8. (E) LOT 310, RIGHT OF WAY
9. (E) TYP. CONCRETE POWER POLE
10. (E) TYP. COMMUNICATIONS BOX
11. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
12. (E) WATER METER
13. (E) WATER SERVICE LATERAL, CONTRACTOR TO VERIFY
14. (E) POWER SERVICE PEDESTAL
15. (E) CENTER OF ROAD
16. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
17. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' (0, 10', 20', 40')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0 — 1")

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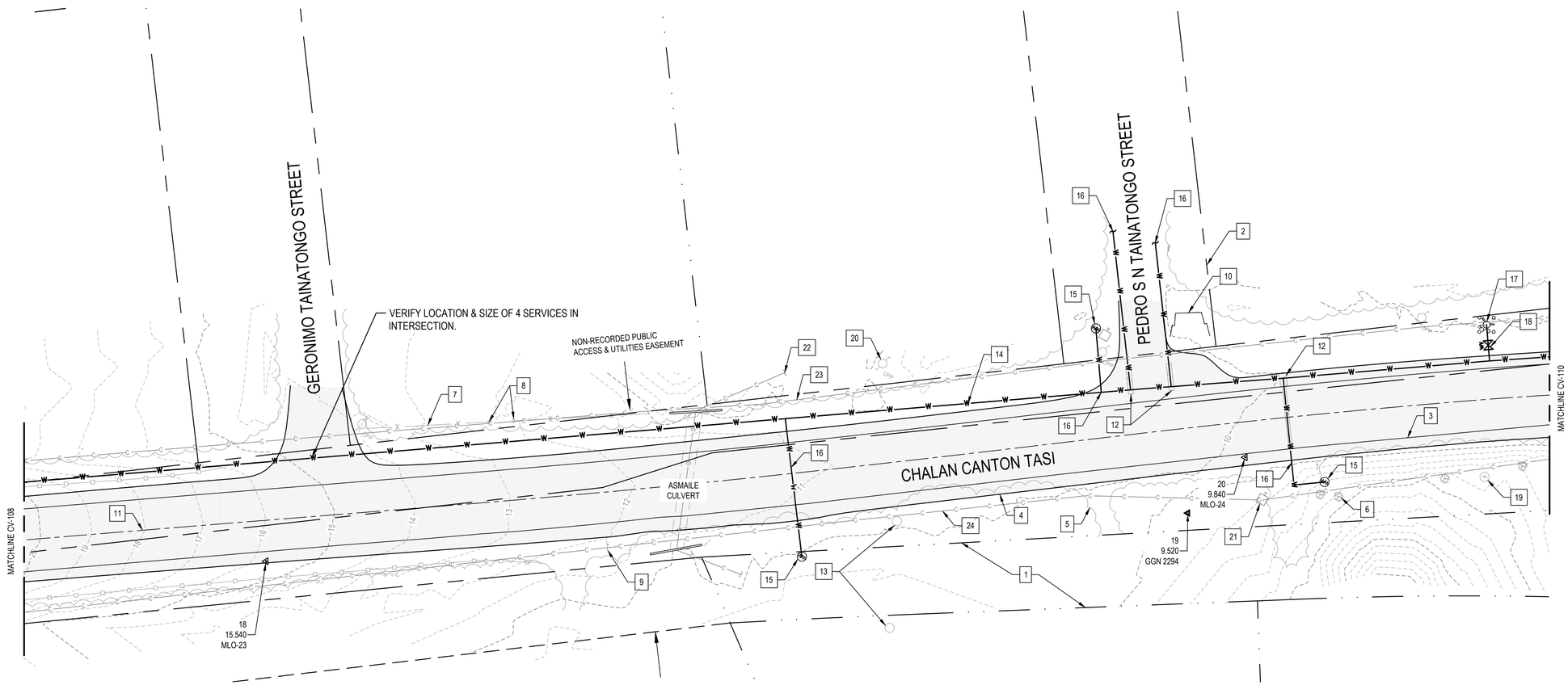
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title SITE CONDITIONS 8
Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN
Sheet No. CV-108 | Sheet 12 of 38

Plot Date: 20 May 2026 - 8:56 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 SITE CONDITIONS PLAN 9

SCALE: 1" = 20'

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES [#]

1. (E) PROPERTY LINE
2. (E) RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) ABANDONED FENCE
8. (E) ABANDONED WOODEN FENCE POST
9. (E) STREET SIGN
10. (E) BUS STOP
11. (E) CENTER OF ROAD
12. (E) AC PATCHWORK
13. (E) UTILITY POLE
14. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
15. (E) WATER METER
16. (E) WATER SERVICE LATERAL, CONTRACTOR TO VERIFY
17. (E) FIRE HYDRANT
18. (E) WATER VALVE
19. (E) POWER SERVICE PEDESTAL
20. (E) TYP. CONCRETE POWER POLE
21. (E) TYP. COMMUNICATIONS BOX
22. (E) CONDUIT
23. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
24. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' 0 10' 20' 40'

FOR CONSTRUCTION

No.	Issue		Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

Seal

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CERTIFIED
NO 1489
(CIVIL)
EXP. 04/30/2027
GUAM
PROFESSIONAL ENGINEER
4/24/26

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

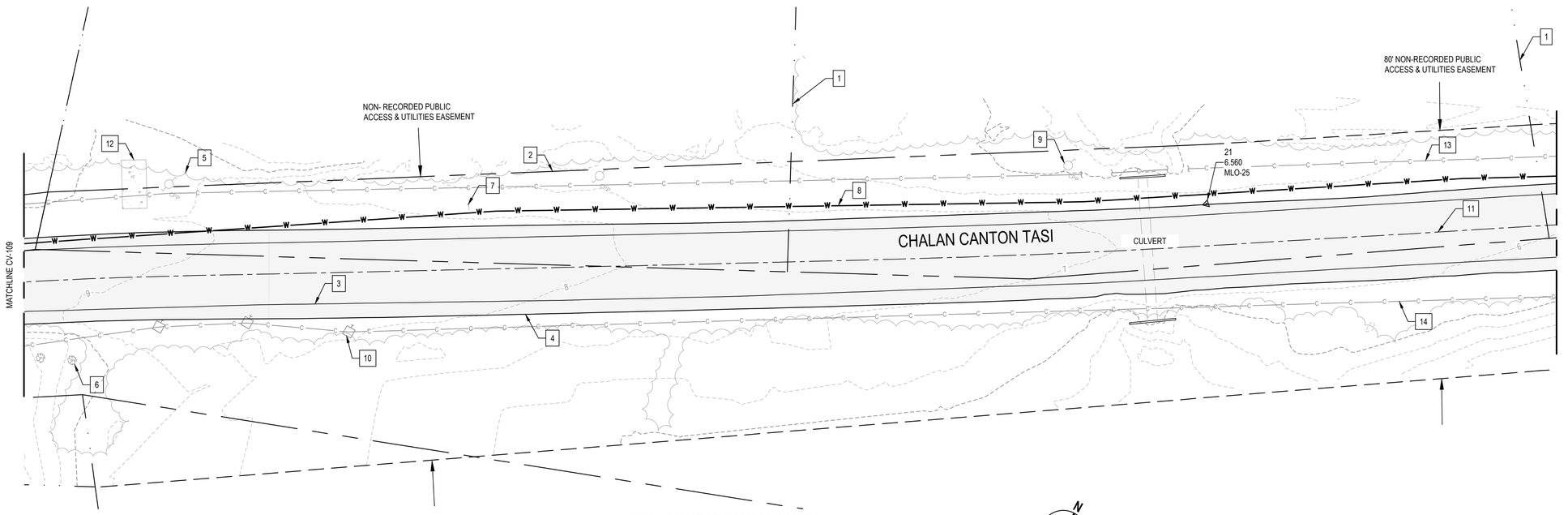
Title SITE CONDITIONS 9

Size ANSI D

Project No. 12582394 Date 04/24/2026 Scale AS SHOWN

Sheet No. CV-109 Sheet 13 of 38

Plot Date: 20 May 2026 - 8:58 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 **SITE CONDITIONS PLAN 10**
SCALE: 1" = 20'

N

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES [#]

1. (E) PROPERTY LINE
2. (E) RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) STREET SIGN
8. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
9. (E) TYP. CONCRETE POWER POLE
10. (E) TYP. COMMUNICATIONS BOX
11. (E) CENTER OF ROAD
12. (E) CONCRETE PAD
13. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
14. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' 0 10' 20' 40'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

Seal

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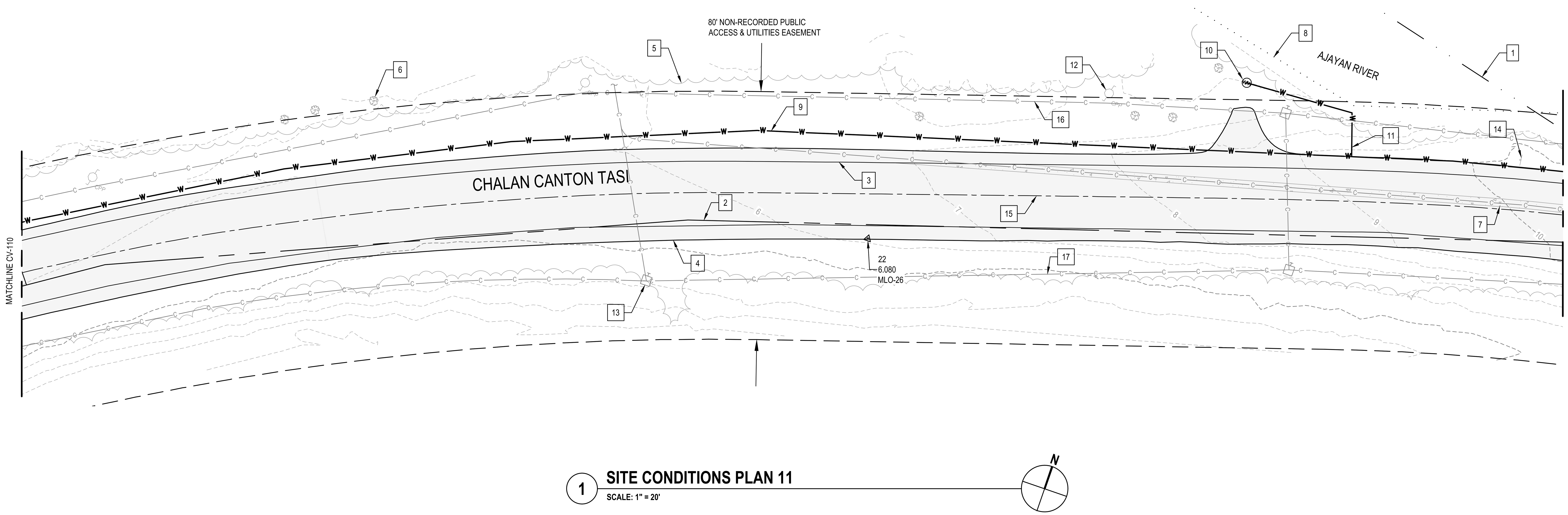
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title SITE CONDITIONS 10

Project No.	Date	Scale
12582394	04/24/2026	AS SHOWN

Size ANSI D
Sheet No. CV-110
Sheet 14 of 38



1 **SITE CONDITIONS PLAN 11**

SCALE: 1" = 20'

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES

1. (E) PROPERTY LINE
2. (E) RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) AC PATCHWORK
8. APPROX. RIVER LIMITS AT TOP OF BANK △1
9. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
10. (E) WATER METER
11. (E) WATER SERVICE LATERAL, CONTRACTOR TO VERIFY
12. (E) TYP. CONCRETE POWER POLE
13. (E) TYP. COMMUNICATIONS BOX
14. (E) STREET SIGN
15. (E) CENTER OF ROAD
16. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
17. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' — 0, 10', 20', 40'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV KEYNOTE	ACS	ACS	05.14.26

Author --- Drafting Check JB Project Manager ACS

Designer ACS Design Check NK Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet

0 1"

Seal

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Conditions of Use

Client **GUAM WATERWORKS AUTHORITY**

Project **ACP WATER LINE REPLACEMENT - AJAYAN**

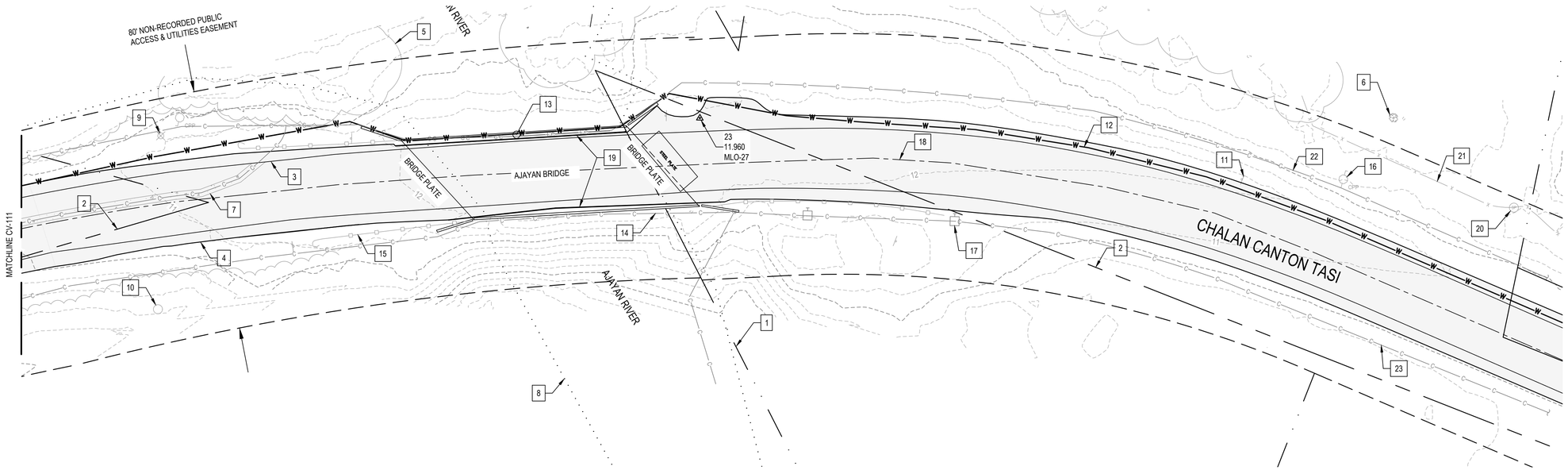
Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

Title **SITE CONDITIONS 11**

Size ANSI D

Sheet No. CV-111

Plot Date: 20 May 2026 - 8:29 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-CV-10X.dwg



1 **SITE CONDITIONS PLAN 12**
SCALE: 1" = 20'

N

GENERAL SHEET NOTES

1. PROPERTY LINE, RIGHT OF WAY, PUBLIC & UTILITY EASEMENT, SURVEY STATIONS AND CONTROL MONUMENTS SHOWN ARE PROVIDED BY GUAM SURVEYORS.
2. LIDAR TOPOGRAPHY IS BASED ON LIDAR INFORMATION COLLECTED BY GHD ON 07-12-2024 TO 07-14-2024
3. OTHER SITE CONDITIONS WERE VERIFIED BY FIELD OBSERVATION ON 02-04-2025, 05-07-2025, 05-08-2025, AND 07-22-2025

KEYNOTES

1. (E) PROPERTY LINE
2. (E) RIGHT OF WAY
3. (E) ROAD STRIPING
4. (E) EDGE OF PAVEMENT
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) AC PATCHWORK
8. APPROX. RIVER LIMITS AT TOP OF BANK △
9. (E) HARAGAN WELCOME SIGN
10. (E) UTILITY POLE
11. (E) TYP. STREET SIGN
12. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
13. (E)12" DIP WL & CONDUITS
14. (E) CONDUIT
15. (E) GUARDRAIL
16. (E) TYP. CONCRETE POWER POLE
17. (E) TYP. COMMUNICATIONS BOX
18. (E) CENTER OF ROAD
19. (E) BRIDGE CURB
20. (E) POWER SERVICE PEDESTAL
21. (E) FENCE
22. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
23. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

GRAPHIC SCALE

1" = 20' 0 10' 20' 40'

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
△	REV KEYNOTE	ACS	ACS	05.14.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

Seal

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

Title SITE CONDITIONS 12

Size ANSI D

Project No. 12582394 Date 04/24/2026 Scale AS SHOWN

Sheet No. CV-112 Sheet 16 of 38

GENERAL NOTES

1. ALL WORK AND MATERIALS SHALL CONFORM TO THE CURRENT EDITION OF GWA STANDARDS AND SPECIFICATIONS, GUAM EPA STANDARDS, AND DPW STANDARDS AND PERMIT REQUIREMENTS. A COPY OF THESE DOCUMENTS SHALL BE ON THE JOB SITE DURING CONSTRUCTION.
2. A COPY OF THE APPROVED CONSTRUCTION PLANS MUST BE ON THE JOB SITE WHEN CONSTRUCTION IS IN PROGRESS.
3. IT IS THE SOLE RESPONSIBILITY OF THE DEVELOPER/CONTRACTOR TO OBTAIN GRADING, RIGHT-OF-WAY, AND ENVIRONMENTAL PERMITS FROM DPW AND GEPA.
4. PRIOR TO ANY CONSTRUCTION ACTIVITY, THE DEVELOPER/CONTRACTOR SHALL ATTEND A PRE-CONSTRUCTION CONFERENCE WITH GWA, PER SPECIFICATION SECTION 01 30 00.
5. CONTRACTOR SHALL PROVIDE MATERIAL SUBMITTALS TO GWA BEFORE MATERIAL IS DELIVERED TO THE JOB SITE. MATERIALS DELIVERED TO THE JOB SITE WITHOUT GWA APPROVAL MAY BE REJECTED AND REQUIRED TO BE REMOVED FROM THE JOB SITE.
6. ALL CONSTRUCTION STAKING SHALL BE PERFORMED BY A LICENSED PROFESSIONAL SURVEYOR ON GAUM. ALL WATER AND SEWER SERVICE LOCATIONS SHALL BE FIELD APPROVED BY THE CONTRACTING OFFICER. IN CONNECTION WITH THE STAKING AND PRIOR TO ANY EXCAVATION, THE LICENSED SURVEYOR SHALL LOCATE THE ROW/PROPERTY LINES IN RELATION TO THE IMPROVEMENTS. THE ROW/PROPERTY LINES WILL SHOWN IN THE SHOP DRAWING AND BE SUBMITTED FOR REVIEW BY THE CONTRACTING OFFICER.
7. ALL WATER/SEWER FACILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPROVED PLANS. ANY DEVIATION FROM THE APPROVED PLANS WILL REQUIRE PRIOR APPROVAL FROM THE OWNER, GWA, AND OTHER APPROPRIATE PUBLIC AGENCIES.
8. CONTRACTOR SHALL LOCATE AND PROTECT ALL CASTINGS AND UTILITIES DURING CONSTRUCTION AND SHALL OBTAIN UTILITY CLEARANCES PRIOR TO CONSTRUCTION.
9. CONTRACTOR SHALL NOT INSTALL WATER OR SEWER FACILITIES BEFORE GRADING IS COMPLETED AND ACCEPTED BY THE CONTRACTING OFFICER
10. ADEQUATE TRENCH SHEETING AND/OR SHORING SHALL BE PROVIDED BY THE CONTRACTOR AS REQUIRED BY OSHA.
11. THE FOLLOWING WORK MUST BE DONE WITH THE PRESENCE OF THE CONTRACTING OFFICER OR BY THE CONSTRUCTION MANAGER INSPECTOR: (1) WHEN PERFORMING EXPLORATORY EXCAVATION TO LOCATE EXISTING WATER/SEWER UTILITIES, (2) BEFORE WATER PIPE IS BACKFILLED, (3) WHEN PERFORMING PRESSURE TESTS, BACTERIOLOGICAL TESTS, OR SEWER TESTS, (4) WHEN FLUSHING FIRE HYDRANTS, (5) WHEN A UTILITY CONFLICT IS ENCOUNTERED, (6) WHEN SITE CONDITIONS DEVIATE FROM CONSTRUCTION PLANS, (7) WHEN THE MINIMUM WATER/SEWER SEPARATION REQUIREMENTS ARE NOT MET, (8) WHEN CONNECTING TO EXISTING GWA WATER/SEWER LINES, ETC.
12. ALL WATER SYSTEM COMPONENTS IN CONTACT WITH POTABLE WATER ARE REQUIRED TO BE LISTED BY THE NSF INTERNATIONAL AS IN COMPLIANCE WITH NSF-372.
13. AJAYAN BRIDGE IS LOAD-POSTED. ANY CONSTRUCTION EQUIPMENT ACCESSING OR CROSSING THE BRIDGE SHALL NOT EXCEED THE POSED MAXIMUM LOAD LIMIT. ⚠
14. PAVEMENT RESTORATION SHALL INCLUDE THE FULL WIDTH SHOULDER, IF ANY SHOULDER PAVEMENT IS REMOVED, OR FULL WIDTH TRAVEL LANE, IF ANY TRAVEL PAVEMENT IS REMOVED.
15. CONTRACTOR IS REQUIRED TO OBTAIN ANY BOND BY AN APPROVED SURETY OR A CASH BOND AS MAY BE REQUIRED BY DPW FOR THE HIGHWAY ENCROACHMENT PERMIT AS AN ASSURANCE FOR ALL POST-CONSTRUCTION RESTORATION WITHIN GUAM'S HIGHWAYS, STREETS AND ROADS UNDER DPW.

WATER SYSTEM CONSTRUCTION NOTES

PIPE

1. DIP WATER MAINS SHALL BE PRESSURE CLASS 250 MINIMUM.
2. ALL DIP SHALL HAVE ADEQUATE PROTECTIVE MEASUREMENTS AGAINST CORROSION AND IT SHALL BE USED ONLY IF AS DETERMINED BY THE DESIGN ENGINEER BASED ON FIELD CONDITIONS.
3. PVC PIPE MAY BE USED FOR WATER MAINS 16" AND SMALLER. ALL PVC WATER MAINS SHALL BE CLASS 305 (DR 14) PRESSURE PIPE CONFORMING TO ANSI/AWWA C-900, OR LATEST REVISION, AND SHALL HAVE PUSH-ON JOINTS, AND IRON PIPE O.D.
4. ALL PVC WATER MAIN SHALL BE OF BLUE COLOR.
5. ALL PVC WATER MAINS MUST HAVE #10 TRACER WIRE PLACED ON TOP OF PIPE, IT SHALL BE ELECTRICALLY CONTINUOUS OVER THE ENTIRE LENGTH OF PIPE, AND FASTENED EVERY 10' WITH DUCT TAPE.

FITTINGS

6. FITTINGS SHALL BE DUCTILE IRON C153/A21.53 AND SHALL BE COATED IN ACCORDANCE WITH SPECIFICATION 33 11 16
7. THRUST BLOCKING SHALL BE USED FOR ALL BENDS, TEES, CROSSES, PLUGS, AND FIRE HYDRANTS.
8. RESTRAINED JOINTS SHALL BE USED PER PLANS OR GWA STANDARD DETAILS.
9. ALL MECHANICAL JOINT "MJ" FITTINGS SHALL HAVE "MEGALUG" RESTRAINT OR APPROVED EQUAL.
10. FLANGE CONNECT VALVES TO TEES OR CROSSES.
11. ALL FITTINGS AND PIPING INSIDE VAULTS SHALL BE FLANGE CONNECTIONS.

VALVES

12. ALL BURIED VALVES SHALL BE NON-RISING RESILIENT GATE VALVES. VALVES LARGER THAN 12" SHALL BE BUTTERFLY VALVES OR OTHERWISE APPROVED BY GWA ENGINEER.
13. EACH BURIED VALVE SHALL BE FURNISHED WITH A VALVE BOX (12" AND SMALLER) OR A VAULT (LARGER THAN 12' UNLESS OTHERWISE SPECIFIED IN DESIGN).

HYDRANTS

14. ALL FIRE HYDRANTS SHALL BE WET BARREL. ONLY HYDRANTS IN "GWA APPROVED MATERIAL LIST" ARE ACCEPTED.
15. DEAD-END WATER MAINS 6" OR LARGER SHALL TERMINATE WITH A FIRE HYDRANT.

SEPARATION

16. A MINIMUM HORIZONTAL SEPARATION OF 10' SHALL BE MAINTAINED BETWEEN SEWER LINE AND WATER LINE IN PARALLEL INSTALLATIONS.
17. SANITARY SEWERS AND FORCE MAINS SHALL BE CROSS UNDER WATER MAINS. THE MINIMUM VERTICAL SEPARATION BETWEEN WATER AND SEWER IS 18".
18. IF THE HORIZONTAL OR VERTICAL SEPARATION CANNOT MEET THE ABOVE REQUIREMENTS, CONTRACTOR SHALL CONTACT GWA ENGINEER FOR A SOLUTION.

PRESSURE AND BACTERIOLOGICAL TESTING

19. TO FILL THE WATER MAIN FOR FLUSHING, PRESSURE AND BACTERIOLOGICAL TESTS, THE CONTRACTOR SHALL USE AN APPROVED METER AND BACKFLOW PREVENTION DEVICE.
20. WATER MAIN SHALL BE TESTED UNDER CONSTANT PRESSURE OF 200 PSI FOR A MINIMUM TEST PERIOD OF 2 HOURS AND SHALL NOT EXCEED THE LEAKAGE REQUIREMENTS AS PER ANSI/AWWA SPECIFICATIONS OF LEAKAGE FORMULA.
21. THE DISINFECTION OF WATER MAINS SHALL COMPLY WITH ANSI/AWWA C-651 STANDARDS. BACTERIAL SAMPLING POINTS SHALL BE DETERMINED BY THE CONTRACTING OFFICER, MINIMUM ONE SAMPLING POINT AT EACH END AND MAXIMUM SPACING OF 1,200 FEET BETWEEN SAMPLING POINTS.
22. AFTER SUCCESSFUL TESTING, THE CONTRACTOR WILL TIE INTO THE EXISTING SYSTEM USING DISINFECTED SLEEVES AND SPOOL PIECES.

WATER MAIN CONNECTION

23. NO CONNECTION TO THE GWA WATER SYSTEM IS ALLOWED UNTIL THE NEW CONSTRUCTION PASSES PRESSURE AND BACTERIOLOGICAL TESTS AND HAS BEEN APPROVED BY GWA.
24. PRIOR TO MAKING CONNECTIONS TO THE EXISTING WATER SYSTEM, CONTRACTOR SHALL VERIFY THE LOCATION, DEPTH AND MATERIAL OF EXISTING WATER MAINS AT THE POINT OF CONNECTION.
25. TAPPING SLEEVE SHALL BE STAINLESS STEEL 316 WITH MECHANICAL CONNECTION OR OTERWISE APPROVED BY GWA ENGINEER. A MJ X MJ VALVE IS REQUIRED AT EACH TAPPING POINT.
26. CUT-IN CONNECTION MAY BE REQUIRED WHEN (1) THE EXISTING MAIN IS ASBESTOS CEMENT PIPE, (2) BRANCH MAIN IS EQUAL OR LARGER THAN THE EXISTING WATER MAIN, OR (3) TO ADD VALVES TO THE EXISTING WATER MAIN.
27. ALL CONNECTIONS TO EXISTING WATER MAINS SHALL BE MADE BY A LICENSED PLUMBER WITH THE PRESENCE OF A GWA INSPECTOR. CONTRACTOR SHALL SCHEDULE INSPECTION THROUGH THE CONTRACTING OFFICER AT LEAST 48 HOURS BEFORE CONNECTION IS SCHEDULED.
28. CONTRACTOR SHALL CONNECT (N) PIPING TO (E) PIPING WITH TRANSITION FITTINGS AS REQUIRED

SERVICES

29. ALL SERVICE SADDLES SHALL BE STAINLESS STEEL DOUBLE STRAPS. ALL SERVICE SADDLES SHALL CONFORM TO ANSI/AWWA C111/A-21.11 AND ASTM A588.
30. ALL SERVICE LINES SHALL BE COPPER TYPE "K", OR PLASTICIZED POLYETHYLENE 3408, ASTM D-2737, SDR 9, 200 PSI.

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
⚠	REV GENERAL NOTES	ACS	ACS	05.12.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc: GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

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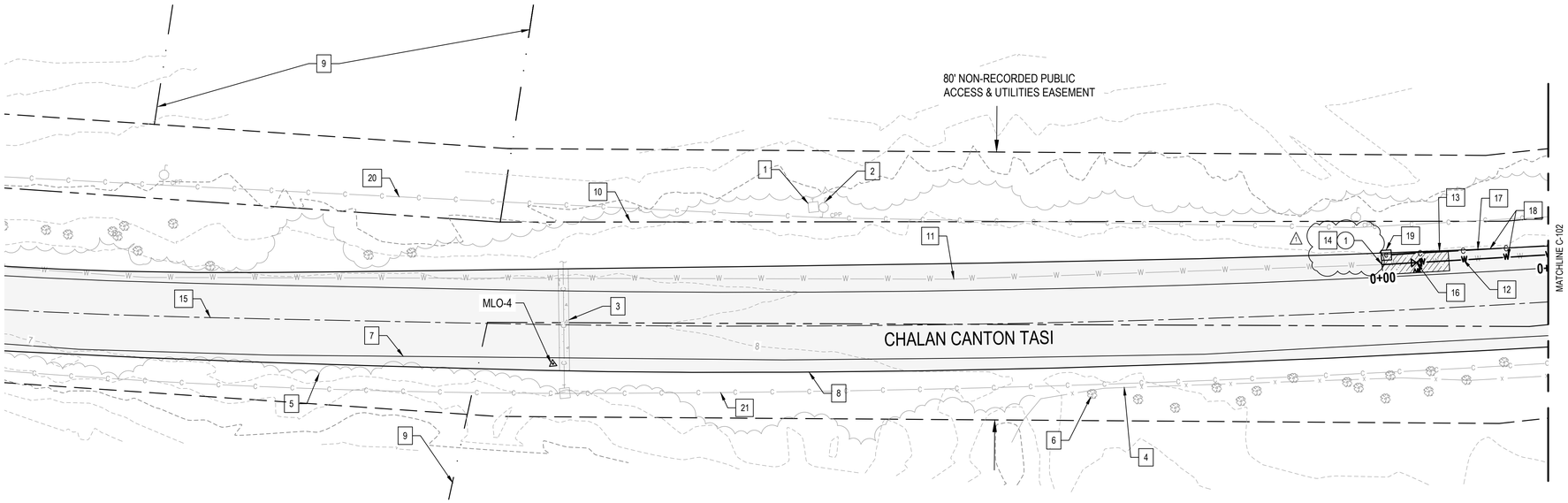
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title GENERAL CIVIL NOTES
Size ANSI D

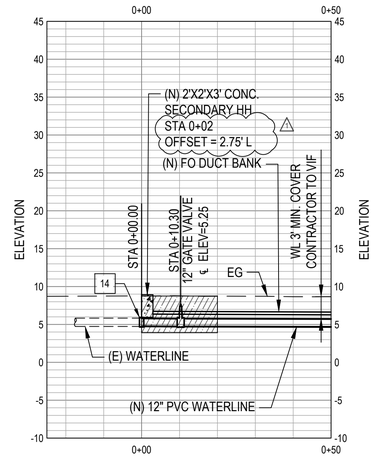
Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN
Sheet No. C-001 | Sheet 17 of 38

Plot Date: 1 June 2026 - 11:32 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-001.dwg



1 WATERLINE REPLACEMENT PLAN 1 (STA 0+00 TO STA 0+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 1 (STA 0+00 TO STA 0+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505

KEYNOTES

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) AC PATCHWORK
4. (E) FENCE
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) ROAD STRIPING
8. (E) EDGE OF PAVEMENT
9. (E) PROPERTY LINE
10. (E) RIGHT OF WAY
11. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
12. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS
13. 6' X 20' CTPS INSTALLATION EXCAVATION, SEE DETAILS 4/C-502
14. CONNECT (N) 12" PVC WATER LINE TO (E) WATERLINE WITH TRANSITION COUPLING
15. (E) CENTER OF ROAD
16. PROVIDE (N) 12" GATE VALVE, SEE DETAIL 3/C-503
17. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
18. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
19. PROVIDE (N) 2'X2'X3' CONCRETE SECONDARY HANDHOLE, SEE DETAIL 1/C-504
20. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
21. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

POINT TABLE

POINT #	NORTHING	EASTING	RAW DESCRIPTION
1	564310.4175	312247.2193	EXTENT OF WL IMPROVEMENT

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV NOTES	ACS	ACS	05.15.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

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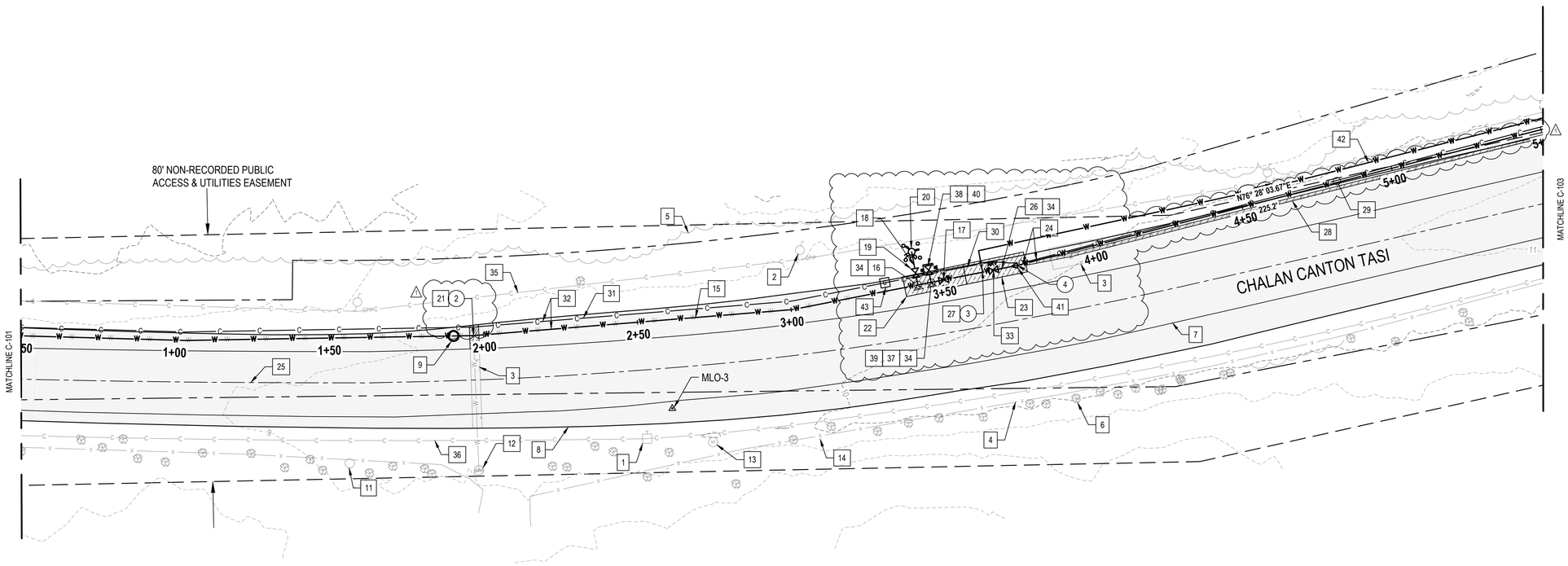
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title CIVIL PLAN & PROFILE 1
Size ANSI D

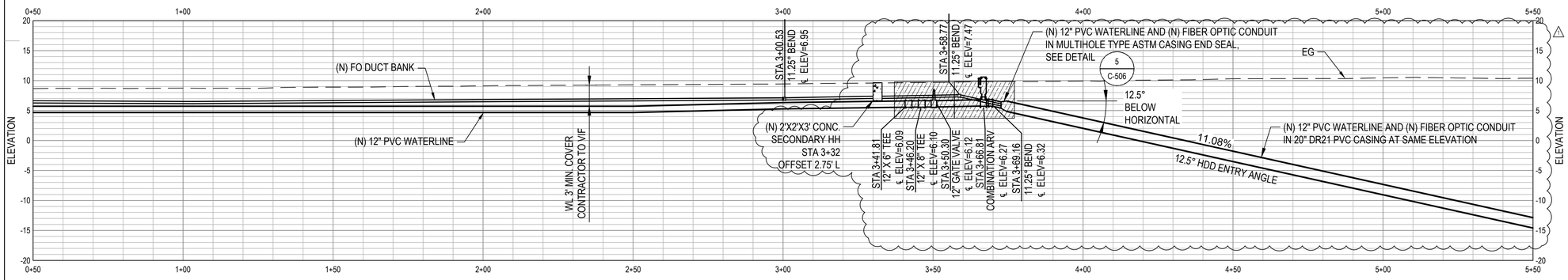
Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN
Sheet No. C-101 | Sheet 18 of 38

Plot Date: 1 June 2026 - 11:37 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 2 (STA 0+50 TO STA 5+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 2 (STA 0+50 TO STA 5+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505
4. TYPICAL HORIZONTAL AND VERTICAL CONC. THRUST BLOCK, SEE DETAILS 2/C-505 AND 3/C-505.

KEYNOTES [#]

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) AC PATCHWORK
4. (E) FENCE
5. (E) TYP. TREELINE
6. (E) TYP. TREES
7. (E) ROAD STRIPING
8. (E) EDGE OF PAVEMENT
9. PROVIDE 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
10. (E) RIGHT OF WAY
11. (E) UTILITY POLE
12. (E) WATER METER
13. (E) POWER SERVICE PEDESTAL
14. (E) WOODEN LIGHT POLE
15. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS.
16. PROVIDE (N) 12"X12"X6" TEE
17. PROVIDE (N) 12" GATE VALVE, SEE DETAIL 3/C-503
18. PROVIDE (N) 6" PVC WATER LINE, SEE DETAIL 1/C-505
19. PROVIDE (N) 6" GATE VALVE, SEE DETAIL 3/C-503
20. PROVIDE (N) FIRE HYDRANT WITH BOLLARDS, SEE DETAIL 1/C-503
21. CONTRACTOR TO VERIFY SERVICE LATERAL. CONNECT TO (N)12" PVC WATER LINE SEE DETAIL 5/C-503
22. 6.5' X 20' CTPS INSTALLATION EXCAVATION, SEE DETAILS 4/C-502
23. 6.5' X 20' HDD INSTALLATION EXCAVATION, SEE DETAILS 6/C-503
24. REMOVE CONFLICTING (E) 12" WATER LINE AS NECESSARY FOR HDD INSTALLATION OF (N) 12" PVC WATER LINE.
25. (E) CENTER OF ROAD
26. PROVIDE (N) 12" 11.25° VERTICAL BEND
27. PROVIDE (N) SADDLE TAP AND CONNECT SERVICE LATERAL SEE DETAIL 5/C-503
28. REMOVE UNDERGROUND (E) 12" ACP ASSUMED BETWEEN HDD PITS
29. HDD INSTALLATION OF (N) 12" WATERLINE AND (N) FIBER OPTIC CONDUIT IN 20" DR21 PVC CASING.
30. PROVIDE (N) 4" 11.25° VERTICAL BEND
31. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
32. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION.
33. PROVIDE (N) COMBINATION ARV, SEE DETAIL 4/C-505
34. PROVIDE (N) CONC. THRUST BLOCK
35. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
36. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY
37. PROVIDE (N) 12"X12"X8" TEE FOR BY-PASS PIPE CONNECTION
38. PROVIDE (N) 8" GATE VALVE, SEE DETAIL 3/C-503
39. PROVIDE (N) 8" PVC WATER LINE, SEE DETAIL 1/C-505
40. PROVIDE (N) 8" BLIND FLANGE AFTER BY-PASS PIPE CONNECTION IS NO LONGER NEEDED.
41. PROVIDE (N) MULTIHOLE TYPE ASTM CASING END SEAL, SEE DETAIL 5/C-506
42. PROVIDE (N) WATER SERVICE LINE, SEE DETAIL 5/C-503
43. PROVIDE (N) 2'X2'X3' CONCRETE SECONDARY HANDHOLE, SEE DETAIL 1/C-504

POINT TABLE [#]

POINT #	NORTHING	EASTING	Description
2	564305.64	312443.82	WATER SERVICE LATERAL
3	564323.31	312609.15	WATER SERVICE LATERAL
4	564325.33	312620.48	HDD ENTRY

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV HDD PLAN AND PROFILE	ACS	ACS	05.15.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0 — 1")

Seal: AARON C. SUTTON, CERTIFICATE NO. 1469 (CIVIL), EXP. 04/30/2027, PROFESSIONAL ENGINEER, 4/24/26

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

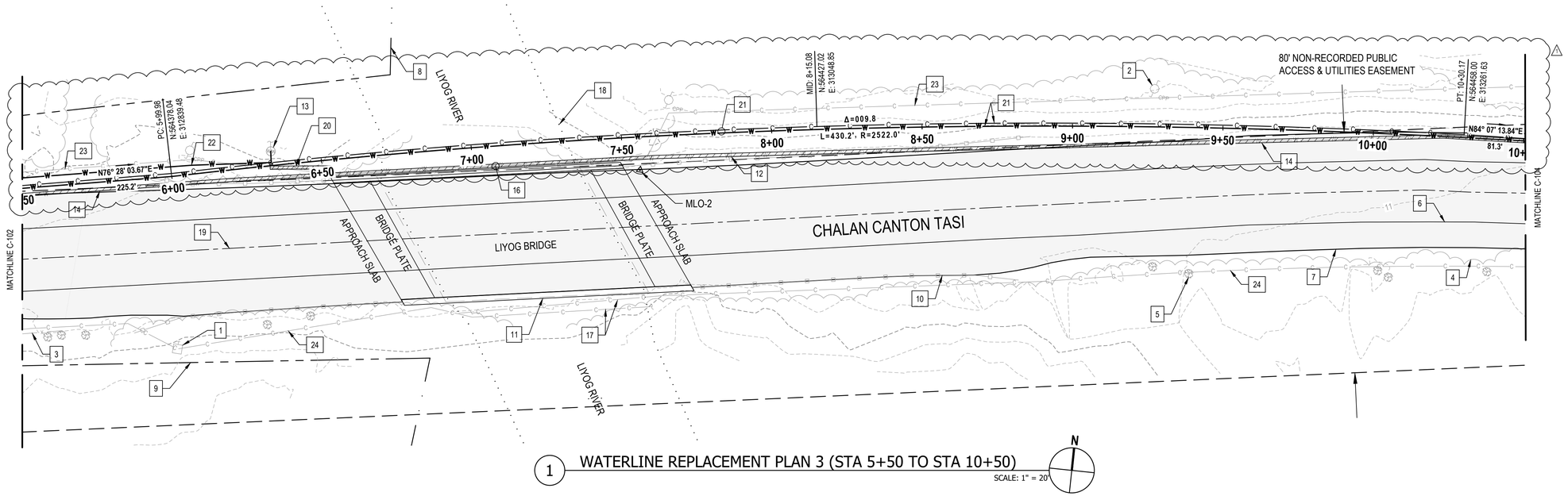
Title CIVIL PLAN & PROFILE 2

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

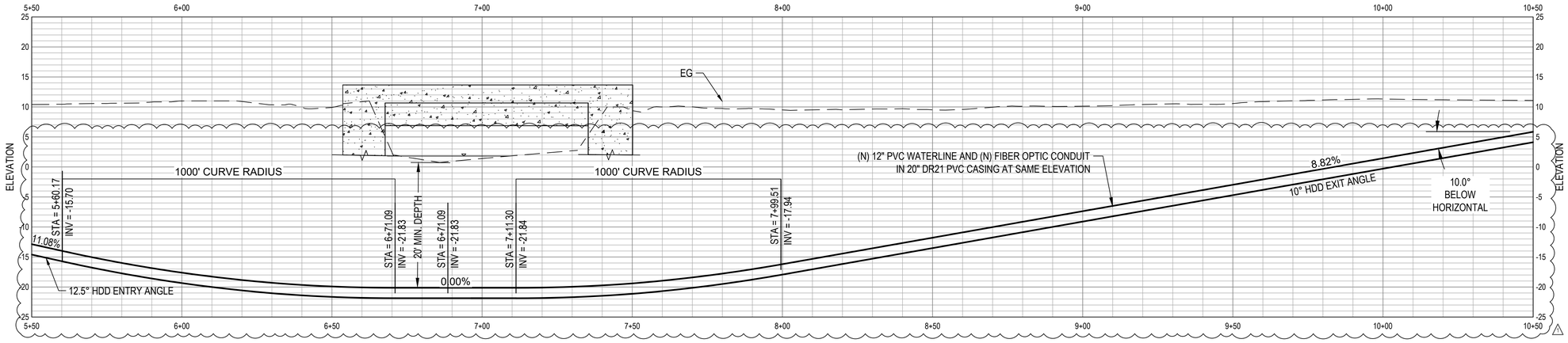
Sheet No. C-102 | Sheet 19 of 38

Plot Date: 1 June 2026 - 11:40 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 3 (STA 5+50 TO STA 10+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 3 (STA 5+50 TO STA 10+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.

KEYNOTES [#]

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) FENCE
4. (E) TYP. TREELINE
5. (E) TYP. TREES
6. (E) ROAD STRIPING
7. (E) EDGE OF PAVEMENT
8. (E) PROPERTY LINE
9. (E) RIGHT OF WAY
10. (E) GUARDRAIL
11. (E) CONCRETE BARRIER
12. (E) STREET SIGN
13. (E) WATER METER
14. REMOVE UNDERGROUND (E) 12" ACP ASSUMED BETWEEN HDD PITS
15. NOT USED
16. REMOVE EXISTING 12" WL PIPE & PIPE SUPPORTS AND PROTECT IN PLACE (E) CONDUIT PIPES & PIPE SUPPORTS ON BRIDGE
17. (E) CONDUITS
18. APPROX. RIVER LIMITS AT TOP OF BANK
19. (E) CENTER OF ROAD
20. DISCONNECT (E) WATER SERVICE LATERAL AND RECONNECT TO (N) SADDLE TAP SEE DETAIL 5/C-503
21. HDD INSTALLATION OF (N) 12" WATERLINE AND (N) FIBER OPTIC CONDUIT IN 20" DR21 PVC CASING
22. PROVIDE (N) WATER SERVICE LINE, SEE DETAIL 5/C-503
23. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
24. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV HDD PLAN AND PROFILE	ACS	ACS	05.05.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

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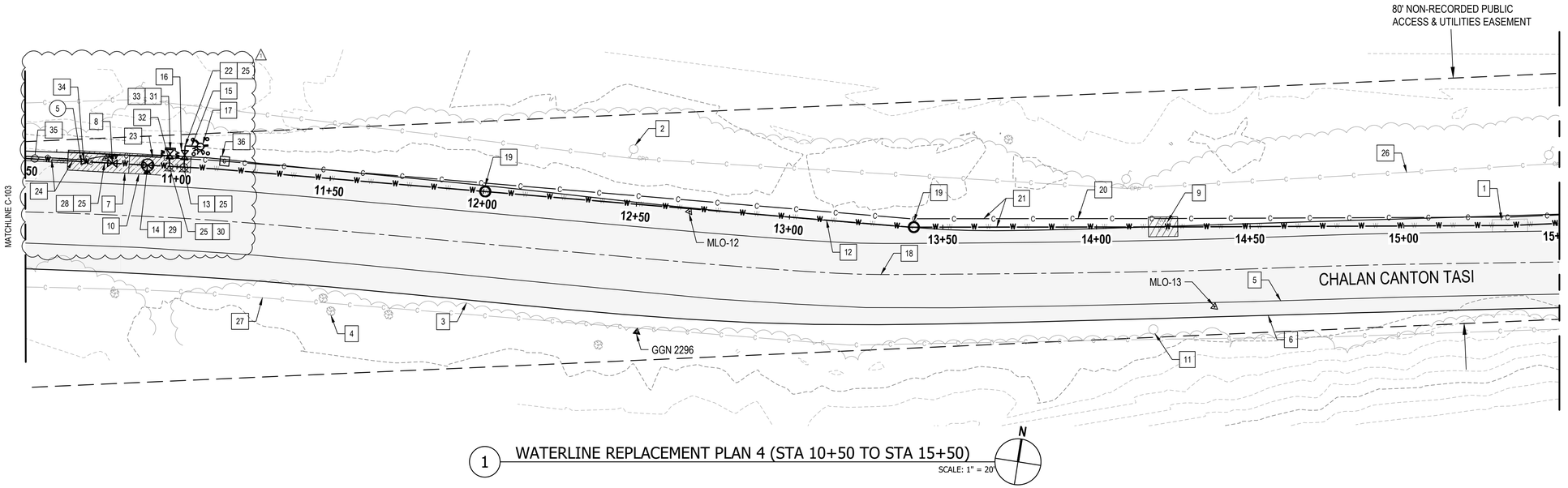
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title CIVIL PLAN & PROFILE 3
Size ANSI D

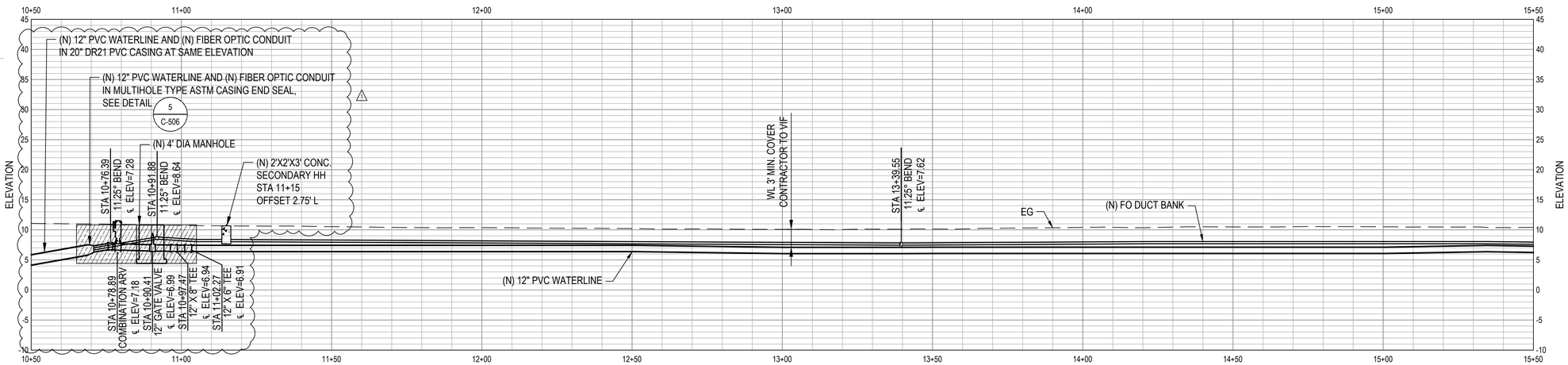
Project No.	Date	Scale	Sheet No.	Sheet
12582394	04/24/2026	AS SHOWN	C-103	20 of 38

Plot Date: 20 May 2026 - 9:09 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 4 (STA 10+50 TO STA 15+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 4 (STA 10+50 TO STA 15+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505
4. TYPICAL HORIZONTAL AND VERTICAL CONC. THRUST BLOCK, SEE DETAILS 2/C-505 AND 3/C-505.

KEYNOTES [#]

1. (E) AC PATCHWORK
2. (E) TYP. CONCRETE POWER POLE
3. (E) TYP. TREELINE
4. (E) TYP. TREES
5. (E) ROAD STRIPING
6. (E) EDGE OF PAVEMENT
7. 6.5'X20' HDD INSTALLATION EXCAVATION, SEE DETAILS 6/C-503
8. PROVIDE (N) COMBINATION ARV, SEE DETAIL 4/C-505
9. REMOVE (E) WATER VALVE
10. 6.5' X 20' CTPS INSTALLATION EXCAVATION, SEE DETAILS 4/C-502
11. (E) UTILITY POLE
12. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS.
13. PROVIDE (N) 12"X12"X8" TEE
14. PROVIDE (N) 12" GATE VALVE
15. PROVIDE (N) 6" PVC WATER LINE, SEE DETAIL 1/C-505
16. PROVIDE (N) 6" GATE VALVE, SEE DETAIL 3/C-503
17. PROVIDE (N) FIRE HYDRANT WITH BOLLARDS, SEE DETAIL 1/C-503
18. (E) CENTER OF ROAD
19. PROVIDE 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
20. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
21. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION.
22. PROVIDE (N) 6" 90° HORIZONTAL BEND
23. PROVIDE (N) 4" 11.25° VERTICAL BEND
24. REMOVE CONFLICTING (E) 12" WATER LINE AS NECESSARY FOR HDD INSTALLATION OF (N) 12" PVC WATER LINE.
25. PROVIDE (N) CONC. THRUST BLOCK
26. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
27. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY
28. PROVIDE (N) 12" 11.25° VERTICAL BEND
29. INSTALL TESTING MANHOLE FOR 12" GATE VALVE WITH PRESSURE GAUGE, SEE DETAIL 1/C-506.
30. PROVIDE (N) 12"X12"X8" TEE FOR BY-PASS PIPE CONNECTION
31. PROVIDE (N) 8" GATE VALVE, SEE DETAIL 3/C-503
32. PROVIDE (N) 8" PVC WATER LINE, SEE DETAIL 1/C-505
33. PROVIDE (N) 8" BLIND FLANGE AFTER BY-PASS PIPE CONNECTION IS NO LONGER NEEDED.
34. PROVIDE (N) MULTIHOLE TYPE ASTM CASING END SEAL, SEE DETAIL 5/C-506
35. HDD INSTALLATION OF (N) 12" WATERLINE AND (N) FIBER OPTIC CONDUIT IN 20" DR21 PVC CASING.
36. PROVIDE (N) 2'X2'X3' CONCRETE SECONDARY HANDHOLE, SEE DETAIL 1/C-504

POINT TABLE (#)

POINT #	NORTHING	EASTING	RAW DESCRIPTION
5	564461.9514	313300.0199	HDD EXIT

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Drafting Check	Checked	Approved	Date
1	REV HDD PLAN AND PROFILE		ACS	ACS	05.15.26
Author	---	Drafting Check JB	Project Manager ACS		
Designer	ACS	Design Check NK	Project Director MGK		

Misc.

GUAM WATERWORKS AUTHORITY

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Seal

AARON C. SUTTON — CERTIFICATE — No 1489 (CIVIL) — EXP. 04/30/2027 — PROFESSIONAL ENGINEER

4/24/26

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Client: GUAM WATERWORKS AUTHORITY

Project: ACP WATER LINE REPLACEMENT - AJAYAN

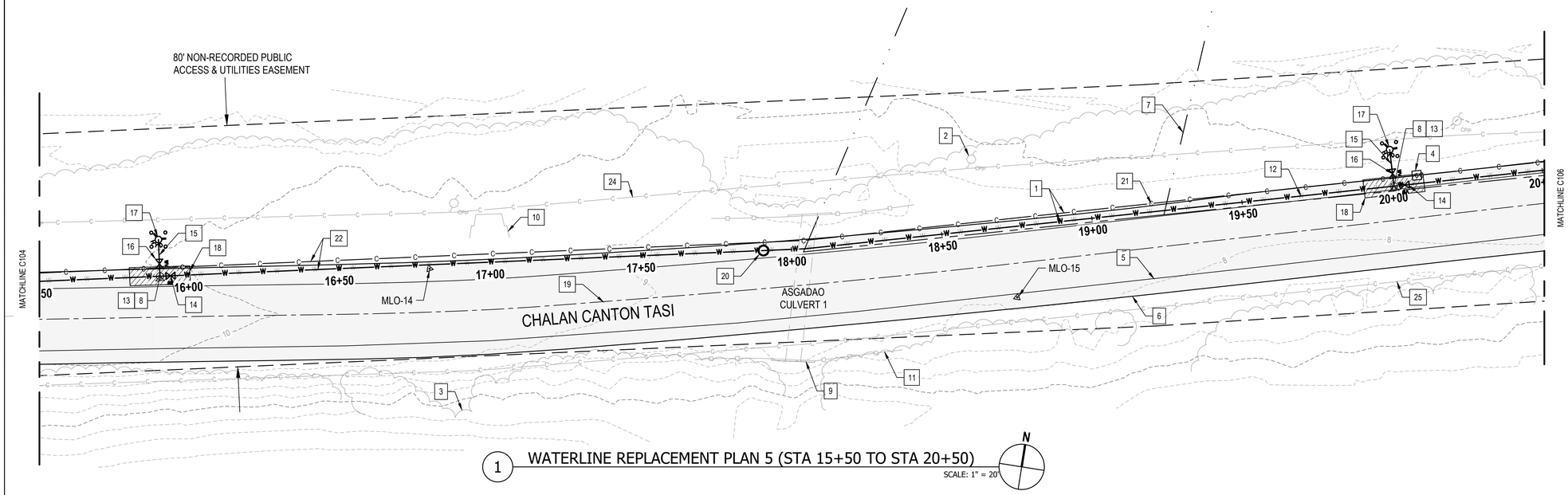
Title: CIVIL PLAN & PROFILE 4

Size: ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

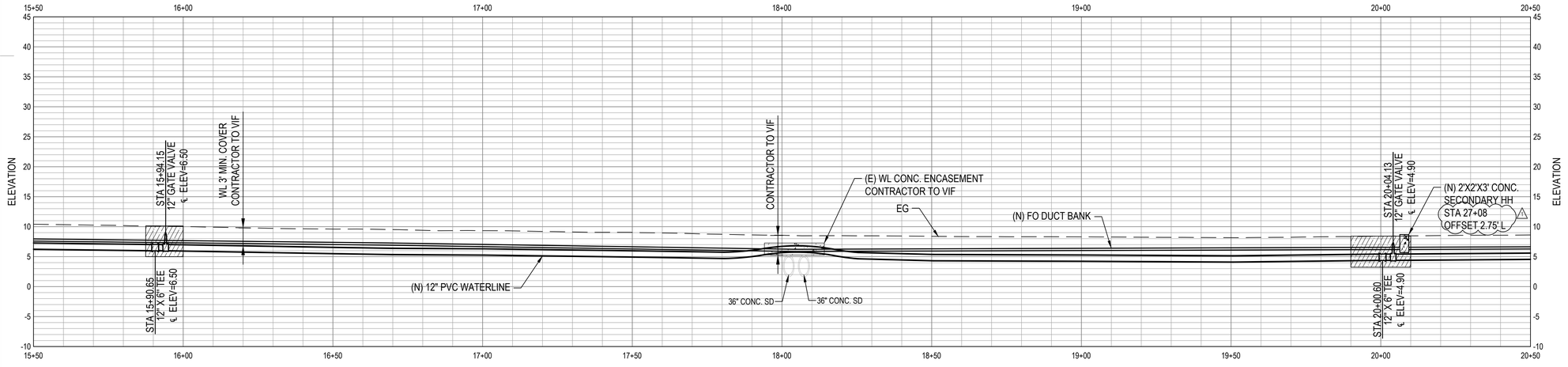
Sheet No. C-104 | Sheet 21 of 38

Plot Date: 1 June 2026 - 11:42 AM | Plotted By: Julius Bonifacio | Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 5 (STA 15+50 TO STA 20+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 5 (STA 15+50 TO STA 20+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505
4. TYPICAL HORIZONTAL AND VERTICAL CONC. THRUST BLOCK, SEE DETAILS 2/C-505 AND 3/C-505.

KEYNOTES [#]

1. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATER LINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
2. (E) TYP. CONCRETE POWER POLE
3. (E) TYP. TREELINE
4. PROVIDE (N) 2'X2'X3' CONCRETE SECONDARY HANDHOLE, SEE DETAIL 1/C-504
5. (E) ROAD STRIPING
6. (E) EDGE OF PAVEMENT
7. (E) PROPERTY LINE
8. PROVIDE (N) CONCRETE THRUST BLOCK
9. (E) TYP. CONC. HEADWALL
10. (E) BUS STOP
11. (E) TYP. GUARDRAIL
12. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS
13. PROVIDE (N) 12"X12"X8" TEE
14. PROVIDE (N) 12" GATE VALVE, SEE DETAIL 3/C-503
15. PROVIDE (N) 6" PVC WATER LINE, SEE DETAIL 1/C-505
16. PROVIDE (N) 6" GATE VALVE, SEE DETAIL 3/C-503
17. PROVIDE (N) FIRE HYDRANT WITH BOLLARDS, SEE DETAIL 1/C-503
18. 6' X 20' CTPS INSTALLATION EXCAVATION, SEE DETAILS 4/C-502
19. (E) CENTER OF ROAD
20. PROVIDE 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
21. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
22. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
23. NOT USED
24. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
25. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV NOTES	ACS	ACS	05.15.26

Author --- Drafting Check JB Project Manager ACS

Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

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Seal: AARON C. SUTTON, CERTIFICATE NO 14859 (CIVIL), EXP. 04/30/2027, PROFESSIONAL ENGINEER — 4/24/26

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

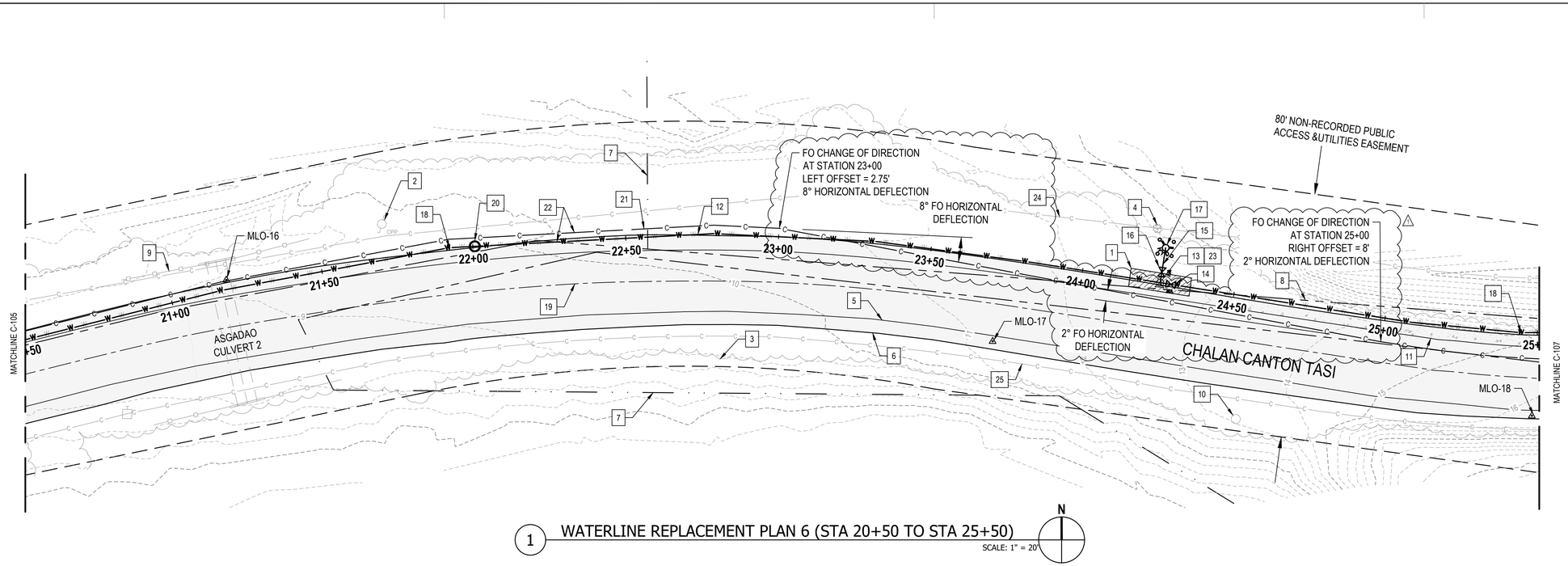
Title CIVIL PLAN & PROFILE 5

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

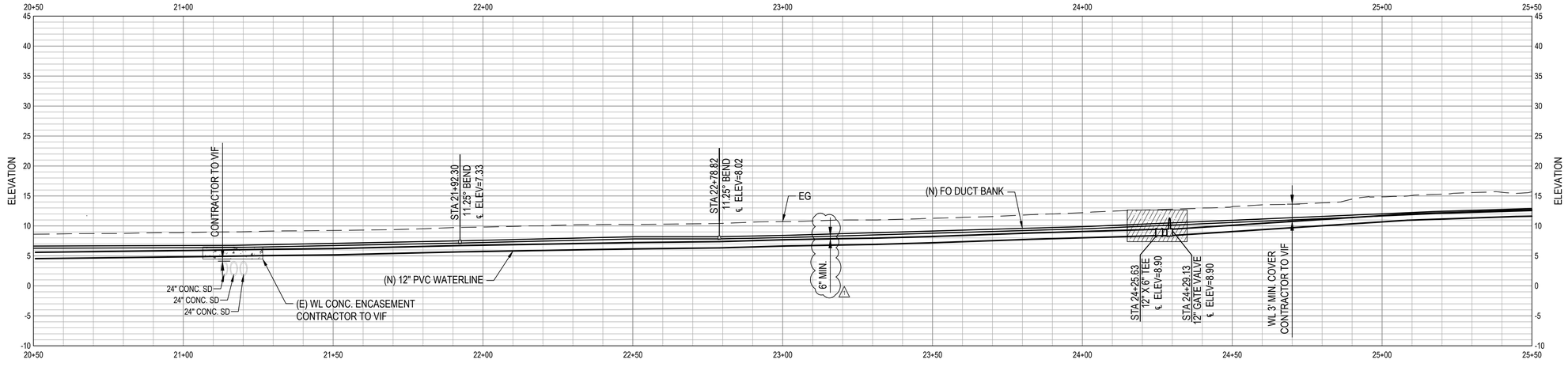
Sheet No. C-105 | Sheet 22 of 38

Plot Date: 1 June 2026 - 11:47 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 6 (STA 20+50 TO STA 25+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 6 (STA 20+50 TO STA 25+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505
4. TYPICAL HORIZONTAL AND VERTICAL CONC. THRUST BLOCK, SEE DETAILS 2/C-505 AND 3/C-505.

KEYNOTES

1. 6' X 20' CTPS INSTALLATION EXCAVATION, SEE DETAILS 4/C-502
2. (E) TYP. CONCRETE POWER POLE
3. (E) TYP. TREELINE
4. (E) TYP. TREES
5. (E) ROAD STRIPING
6. (E) EDGE OF PAVEMENT
7. (E) PROPERTY LINE
8. (E) RIGHT OF WAY
9. (E) GUARDRAIL
10. (E) UTILITY POLE
11. (E) CONCRETE SWALE
12. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS
13. PROVIDE (N) 12"X12"X6" TEE
14. PROVIDE (N) 12" GATE VALVE, SEE DETAIL 3/C-503
15. PROVIDE (N) 6" PVC WATER LINE, SEE DETAIL 1/C-505
16. PROVIDE (N) 6" GATE VALVE, SEE DETAIL 3/C-503
17. PROVIDE (N) FIRE HYDRANT WITH BOLLARDS, SEE DETAIL 1/C-503
18. ASSUME HORIZONTAL FITTING(S) ON CURVE
19. (E) CENTER OF ROAD
20. PROVIDE 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
21. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
22. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
23. PROVIDE (N) CONC. THRUST BLOCK
24. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
25. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV NOTES & FO ALIGNMENT	ACS	ACS	05.19.26

Author --- Drafting Check JB Project Manager ACS

Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

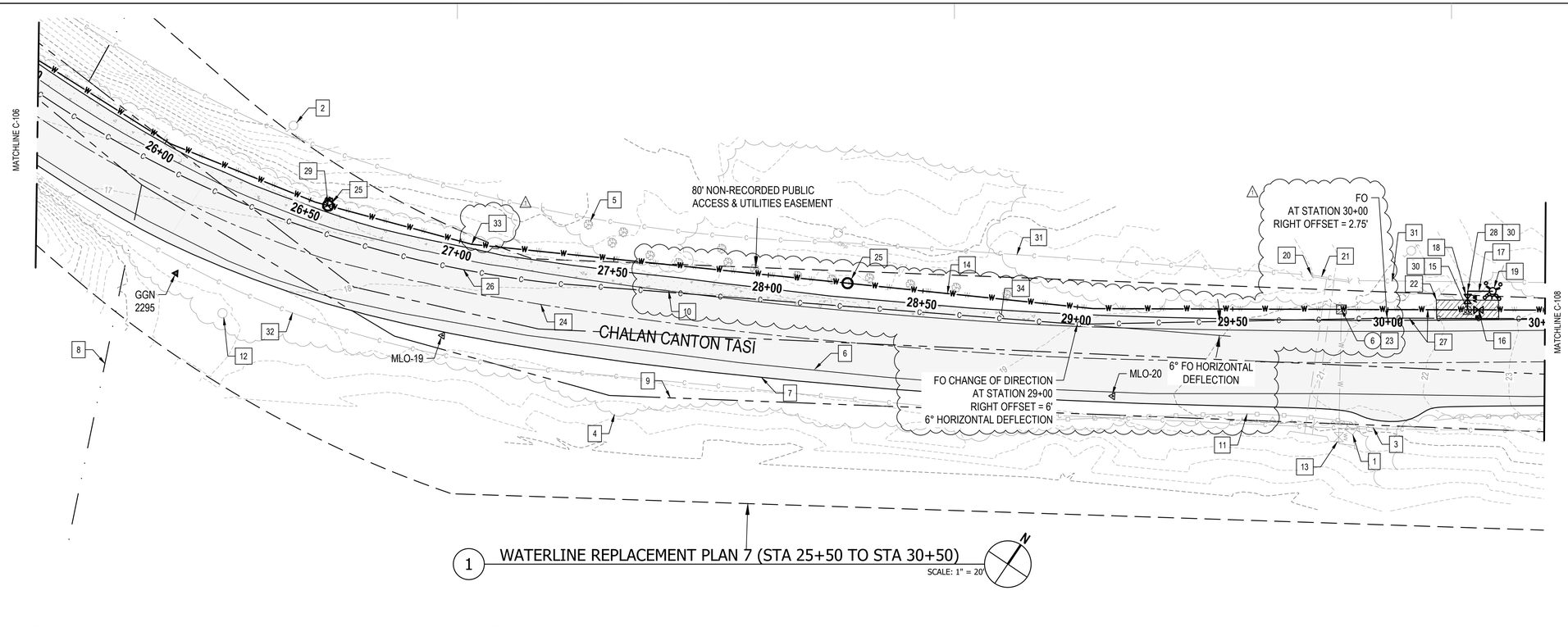
Title CIVIL PLAN & PROFILE 6

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

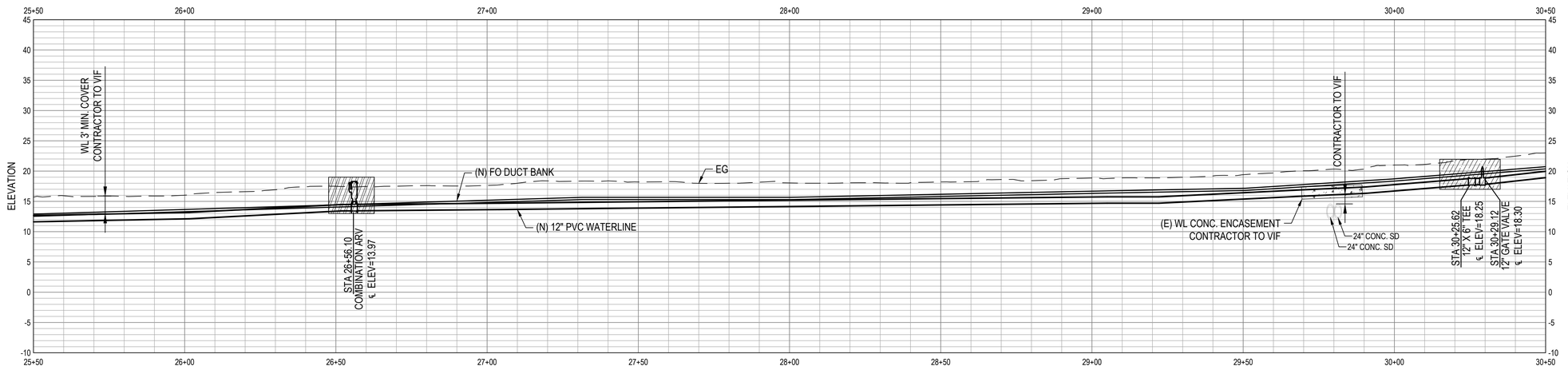
Sheet No. C-106 | Sheet 23 of 38

Plot Date: 1 June 2026 - 9:46 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 7 (STA 25+50 TO STA 30+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 7 (STA 25+50 TO STA 30+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505
4. TYPICAL HORIZONTAL AND VERTICAL CONC. THRUST BLOCK, SEE DETAILS 2/C-505 AND 3/C-505.

KEYNOTES [#]

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) FENCE
4. (E) TYP. TREELINE
5. (E) TYP. TREES
6. (E) ROAD STRIPING
7. (E) EDGE OF PAVEMENT
8. (E) PROPERTY LINE
9. (E) RIGHT OF WAY
10. (E) CONCRETE SWALE
11. (E) GUARDRAIL
12. (E) UTILITY POLE
13. (E) SERVICE SHUTOFF VALVE
14. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY REMOVE AND REPLACE WITH 12" PVC WATER LINE BY CTPS
15. PROVIDE (N) 12"X6" TEE
16. PROVIDE (N) 12" GATE VALVE, SEE DETAIL 3/C-503
17. PROVIDE (N) 6" PVC WATER LINE, SEE DETAIL 1/C-505
18. PROVIDE (N) 6" GATE VALVE, SEE DETAIL 3/C-503
19. PROVIDE (N) FIRE HYDRANT WITH BOLLARDS, SEE DETAIL 1/C-503
20. (E) CULVERT
21. (E) ABANDONED 2" PIPE
22. 6' X 20' CTPS INSTALLATION EXCAVATION, SEE DETAILS 4/C-502
23. CONTRACTOR TO VERIFY SERVICE LATERAL. CONNECT TO (N) 12" PVC WATER LINE, SEE DETAIL 5/C-503
24. (E) CENTER OF ROAD
25. INSTALL 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
26. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
27. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
28. PROVIDE (N) 6" 90° HORIZONTAL BEND
29. PROVIDE (N) COMBINATION ARV, SEE DETAIL 4/C-505
30. PROVIDE (N) CONC. THRUST BLOCK
31. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
32. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY
33. ASSUME HORIZONTAL FITTING(S) ON CURVE
34. RESTORE CONCRETE SWALE APPROXIMATELY 146' FROM FO DUCT BANK TRENCH

POINT TABLE [#]

POINT #	NORTHING	EASTING	RAW DESCRIPTION
6	564810.6412	315152.2245	WATER SERVICE LATERAL

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV NOTES & FO ALIGNMENT	ACS	ACS	05.19.26

Author --- Drafting Check JB Project Manager ACS

Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0 — 1")

Seal: JASON C. SUTTON, No 1489 (CIVIL), EXP. 04/30/2027, PROFESSIONAL ENGINEER, GUAM. 4/24/26

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

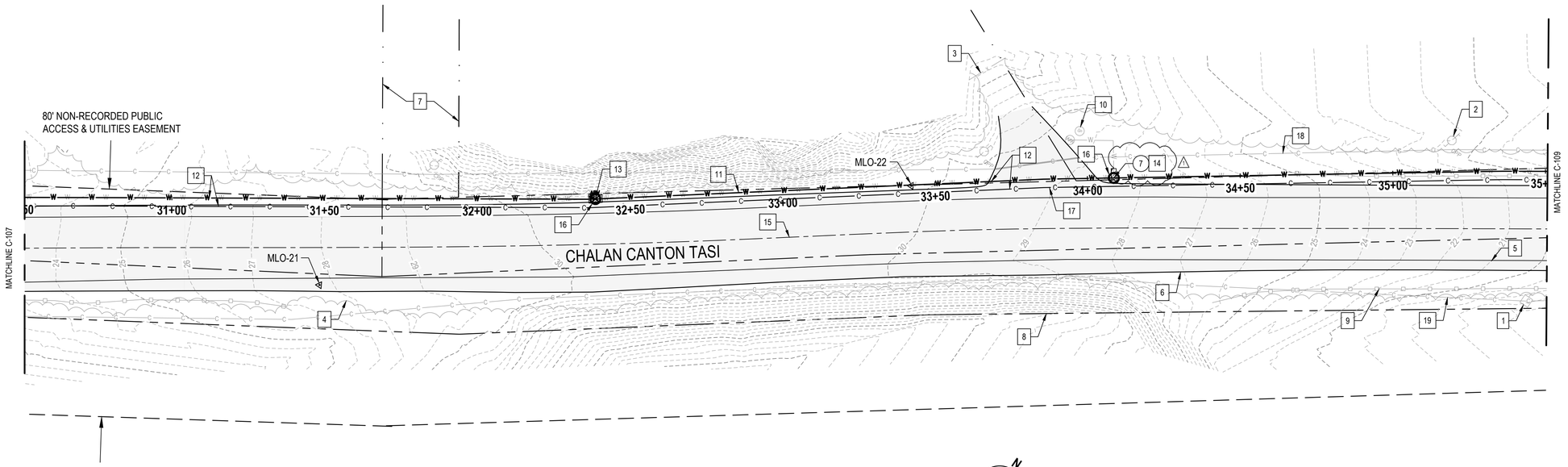
Title CIVIL PLAN & PROFILE 7

Size ANSI D

Project No. 12582394 Date 04/24/2026 Scale AS SHOWN

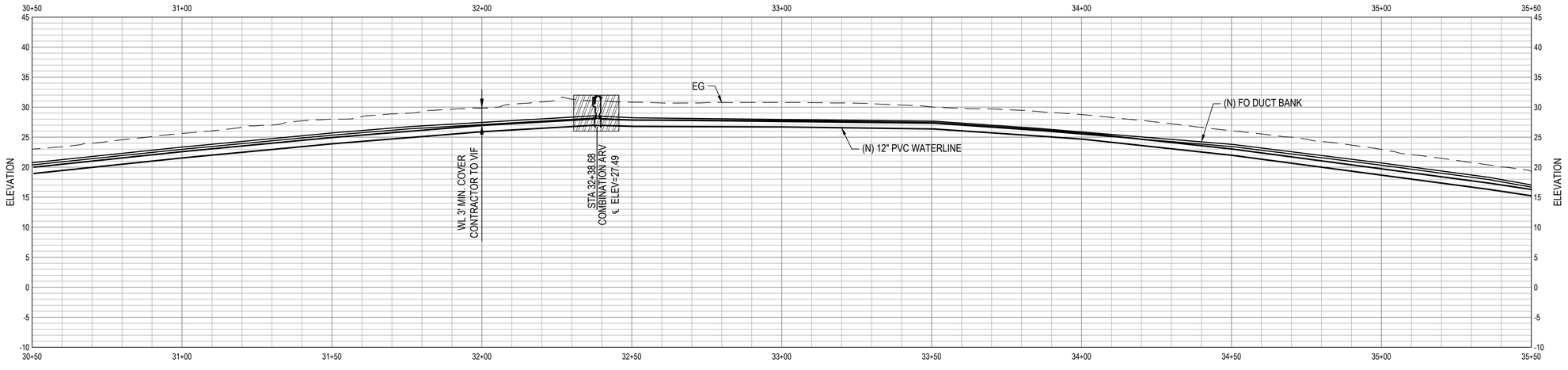
Sheet No. C-107 Sheet 24 of 38

Plot Date: 20 May 2026 - 12:33 PM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 8 (STA 30+50 TO STA 35+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 8 (STA 30+50 TO STA 35+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. FOR TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAILS 1/C-505

KEYNOTES [#]

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) FENCE
4. (E) TYP. TREELINE
5. (E) ROAD STRIPING
6. (E) EDGE OF PAVEMENT
7. (E) PROPERTY LINE
8. (E) RIGHT OF WAY
9. (E) GUARDRAIL
10. (E) POWER SERVICE PEDESTAL
11. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY
    REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS
12. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATER LINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
13. PROVIDE (N) COMBINATION ARV, SEE DETAIL 4/C-505
14. CONTRACTOR TO VERIFY SERVICE LATERAL.
    CONNECT TO (N) 12" PVC WATER LINE, SEE DETAIL 5/C-503
15. (E) CENTER OF ROAD
16. INSTALL 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
17. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
18. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
19. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

POINT TABLE (#)

POINT #	NORTHING	EASTING	RAW DESCRIPTION
7	565052.5468	315499.8724	WATER SERVICE LATERAL

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV KEYNOTES	ACS	ACS	05.05.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0 — 1")

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

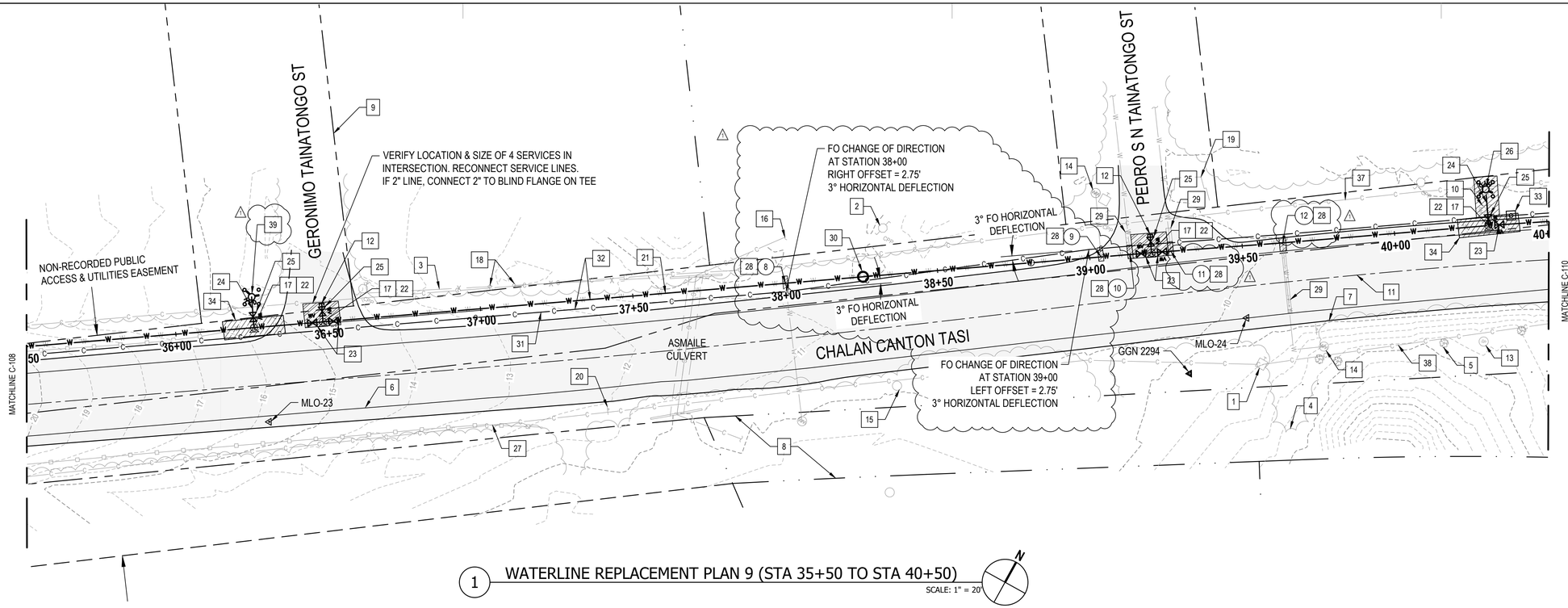
Title CIVIL PLAN & PROFILE 8

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

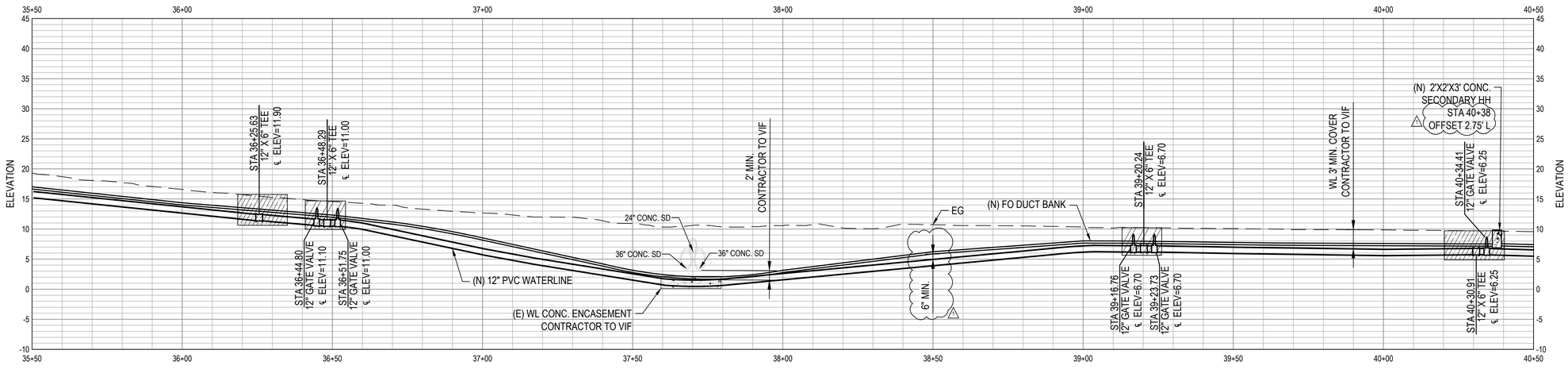
Sheet No. C-108 | Sheet 25 of 38

Plot Date: 20 May 2026 - 11:43 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 9 (STA 35+50 TO STA 40+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 9 (STA 35+50 TO STA 40+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505
4. TYPICAL HORIZONTAL AND VERTICAL CONC. THRUST BLOCK, SEE DETAIL 2/C-505 AND 3/C-505.

KEYNOTES

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) ABANDONED FENCE
4. (E) TYP. TREELINE
5. (E) TYP. TREES
6. (E) ROAD STRIPING
7. (E) EDGE OF PAVEMENT
8. (E) PROPERTY LINE
9. (E) RIGHT OF WAY
10. REMOVE (E) WATER VALVE
11. (E) CENTER OF ROAD
12. CAP PIPE AFTER 6" GATE VALVE
13. (E) POWER SERVICE PEDESTAL
14. (E) WATER METER
15. (E) UTILITY POLE
16. (E) CONDUITS
17. PROVIDE (N) CONC. THRUST BLOCK
18. (E) ABANDONED WOODEN FENCE POST
19. (E) BUST STOP
20. (E) STREET SIGN
21. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY. REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS
22. PROVIDE (N) 12"X12"X6" TEE
23. PROVIDE (N) 12" GATE VALVE, SEE DETAIL 3/C-503
24. REMOVE (E) 6" PIPE AND PROVIDE (N) 6" PVC WATER LINE, SEE DETAIL 1/C-505
25. PROVIDE (N) 6" GATE VALVE, SEE DETAIL 3/C-503
26. REMOVE (E) FIRE HYDRANT & BOLLARDS AND PROVIDE (N) FIRE HYDRANT WITH BOLLARDS, SEE DETAIL 1/C-503
27. (E) GUARDRAIL
28. CONTRACTOR TO VERIFY SERVICE LATERAL. CONNECT TO (N) 12" PVC WATER LINE, SEE DETAIL 5/C-503
29. (E) AC PATCHWORK
30. PROVIDE 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
31. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
32. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
33. PROVIDE (N) 2'X2'X3' CONCRETE SECONDARY HANDHOLE, SEE DETAIL 1/C-504
34. 6' X 20' CTPS INSTALLATION EXCAVATION, SEE DETAILS 4/C-502
35. CAP PIPE AFTER 6" GATE VALVE
36. PROVIDE (N) CONC. THRUST BLOCK
37. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
38. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY
39. PROVIDE (N) FIRE HYDRANT WITH BOLLARDS, SEE DETAIL 1/C-503

POINT TABLE

POINT #	NORTHING	EASTING	Description
8	565272.33	315823.67	WATER SERVICE LATERAL
9	565329.96	315909.85	WATER SERVICE LATERAL
10	565335.30	315917.84	WATER SERVICE LATERAL
11	565342.67	315928.95	WATER SERVICE LATERAL
12	565362.80	315959.62	WATER SERVICE LATERAL

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV NOTES & FO ALIGNMENT	ACS	ACS	05.19.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0 — 1")

Seal: AARON C. SUTTON, No 1489 (CIVIL), EXP. 04/30/2027, COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS
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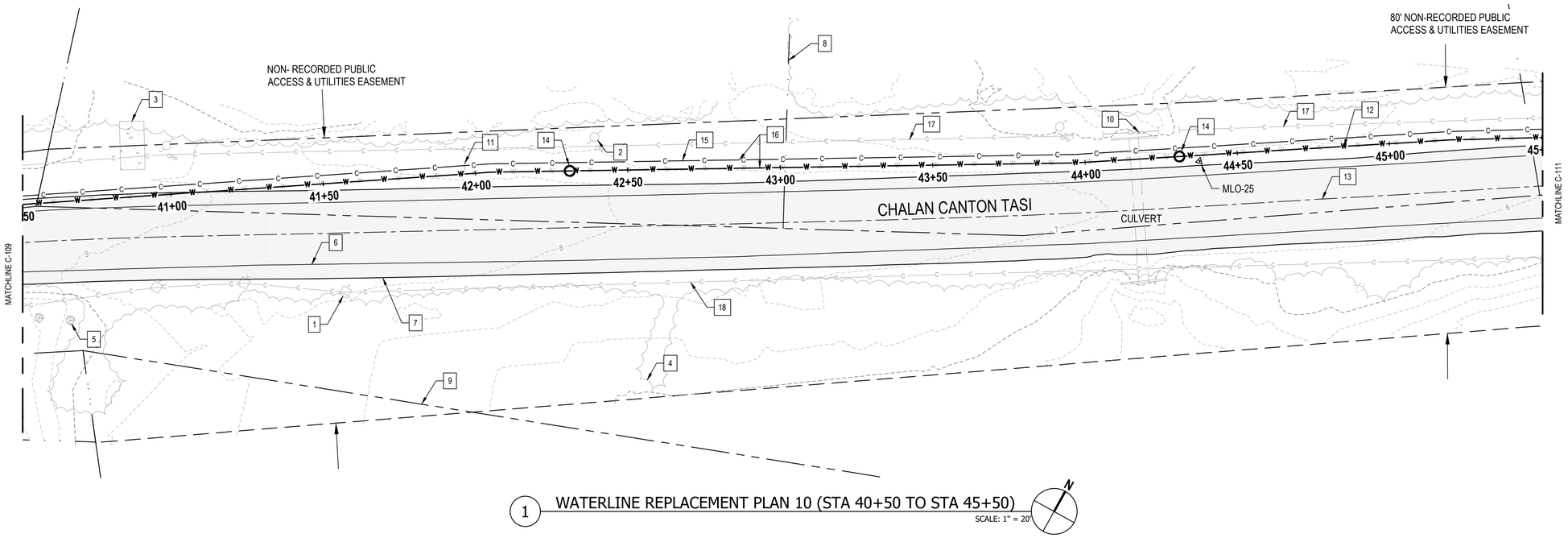
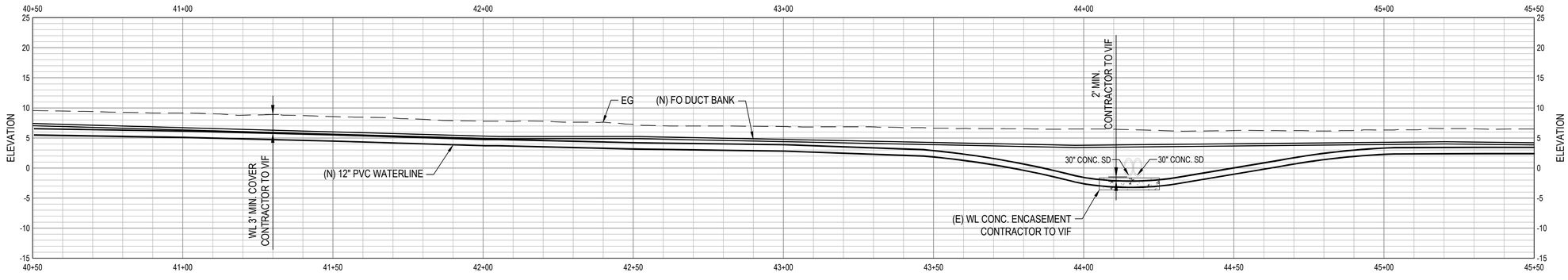
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title CIVIL PLAN & PROFILE 9
Size ANSI D
Project No. 12582394 Date 04/24/2026 Scale AS SHOWN
Sheet No. C-109 Sheet 26 of 38



1 WATERLINE REPLACEMENT PLAN 10 (STA 40+50 TO STA 45+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 10 (STA 40+50 TO STA 45+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.

KEYNOTES [#]

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) CONCRETE PAD
4. (E) TYP. TREELINE
5. (E) TYP. TREES
6. (E) ROAD STRIPING
7. (E) EDGE OF PAVEMENT
8. (E) PROPERTY LINE
9. (E) RIGHT OF WAY
10. (E) ABANDONED 2" CONDUIT
11. (E) STREET SIGN
12. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS
13. (E) CENTER OF ROAD
14. INSTALL 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
15. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
16. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
17. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
18. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV KEYNOTES	ACS	ACS	05.05.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0, 1")

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

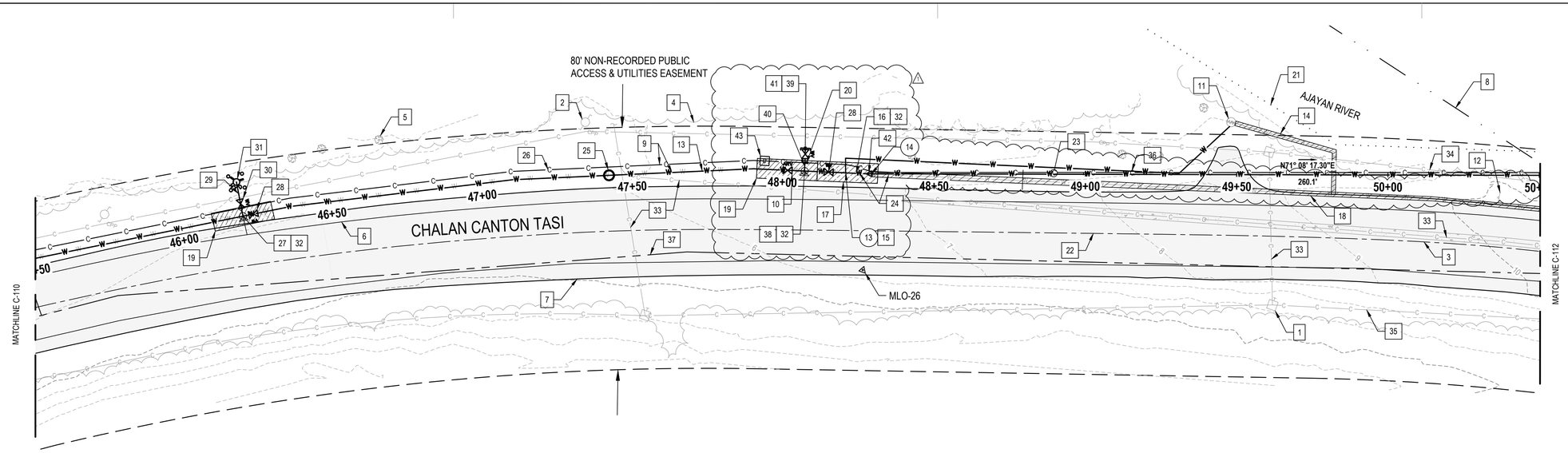
Title CIVIL PLAN & PROFILE 10

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

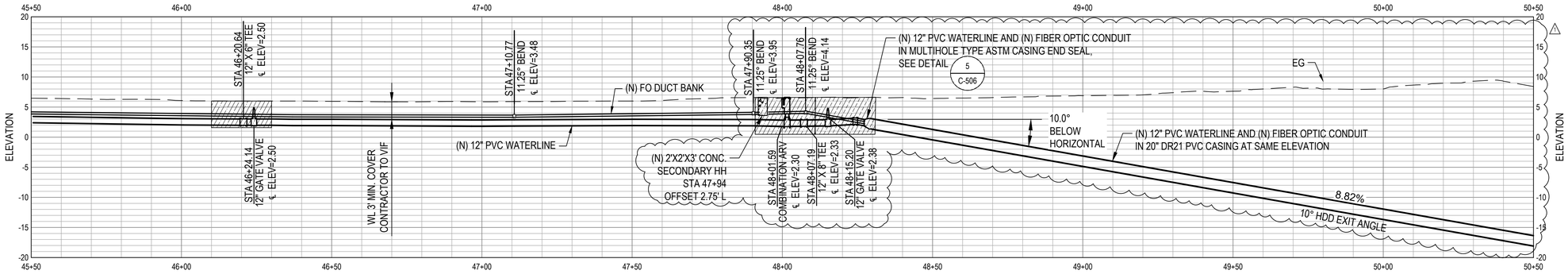
Sheet No. C-110 | Sheet 27 of 38

Plot Date: 20 May 2026 - 8:32 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 11 (STA 45+50 TO STA 50+50)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 11 (STA 45+50 TO STA 50+50)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505
4. TYPICAL HORIZONTAL AND VERTICAL CONC. THRUST BLOCKS, SEE DETAILS 2/C-505 AND 3/C-505

KEYNOTES

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) AC PATCHWORK
4. (E) TYP. TREELINE
5. (E) TYP. TREES
6. (E) ROAD STRIPING
7. (E) EDGE OF PAVEMENT
8. (E) PROPERTY LINE
9. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATER LINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION.
10. PROVIDE (N) COMBINATION ARV, SEE DETAIL 4/C-505
11. (E) WATER METER
12. (E) STREET SIGN
13. (E) 12" ACP ASSUMED, CONTRACTOR TO VERIFY. REMOVE AND REPLACE WITH (N) 12" PVC WATER LINE BY CTPS
14. DISCONNECT (E) WATER SERVICE LATERAL
15. PROVIDE (N) SADDLE TAP AND CONNECT SERVICE LATERAL SEE DETAIL 5/C-503
16. PROVIDE (N) 12" 11.25° VERTICAL BEND
17. 6.5' X 20' HDD INSTALLATION EXCAVATION, SEE DETAILS 6/C-503
18. REMOVE UNDERGROUND (E) 12" ACP BETWEEN HDD PITS
19. 6.5' X 20' CTPS INSTALLATION EXCAVATION, SEE DETAILS 4/C-502
20. PROVIDE (N) 4" 11.25° VERTICAL BEND
21. APPROX. RIVER LIMIT
22. (E) CENTER OF ROAD
23. HDD INSTALLATION OF (N) 12" WATERLINE AND (N) FIBER OPTIC CONDUIT IN 20" DR21 PVC CASING.
24. REMOVE CONFLICTING (E) 12" WATER LINE AS NECESSARY FOR HDD INSTALLATION OF (N) 12" PVC WATER LINE
25. PROVIDE 8" STAND PIPE FOR SLURRY VACUUM DURING CTPS
26. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
27. PROVIDE (N) 12"X12"X6" TEE
28. PROVIDE (N) 12" GATE VALVE, SEE DETAIL 3/C-503
29. PROVIDE (N) 6" PVC WATER LINE, SEE DETAIL 1/C-505
30. PROVIDE (N) 6" GATE VALVE, SEE DETAIL 3/C-503
31. PROVIDE (N) FIRE HYDRANT WITH BOLLARDS, SEE DETAIL 1/C-503
32. PROVIDE (N) CONC. THRUST BLOCK
33. (E) COMMUNICATIONS LINE, CONTRACTOR TO VERIFY
34. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
35. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY
36. PROVIDE (N) WATER SERVICE, SEE DETAIL 5/C-503
37. (E) RIGHT OF WAY
38. PROVIDE (N) 12"X12"X6" TEE FOR BY-PASS PIPE CONNECTION
39. PROVIDE (N) 8" GATE VALVE, SEE DETAIL 3/C-503
40. PROVIDE (N) 8" PVC WATER LINE, SEE DETAIL 1/C-504
41. PROVIDE (N) 8" BLIND FLANGE AFTER BY-PASS PIPE CONNECTION IS NO LONGER NEEDED.
42. PROVIDE (N) MULTIHOLE TYPE ASTM CASING END SEAL, SEE DETAIL 5/C-506
43. PROVIDE (N) 2'X2'X3' CONCRETE SECONDARY HANDHOLE, SEE DETAIL 1/C-504

POINT TABLE

POINT #	NORTHING	EASTING	RAW DESCRIPTION
13	565786.3389	316702.4620	WATER SERVICE LATERAL
14	565788.7708	316710.7157	HDD EXIT

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV PLAN & PROFILE	ACS	ACS	05.11.26

Author --- Drafting Check JB Project Manager ACS

Designer ACS Design Check NK Project Director MGK

Misc: GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0 — 1")

Seal: AARON C. SUTTON, No 1489 (CIVIL), EXP. 04/30/2027, GUAM, PROFESSIONAL ENGINEER — 4/24/26

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

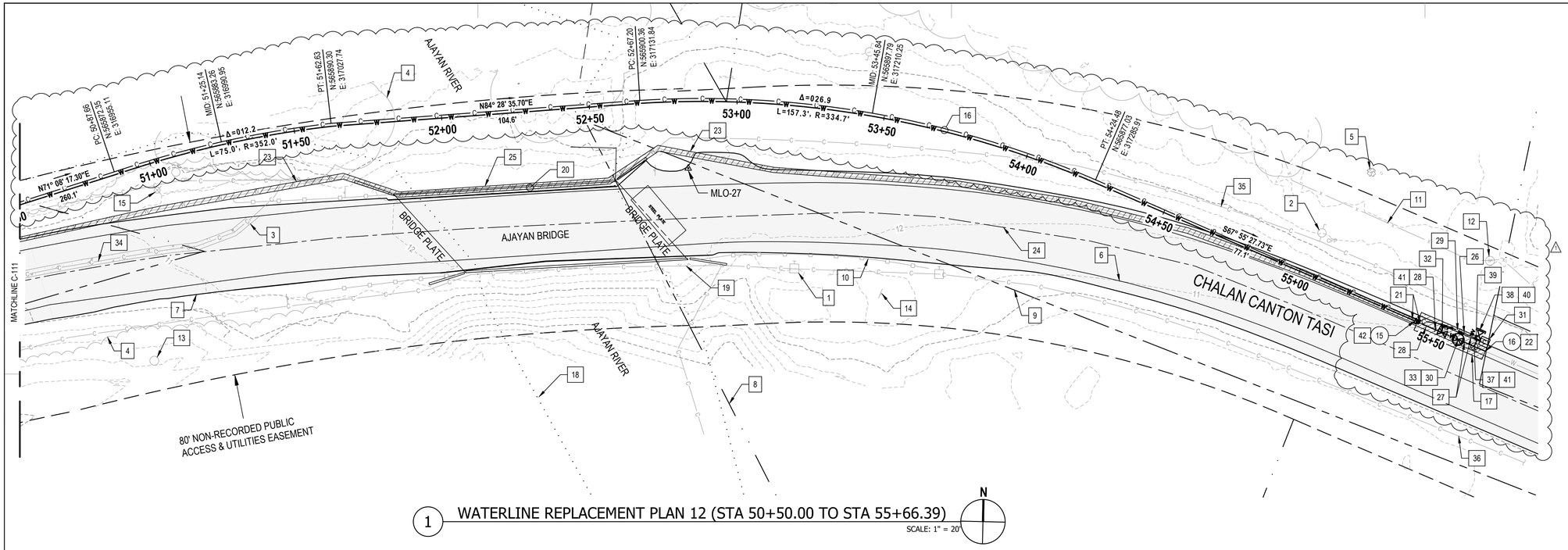
Title CIVIL PLAN & PROFILE 11

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

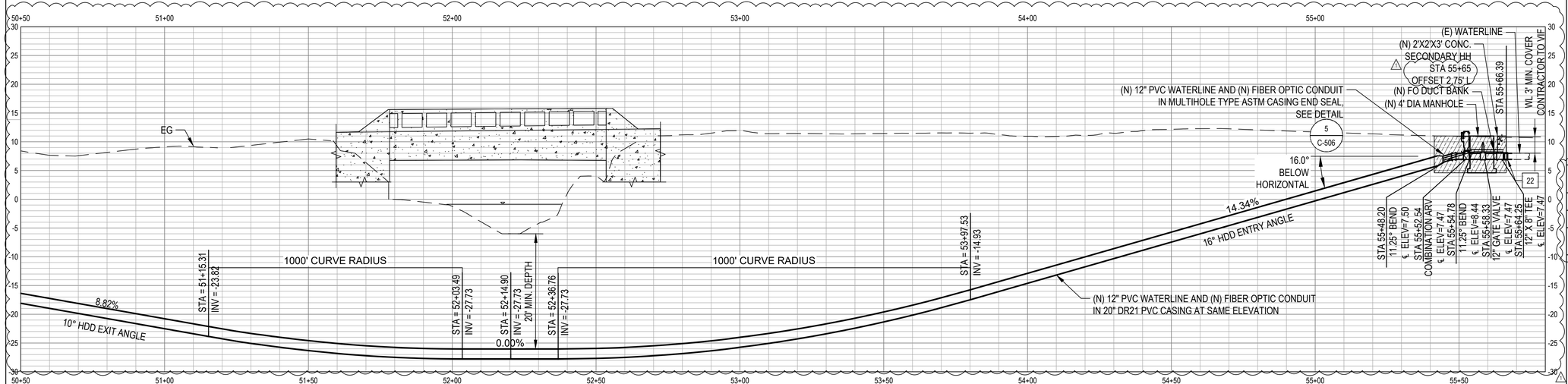
Sheet No. C-111 | Sheet 28 of 38

Plot Date: 1 June 2026 - 11:52 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 WATERLINE REPLACEMENT PLAN 12 (STA 50+50.00 TO STA 55+66.39)

SCALE: 1" = 20'



2 WATERLINE REPLACEMENT PROFILE 12 (STA 50+50.00 TO STA 55+66.39)

SCALE: HORIZ: 1" = 20, VERT: 1"=10'

GENERAL SHEET NOTES

1. THE PROPOSED LOCATION FOR THE EXISTING UNDERGROUND WATERLINE FOLLOWS AN APPROXIMATE LOCATION DETERMINED FROM WATER VALVES, WATERLINES ON BRIDGES, FIRE HYDRANTS, AND PAVEMENT PATCHES. CONTRACTOR TO VERIFY THE ROUTE, TYPE OF PIPE AND FITTING LOCATIONS.
2. WATER SERVICE LATERALS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL VERIFY AND LOCATE ALL (E) WATER SERVICE LATERALS IN THE FIELD AND RE-CONNECT TO THE (N) WATER MAIN LINE.
3. AJAYAN BRIDGE IS LOAD-POSTED. ANY CONSTRUCTION EQUIPMENT ACCESSING OR CROSSING THE BRIDGE SHALL NOT EXCEED THE POSED MAXIMUM LOAD LIMIT
4. TYPICAL TRENCHING AND ROAD RESTORATION, SEE DETAIL 1/C-505
5. TYPICAL HORIZONTAL AND VERTICAL CONC. THRUST BLOCK, SEE DETAILS 2/C-505 AND 3/C-505.

KEYNOTES

1. (E) TYP. COMMUNICATIONS BOX
2. (E) TYP. CONCRETE POWER POLE
3. (E) AC PATCHWORK
4. (E) TYP. TREELINE
5. (E) TYP. TREES
6. (E) ROAD STRIPING
7. (E) EDGE OF PAVEMENT
8. (E) PROPERTY LINE
9. (E) RIGHT OF WAY
10. (E) GUARDRAIL
11. (E) FENCE
12. (E) POWER SERVICE PEDESTAL
13. (E) UTILITY POLE
14. (E) TYP. STREET SIGN
15. (E) CONCRETE VILLAGE WELCOME SIGN
16. HDD INSTALLATION OF (N) 12" WATERLINE AND (N) FIBER OPTIC CONDUIT IN 20" DR21 PVC CASING.
17. 6.5' X 25' HDD INSTALLATION EXCAVATION, SEE DETAILS 6/C-503
18. APPROX. RIVER LIMITS
19. (E) CONDUITS
20. (E) 12" DIP AND CONDUITS
21. REMOVE CONFLICTING (E) 12" WATER LINE AS NECESSARY FOR HDD INSTALLATION OF (N) 12" PVC WATER LINE
22. CONNECT (N) 12" PVC WATER LINE TO (E) WATER LINE WITH TRANSITION COUPLING
23. REMOVE UNDERGROUND (E) 12" ACP ASSUMED BETWEEN HDD PITS
24. (E) CENTER OF ROAD
25. REMOVE (E) 12" WL PIPE & PIPE SUPPORT ON BRIDGE
26. PROVIDE (N) FIBER OPTIC DUCT BANK, SEE DETAIL 3/C-504
27. MAINTAIN 2.75' SEPARATION @ O.C. OF (N) 12" WATERLINE AND (N) FIBER OPTIC DUCT BANK INSTALLATION
28. PROVIDE (N) 12" 11.25° VERTICAL BEND
29. PROVIDE (N) 4" 11.25° VERTICAL BEND
30. PROVIDE (N) 12" GATE VALVE
31. PROVIDE (N) 2'X2'X3' CONCRETE SECONDARY HANDHOLE, SEE DETAIL 1/C-504
32. PROVIDE (N) COMBINATION ARV, SEE DETAIL 4/C-505
33. INSTALL TESTING MANHOLE FOR 12" GATE VALVE WITH PRESSURE GAUGE, SEE DETAIL 1/C-506
34. (E) COMMUNICATIONS LINE, CONTRACTOR TO VERIFY
35. (E) 2" & 4" UNDERGROUND CONDUIT, CONTRACTOR TO VERIFY
36. (E) UNDERGROUND FIBER CABLE, CONTRACTOR TO VERIFY
37. PROVIDE (N) 12"X12"X8" TEE FOR BY-PASS PIPE CONNECTION
38. PROVIDE (N) 8" GATE VALVE, SEE DETAIL 3/C-503
39. PROVIDE (N) 8" PVC WATER LINE, SEE DETAIL 1/C-504
40. PROVIDE (N) 8" BLIND FLANGE AFTER BY-PASS PIPE CONNECTION IS NO LONGER NEEDED
41. PROVIDE (N) CONC. THRUST BLOCK
42. PROVIDE (N) MULTIHOLE TYPE ASTM CASING END SEAL, SEE DETAIL 5/C-506

POINT TABLE

POINT #	NORTHING	EASTING	RAW DESCRIPTION
15	565832.7033	317395.1835	HDD ENTRY
16	565822.9621	317419.2259	EXTENT OF WL IMPROVEMENT

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

VERTICAL SCALE: 1" = 10' (0, 10', 20')

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV HDD PLAN AND PROFILE	ACS	ACS	05.11.26

Author --- Drafting Check JB Project Manager ACS

Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0 — 1")

Seal: AARON C. SUTTON, CERTIFICATE NO. 1469 (CIVIL), EXP. 04/30/2027, PROFESSIONAL ENGINEER, GUAM

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Project ACP WATER LINE REPLACEMENT - AJAYAN

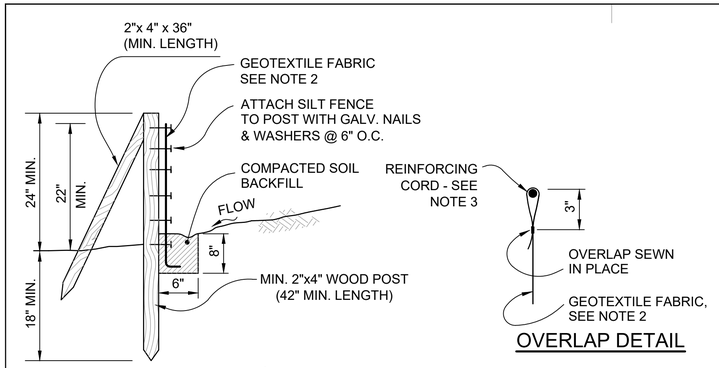
Title CIVIL PLAN & PROFILE 12

Size ANSI D

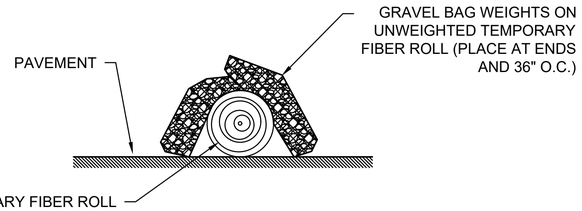
Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

Sheet No. C-112 | Sheet 29 of 38

Plot Date: 1 June 2026 - 11:55 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-10X.dwg



1 C-502 **REINFORCED SILT FENCE DETAIL**
SCALE: NTS



2 C-502 **FIBER ROLL**
SCALE: NTS

GENERAL EROSION CONTROL NOTES

1. CONSTRUCT AND MAINTAIN EROSION CONTROLS ON AND AROUND SOIL STOCKPILES TO PREVENT SOIL LOSS. SILT FENCE SHOULD SURROUND SOIL STOCKPILES, AND STOCKPILES SHOULD BE SEEDED WITH AN APPROPRIATE GRASS SPECIES FOR EROSION CONTROL IF THE STOCKPILE IS TO REMAIN FOR A PERIOD GREATER THAN 30 DAYS.
2. OBTAIN PERMISSION FROM GEPA PRIOR TO OPENING MATERIAL STAGING OR STOCKPILE AREAS. DO NOT LOCATE SOIL STOCKPILES IN SLOPED AREAS OR AREAS THAT MAY BE SUBJECT TO CONCENTRATED FLOWS OF RUNOFF DURING STORM EVENTS, SUCH AS GUTTERS, SWALES, NATURAL DRAINAGEWAYS, OR EROSION GULLIES.
3. ALL MATERIALS SUITABLE FOR USE AS BACKFILL SHALL BE PILED IN AN ORDERLY MANNER A SUFFICIENT DISTANCE FROM THE EDGE OF ANY TRENCH TO AVOID OVERLOADING AND TO PREVENT SLIDING IN THE TRENCH.
4. PROVIDE SILT FENCE AROUND EXISTING DRAINAGE INLETS FOR PROTECTION FROM SEDIMENTATION.
5. STOCKPILED MATERIALS SHALL BE PLACED IN AREAS WHERE ACCESS TO DRIVEWAYS AND THROUGH TRAFFIC ARE NOT IMPEDED OR OBSTRUCTED.
6. STOCKPILED AND EXCAVATED MATERIALS SHALL NOT BE PLACED AT ANY TIME IN GUTTERS OR SWALES OR ANY OTHER AREAS THAT MAY BE SUBJECT TO CONCENTRATION FLOWS OF STORMWATER RUNOFF.
7. STOCKPILED AND EXCAVATED MATERIALS SHALL BE REMOVED FROM THE SITE ON A DAILY BASIS (WITH THE EXCEPTION OF LONG TERM STOCKPILES PROPERLY PROTECTED FROM EROSION AT A GEPA-APPROVED STAGING AREA).

TEMPORARY EROSION CONTROL NOTES

1. THE CONTRACTOR SHALL FOLLOW ALL GUAM EPA SOIL EROSION AND SEDIMENT CONTROL REGULATIONS AND THE REQUIREMENTS SET FOR IN THE 2006 CNMI AND GUAM STORMWATER MANAGEMENT MANUAL INCLUDING BUT NOT LIMITED TO THE FOLLOWING EROSION & SEDIMENT CONTROL STANDARDS.
2. MINIMIZE UNNECESSARY CLEARING AND GRADING FROM ALL CONSTRUCTION SITES. CLEARING AND GRADING SHALL ONLY BE PERFORMED WITHIN AREAS NEEDED TO BUILD THE PROJECT, INCLUDING STRUCTURES, UTILITIES, ROADS, RECREATIONAL AMENITIES, POST-CONSTRUCTION STORMWATER MANAGEMENT FACILITIES, AND RELATED INFRASTRUCTURE. CLEARING SHOULD ONLY BE SCHEDULED DURING THE DRY SEASON IF POSSIBLE. MASS CLEARING DURING THE WET SEASON SHOULD BE AVOIDED.
3. RIVERS, STREAMS (EPHEMERAL, INTERMITTENT, AND PERENNIAL), PONDS, AND WETLANDS SHALL BE PROTECTED BY LIMITING CLEARING WITHIN THE RIPARIAN CORRIDOR (MINIMUM OF 25 FEET FROM TOP OF BANK, MORE MAY BE REQUIRED FOR STEEP SLOPES) AND APPLYING PERIMETER SEDIMENT CONTROLS BETWEEN DISTURBED AREAS AND THIS RIPARIAN CORRIDOR. EXISTING AND PROPOSED DRAINAGE WAYS SHOULD ALSO BE PROTECTED BY ENSURING THAT FLOW VELOCITIES ARE NON-EROSIVE.
4. WHENEVER PRACTICABLE AND FEASIBLE, CONSTRUCTION SHALL BE PHASED TO LIMIT DISTURBANCE TO ONLY ONE AREA OF ACTIVE CONSTRUCTION AT A TIME. FUTURE PHASES SHALL NOT BE DISTURBED UNTIL CONSTRUCTION OF PRIOR PHASES IS COMPLETE AND THE LAND AREA IS STABILIZED.
5. DISTURBED AREAS SHALL BE STABILIZED AS SOON AS FEASIBLY POSSIBLE AFTER CONSTRUCTION IS COMPLETED WITHIN A DESIGNATED CONSTRUCTION AREA, AND IN NO CASE LONGER THAN 14 DAYS AFTER COMPLETION OF ACTIVE CONSTRUCTION.
6. E&SC STANDARD 5: STEEP SLOPES SHALL BE PROTECTED FROM EROSION BY LIMITING CLEARING OF THESE AREAS IN THE FIRST PLACE OR, WHERE GRADING IS UNAVOIDABLE, BY PROVIDING SPECIAL TECHNIQUES TO PREVENT UPLAND RUNOFF FROM FLOWING DOWN A STEEP SLOPE AND THROUGH IMMEDIATE STABILIZATION TO PREVENT GULLYING. A STEEP SLOPE IS DEFINED AS ANY SLOPE OVER 20% (5:1) IN GRADE OVER A LENGTH OF 50 FEET.
7. E&SC STANDARD 6: PERIMETER SEDIMENT CONTROLS SHALL BE APPLIED TO RETAIN OR FILTER CONCENTRATED RUNOFF FROM DISTURBED AREAS TO TRAP OR RETAIN SEDIMENT BEFORE IT LEAVES A CONSTRUCTION SITE. UPLAND RUNOFF SHOULD BE DIVERTED AROUND EXCAVATIONS WHERE POSSIBLE.
8. E&SC STANDARD 7: SEDIMENT TRAPPING AND SETTLING DEVICES SHALL BE EMPLOYED TO TRAP AND/OR RETAIN SUSPENDED SEDIMENTS AND ALLOW TIME FOR THEM TO SETTLE OUT IN CASES WHERE PERIMETER SEDIMENT CONTROLS (E.G., SILT FENCE) ARE DEEMED TO BE INEFFECTIVE IN TRAPPING SUSPENDED SEDIMENTS ON-SITE.
9. E&SC STANDARD 8: ALL CONSTRUCTION SITE MANAGERS (OR SUPERINTENDENTS) SHALL PROVIDE DOCUMENTATION THAT THEY HAVE RECEIVED ADEQUATE TRAINING IN THE APPLICATION AND MAINTENANCE OF EROSION AND SEDIMENT CONTROL PRACTICES.
10. E&SC STANDARD 9: ALL CONSTRUCTION SITE MANAGERS MUST PARTICIPATE IN A PRE-CONSTRUCTION MEETING WITH THE APPLICABLE AUTHORITY TO REVIEW THE PROVISIONS OF THE EROSION AND SEDIMENT CONTROL PLAN AND MAKE ANY FIELD ADJUSTMENT NECESSARY TO IMPLEMENT THE INTENT OF THE PLAN TO MINIMIZE EROSION AND MAXIMIZE SEDIMENT RETENTION ON-SITE THROUGHOUT THE CONSTRUCTION PROCESS.
11. E&SC STANDARD 10: CONSTRUCTION SHOULD BE SCHEDULED TO MINIMIZE SOIL EXPOSURE IN THE RAINY SEASON (JULY 1ST-NOV. 30TH) AND DURING PERIODS OF CORAL SPAWNING.
12. E&SC STANDARD 11: EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE AGGRESSIVELY MAINTAINED THROUGHOUT ALL PHASES OF CONSTRUCTION. ALL EROSION AND SEDIMENT CONTROL PLANS SHALL HAVE AN ENFORCEABLE OPERATION AND MAINTENANCE AGREEMENT TO ENSURE THAT PRACTICES ARE MAINTAINED DURING THE CONSTRUCTION PROCESS.
13. CONTRACTOR SHALL PROVIDE A MINIMUM OF 5,500 CUBIC FEET OF POND STORAGE PER ACRE OF CLEARED PROJECT AREA, TO SATISFY GUAM EPA REQUIREMENTS FOR 10 YEAR STORM. WHEREVER PRACTICAL DIVERT FLOWS FROM VEGETATED AREAS TO MINIMIZE EROSION OF CLEARED AREAS.
14. THE CONTRACTOR IS RESPONSIBLE FOR DIVERTING AND FLOW CONTROL DURING CONSTRUCTION AND SHALL ADAPT COMPLIANCE WITH THE USEPE GENERAL CONSTRUCTION PERMIT AND STORM WATER POLLUTION PRECAUTION PLAN (SWPPP).

SILT FENCE NOTES

1. PRE-ASSEMBLED SILT FENCE OPTION WILL BE ALLOWED AS LONG AS SPECIFIED MINIMUMS ARE SATISFIED, FOLLOW MANUFACTURER'S INFORMATION FOR INSTALLATION PROCEDURES.
2. GEOTEXTILE FABRIC SHALL MEET THE FOLLOWING CRITERIA:
   a) GRAB TENSILE STRENGTH - 100 LBS (MIN.)
   b) MULLEN BURST - 250 PSI (MIN.)
   c) EQUIVALENT OPENING SIZE SHALL BE SMALLER THAN OR EQUAL TO A STD. #80 SIEVE.
   d) MATERIAL SHALL BE SUITABLE FOR LONG TERM EXPOSURE TO SUNLIGHT.
3. REINFORCING CORD SHALL HAVE A MIN. TENSILE STRENGTH OF 500 LBS.
4. THE CONTRACTOR MAY EXCAVATE A SEEPAGE PIT AT THE DRAINAGE DISCHARGE POINT UPSTREAM OF THE SILT FENCES.
5. THE CONTRACTOR SHALL INSPECT AND MAINTAIN THE REINFORCED SILT FENCES DAILY.

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV DETAIL INDICATOR	ACS	ACS	05.29.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

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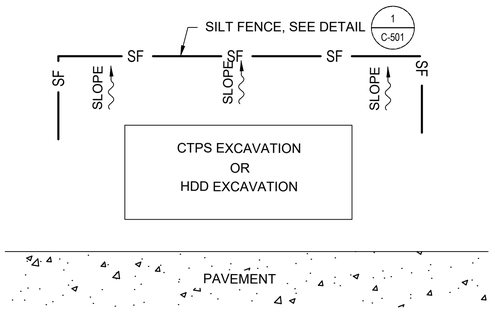
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title CIVIL DETAILS 1
Size ANSI D
Project No. 12582394
Date 04/24/2026
Scale AS SHOWN
Sheet No. C-501
Sheet 30 of 38

Plot Date: 29 May 2026 - 4:33 PM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-501.dwg



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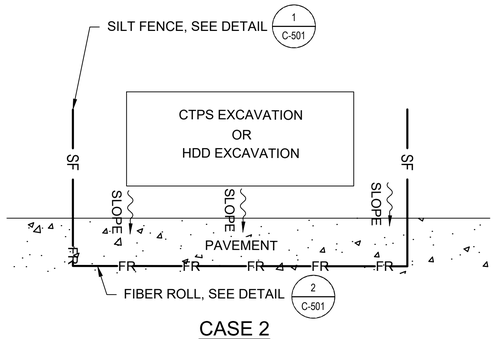

CASE 2

1 - TYP. CTPS & HDD EXCAVATION EROSION CONTROL

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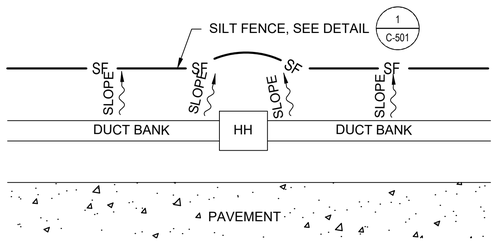
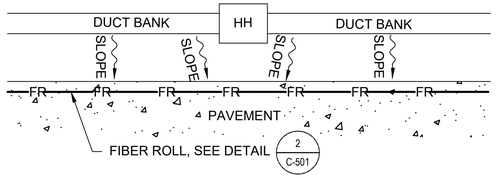


CASE 1



CASE 2

2 - TYP. DUCT BANK & FO HANDHOLE EXCAVATION EROSION CONTROL

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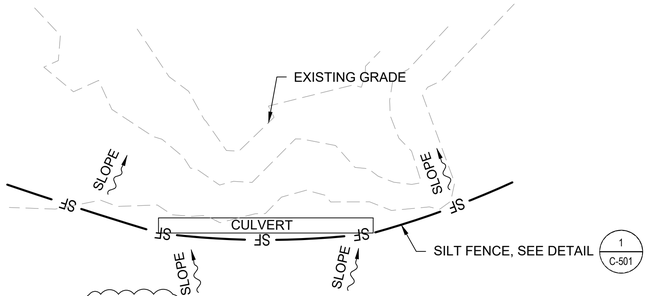
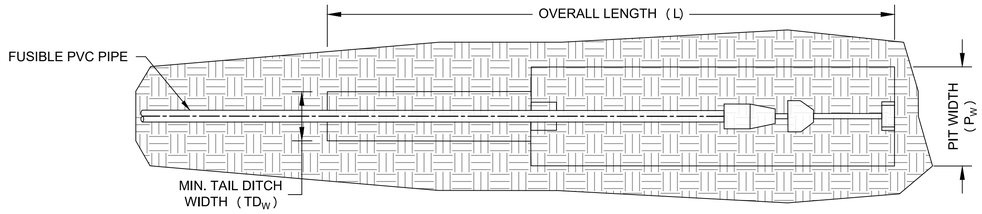
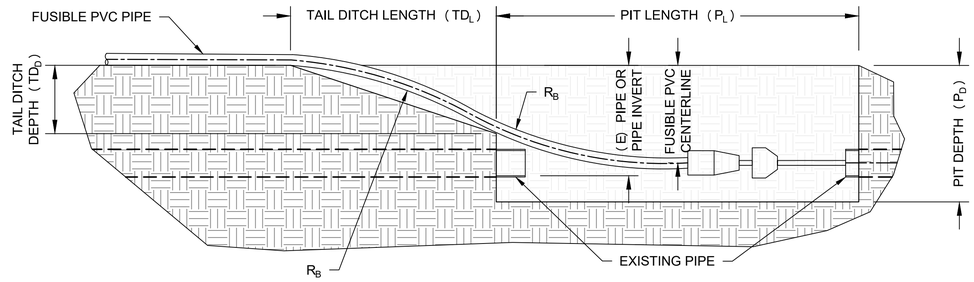


3 - TYP. CULVERT EROSION CONTROL

SCALE: NTS



PLAN



ELEVATION

NOTES:

1. CALCULATIONS ARE BASED ON THE FOLLOWING HOST PIPE:
   - HOST PIPE MATERIAL: ACP
   - HOST PIPE OD: 12"
2. ALLOWABLE BEND RADIUS: BEND RAD. = 275 FT. FOR 12" DR 14
3. THE CALCULATIONS FOR THE PIT SIZING SHOWING ARE BASED ON MINIMUM REQUIREMENTS OF THE PIPE PRODUCT BEING USED AND DO NOT TAKE INTO CONSIDERATION ANY SOIL BEARING CONDITIONS, ACCESS REQUIREMENTS, REQUIRED SHORING, OR PROJECT SPECIFIC INFORMATION, ALL OF WHICH SHOULD BE CONSIDERED AND ADJUSTED AS NECESSARY FOR EACH PROJECT.

12" DR 14 FUSIBLE PVC						
HOST PIPE INVERT	PIT LENGTH (P_L)	TAIL DITCH LENGTH (TD_L)	PIT DEPTH (P_D)	TAIL DITCH DEPTH (TD_D)	PIT WIDTH (P_W)	MIN. TAIL DITCH WIDTH (TD_W)
2 FT	23 FT	18 FT	3 FT	0.51 FT	4 FT	1.5 FT
3 FT	23 FT	29 FT	4 FT	1.51 FT	4 FT	1.5 FT
4 FT	23 FT	37 FT	5 FT	2.51 FT	4 FT	1.5 FT

4 VAR - TYP. CTPS PIT

SCALE: NTS

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
△	REV DETAIL INDICATOR	ACS	ACS	05.14.26

Author --- Drafting Check JB Project Manager ACS

Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

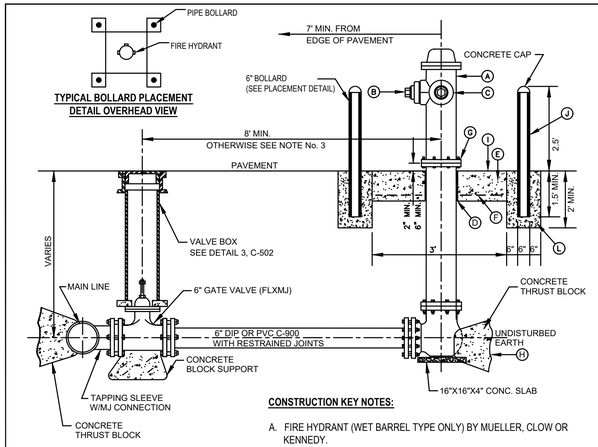
Title CIVIL DETAILS 2

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

Sheet No. C-502 | Sheet 31 of 38

Plot Date: 29 May 2026 - 4:30 PM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-502.dwg



TYPICAL BOLLARD PLACEMENT DETAIL OVERHEAD VIEW

GENERAL NOTES:

1. NO OBSTRUCTIONS WILL BE PERMITTED WITHIN 3 FT. IN ALL DIRECTIONS OF FIRE HYDRANT. FIRE HYDRANT SHALL NOT BE PLACED IN WHEEL CHAIR RAMP OR DRIVEWAY.
2. FIRE HYDRANT SHALL BE LOCATED AT THE BEGINNING OF CURB RETURN OR AT THE PROPERTY LINE COMMON TO ADJOINING LOTS, UNLESS OTHERWISE SHOWN ON PLANS.
3. WHERE DISTANCE IS LESS THAN 8', HYDRANT SHALL BE INSTALLED IN ACCORDANCE WITH C-502 DETAIL 2.
4. ALL VERTICAL JOINTS AND FITTINGS MUST BE RESTRAINED

CONSTRUCTION KEY NOTES:

A. FIRE HYDRANT (WET BARREL TYPE ONLY) BY MUELLER, CLOW OR KENNEDY.

B. PUMPER NOZZLE 4 1/2" TO BE FACING THE TRAVELED WAY, UNLESS OTHERWISE NOTED IN THE PLANS.

C. HOSE NOZZLE 2 1/2".

D. 1/2" PREMOLDED EXPANSION JOINT WITH 1" TOP FILLER.

E. 3'x3'x6" SQ. CONC. PAD, TO BE CONSTRUCTED AROUND FIRE HYDRANT'S CENTER LINE WHEN NOT LOCATED WITHIN SIDEWALK OR CONC. AREA.

F. #10; 6/6 WWF.

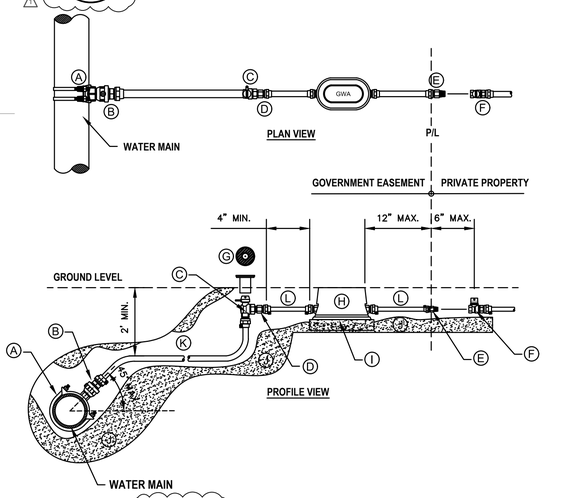
G. BREAKAWAY FLANGE WITH NUTS ON THE UPSIDE OF THE FLANGE.

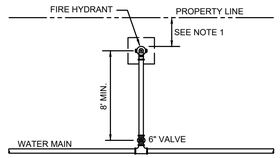
H. CONC. THRUST BLOCK, APPROX. 2'x2'x3' TO BE POURED AGAINST UNDISTURBED EARTH,

I. TOP OF SLAB SHALL BE AT FINISHED GRADE 4" TO 6" BELOW THE BREAK LINE OF THE HYDRANT. UNDER SPECIAL CONDITIONS GWA MAY ALLOW VARIATIONS TO THIS CONSTRUCTION.

J. 6" OUTSIDE DIAMETER STEEL PIPE (PAINTED SAFETY YELLOW) FILLED SOLID WITH CONCRETE.

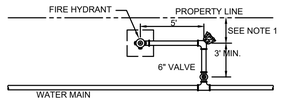
1 FIRE HYDRANT INSTALLATION
VAR — SCALE: NTS





CASE 1

STANDARD LOCATIONS



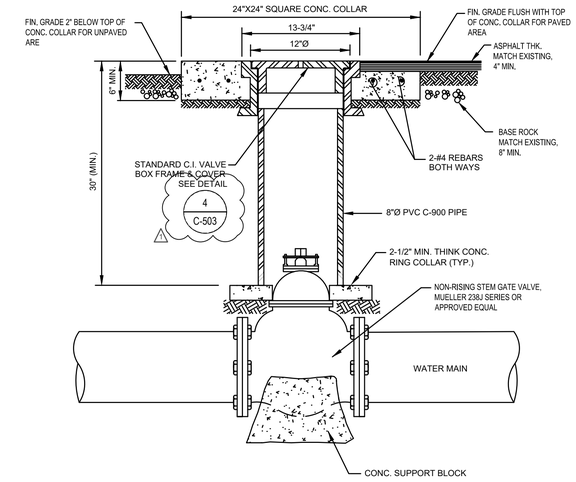
CASE 2

SPECIAL LOCATIONS

NOTES:

1. FOR CASE 1 FIRE HYDRANT SHALL BE LOCATED AT A DISTANCE OF 5 FT. MINIMUM FROM THE PROPERTY LINE.
2. FOR CASE 2 WHERE THE DISTANCE BETWEEN THE VALVE AND THE HYDRANT IS LESS THAN 8 FT. PLACE HYDRANT AS SHOWN.
3. FOR INSTALLATION OF FIRE HYDRANT SEE DETAIL 1, C-502
4. A MINIMUM CLEARANCE OF 3 FT. WILL BE PROVIDED BETWEEN A FIRE HYDRANT AND A PERMANENT OBSTRUCTION (UTILITY POLE, LIGHT POLE, TRAFFIC SIGN, FENCE, ETC.).

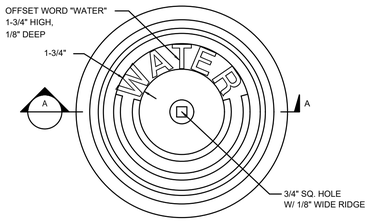
2 FIRE HYDRANT LOCATIONS
- — SCALE: NTS



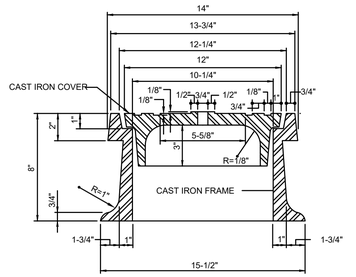
NOTES:

1. A BURIED VALVE 5' AND DEEPER SHALL BE PROVIDED WITH A SOLID STEEL EXTENSION STEM OPERATOR WITH A 2" SQUARE AWWA NUT WITHIN 36" OF VALVE BOX COVER. NUT IS TO INDICATE DIRECTION OF ROTATION TO OPEN VALVE.
2. CONTRACTOR SHALL REMOVE ALL DEBRIS AND SOIL FROM VALVE BOX BEFORE ACCEPTANCE.
3. CONCRETE COLLAR FLUSH WITH FINISHED GRADE FOR PAVED AREA AND 2" ABOVE FINISHED GRADE FOR UNPAVED AREA.
4. JOINTS, BOLTS AND NUTS SHALL BE CLEAR OF CONCRETE.
5. TRACE WIRE IS REQUIRED FOR PVC WATER MAINS. SEE DETAILS 1 & 2, C-503

3 VALVE BOX INSTALLATION
VAR — SCALE: NTS



PLAN VIEW



SECTION A-A

NOTES:

1. ALL CASTING SHALL BE MADE ACCURATELY TO THE DIMENSIONS SHOWN. SEAT AND COVER SHALL BE GROUND WHEN NECESSARY TO SECURE FLAT AND TRUE SURFACES, THE COVER SHALL NOT RATTLE IN ANY POSITION.
2. MINOR CHANGES IN DIMENSIONS MAY BE MADE TO SUIT FOUNDRY CONDITIONS PROVIDED SUCH CHANGES ARE APPROVED BY GWA ENGINEERING DIVISION.

4 VALVE COVER DETAIL
C-503 — SCALE: NTS

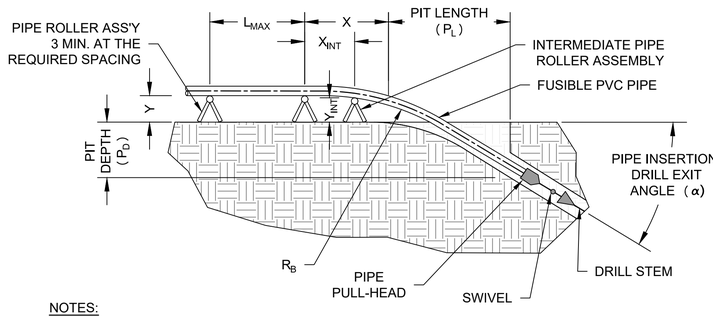
NOTES:

1. VALVE BOX REQUIRED ON CONCRETE OR ASPHALT PAVED SURFACES. OTHERWISE IT IS OPTIONAL.
2. CONTRACTOR TO SUBMIT SHOP DRAWING AND/OR SAMPLES FOR APPROVAL.

SCHEDULE OF FITTINGS

ITEM	DESCRIPTION
A	1"X(SIZE OF MAIN) STAINLESS STEEL DOUBLE STRAP SERVICE SADDLE (FEMALE CC TAPER THREADING)
B	1"X1" BALL CORP STOP (MALE CC TAPER THREADING BY PACK JOINT FOR CTS)
C	1" BRASS ANGLE BALL VALVE (PACK JOINT FOR CTS IN BY FEMALE IP OUT)
D	1" MALE IP X 3/4" CTS PACK JOINT BRASS REDUCING COUPLING
E	3/4" MALE IP X 3/4" CTS PACK JOINT BRASS COUPLING
F	PRIVATE 3/4" BRASS BALL VALVE
G	VALVE BOX WITH COVER, SEE NOTE 1.
H	3/4" METER BOX ASSEMBLY WITH INLET AND OUTLET CTS PACK JOINT FITTINGS
I	16"X12"X2" CONCRETE SLAB
J	BEDDING SAND 3/8" MINUS
K	1" CTS TUBING (CL 200 HDPE W/ 1" STAINLESS STEEL INSERTS (2-3/8" MINIMUM LENGTH) OR COPPER TYPE K)
L	3/4" CTS TUBING (HDPE W/ 3/4" STAINLESS STEEL INSERTS OR COPPER TYPE K)

5 WATER SERVICE LATERAL CONNECTION
VAR — SCALE: NTS



NOTES:

1. ALL PIT SIZING CALCULATIONS WERE MADE USING AN ASSUMED ROLLER HEIGHT (Y) OF: 2 FEET
2. ALLOWABLE BEND RADIUS: BEND RADIUS = 275 FT. FOR 12" DR 14
3. THE CALCULATIONS FOR THE PIT SIZING SHOWN AREA BASED ON MINIMUM REQUIREMENTS OF THE PIPE USED AND DO NOT TAKE INTO CONSIDERATION ANY SOIL BEARING CONDITIONS, ACCESS REQUIREMENTS, REQUIRED SHORING, OR PROJECT SPECIFIC INFORMATION, ALL OF WHICH SHOULD BE CONSIDERED AND ADJUSTED AS NECESSARY FOR EACH PROJECT.

LEGEND:

R_B = ALLOWABLE BEND RADIUS
P_L = PIT LENGTH
P_D = PIT DEPTH
α = PIPE INSERTION/DRILL EXIT ANGLE
X = HORIZONTAL DISTANCE - PIT TO PIPE ROLLER ASSEMBLY
X_{INT} = HORIZONTAL DISTANCE - CENTER OF INTERMEDIATE ROLLER ASS'Y
L_{MAX} = MAXIMUM SPACING BETWEEN ROLLER ASSEMBLIES
Y = VERTICAL DISTANCE - TOP OF PIPE ROLLER ASSEMBLY
Y_{INT} = VERTICAL DISTANCE - TOP OF INTERMEDIATE ROLLER ASS'Y

12" DR 14 FUSIBLE PVC						
ENTRY ANGLE	PIT LENGTH (P_L)	PIT DEPTH (P_D)	HORIZONTAL DISTANCE (X)	HORIZ. DIST.-CTR OR INTERMEDIATE ROLLER ASS'Y (X_{INT})	MAX. DIST. BETWEEN ROLLER ASSEMBLIES (L_{MAX})	VERTICAL DIST. - TOP OF ROLLER ASS'Y (Y_{INT})
(DEG)	(FT)	(FT)	(FT)	(FT)	(FT)	(INCHES)
10.0	17.0	3.0	32.0	7.0	29.0	23.0
11.0	22.0	4.0	32.0	7.0	29.0	23.0
12.0	27.0	5.0	32.0	6.0	29.0	23.0

6 TYP. HDD PIT
VAR — SCALE: NTS

FOR CONSTRUCTION

No.	Issue	Drafting Check	Checked	Approved	Date
1	REV DETAIL INDICATOR		ACS	ACS	05.14.26

Author --- | Drafting Check JB | Project Manager ACS
Designer ACS | Design Check NK | Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 — 1"

Seal

AARON C. SUTTON — CERTIFICATE — NO 1489 (CIVIL) — EXP. 04/30/2027 — PROFESSIONAL ENGINEER — GUAM

4/24/26

THIS WORK WAS PREPARED BY ME OR DONE UNDER MY DIRECT SUPERVISION

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Client **GUAM WATERWORKS AUTHORITY**

Project **ACP WATER LINE REPLACEMENT - AJAYAN**

Title **CIVIL DETAILS 3**

Size **ANSI D**

Project No. **12582394** | Date **04/24/2026** | Scale **AS SHOWN**

Sheet No. **C-503** | Sheet **32 of 38**

Plot Date: 29 May 2026 - 5:00 PM | Plotted By: Julius Bonifacio | Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-503.dwg

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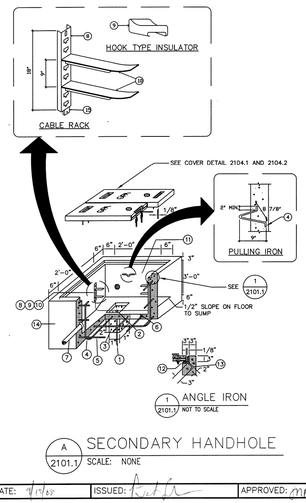
P.O.BOX 2977 HAGATNA, GUAM 96932-2977
PREPARED BY ENGINEERING DEPARTMENT

2' x 2' x 3' CONCRETE SECONDARY HANDHOLE | REF. 2101.1 | REV. 1



A 2101.1 SECONDARY HANDHOLE
SCALE: NONE

EFFECTIVE DATE: 9/19/25 | ISSUED: | APPROVED: MRamache

GUAM POWER AUTHORITY
P.O.BOX 2977 HAGATNA, GUAM 96932-2977
PREPARED BY ENGINEERING DEPARTMENT

2' x 2' x 3' CONCRETE SECONDARY HANDHOLE | REF. 2101.2 | REV. 1

NOTES:
1. COORDINATE LAYOUT AND EXACT DIMENSIONS WITH GPA ENGINEERING PRIOR TO INSTALLATION.
2. THIS HANDHOLE IS TO BE USED IN LOCATIONS WHERE NOT MORE THAN 3 JUNCTIONS OF SECONDARY WILL BE INSTALLED.
3. GROUND ALL HARDWARE IN THE HANDHOLE.
4. TOP OF THE HANDHOLE SHALL BE FLUSH WITH THE SIDEWALK SURFACE, OTHERWISE THERE SHOULD BE A 2" CLEARANCE FROM THE FINISHED GROUND SURFACE.
5. AREA OF CONDUIT ENTRANCES SHOULD BE 6" MINIMUM FROM THE FLOOR SLAB, 10" MINIMUM FROM THE LEFT OR RIGHT SIDE WALL, AND 15" MINIMUM FROM THE TOP OF THE HANDHOLE.
6. PROVIDE APPROXIMATELY $\frac{1}{8}$" CLEARANCE BETWEEN HANDHOLE COVERS AND BETWEEN COVERS AND LEDGE SIDES.

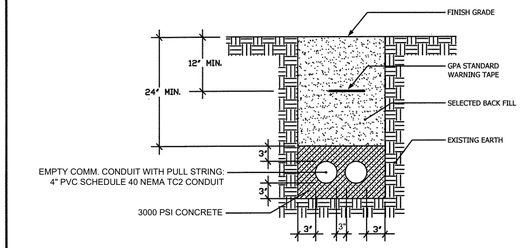
ITEM	BILL OF MATERIALS
①	5/8"ø X 8'-0" COPPER WELD GROUND ROD
②	5/8"ø COPPER GROUND ROD CLAMP
③	3/4"ø MAXIMUM GRAVEL SIZE, FILL TO FINISH FLOOR
④	#4 REBAR AT 10" O.C. VERTICAL
⑤	#4 REBAR AT 10" O.C. VERTICAL
⑥	#6 COPPER WIRE (SOLID) FOR GROUNDING HARDWARE
⑦	CONDUIT WITH END BELL 6" FROM FLOOR SLAB, SIZE AND QUANTITY AS REQUIRED
⑧	CABLE RACK HOT DIP GALVANIZED
⑨	HOOK TYPE INSULATOR
⑩	INSULATOR WELDED SUPPORT
⑪	PULLING IRON 7/8"ø GALVANIZED, LOCATED AT OPPOSITE END OF EACH CONDUIT ENTRANCE
⑫	3" X 3" X 3/8" ANGLE IRON HOT DIP GALVANIZED
⑬	3/8"ø STEEL ROD WELDED TO FRAME EVERY 12" O.C.
⑭	6" THICK CONCRETE FLOOR SLAB AND WALL AT 3000 PSI YIELD STRENGTH OF GRADE 40 FOR REBARS
⑮	SLOT FOR 1/2" BOLT AND LEAD ANCHOR

EFFECTIVE DATE: 9/19/25 | ISSUED: | APPROVED: MRamache

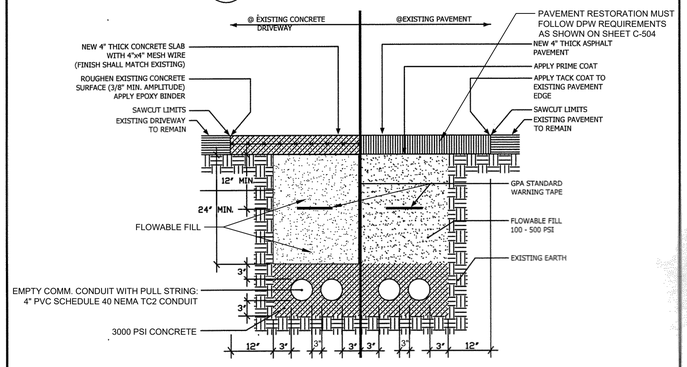
1 VAR — 2' X 2' X 3' CONCRETE SECONDARY HANDHOLE
SCALE: NTS

GUAM POWER AUTHORITY
P.O.BOX 2977 HAGATNA, GUAM 96932-2977
PREPARED BY ENGINEERING DEPARTMENT

UNDERGROUND CONDUIT ENCASEMENT GUIDE | REF. 2205 | REV. 1



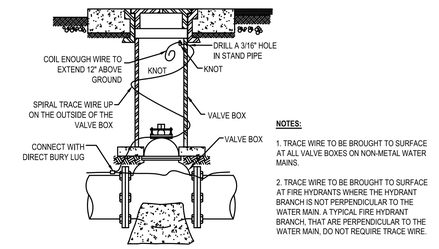
A 2205 DUCT SECTION (SIDEWALK/PLANTER) NTS



B 2205 DUCT SECTION (CONCRETE DRIVEWAY/PAVEMENT) NTS

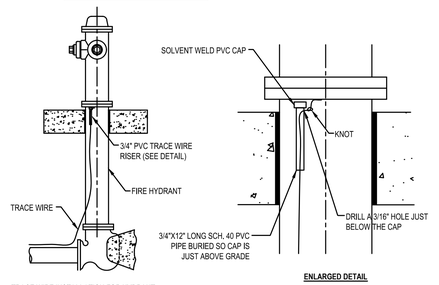
EFFECTIVE DATE: 9/19/25 | ISSUED: | APPROVED: MRamache

3 VAR — TYPICAL UNDERGROUND CONDUIT ENCASEMENT
SCALE: NTS



NOTES:
1. TRACE WIRE TO BE BROUGHT TO SURFACE AT ALL VALVE BOXES ON NON-METAL WATER MAINS.
2. TRACE WIRE TO BE BROUGHT TO SURFACE AT FIRE HYDRANTS WHERE THE HYDRANT BRANCH IS NOT PERPENDICULAR TO THE WATER MAIN. A TYPICAL FIRE HYDRANT BRANCH, THAT ARE PERPENDICULAR TO THE WATER MAIN, DO NOT REQUIRE TRACE WIRE.

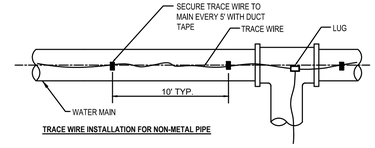
TRACE WIRE INSTALLATION AT VALVE BOX



TRACE WIRE INSTALLATION FOR HYDRANT

ENLARGED DETAIL

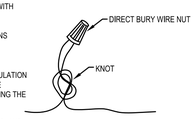
4 - TRACE WIRE INSTALLATION FOR FIRE HYDRANT AND VALVE BOX
SCALE: NTS



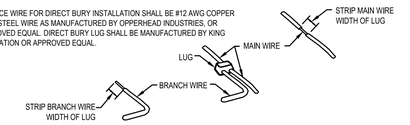
TRACE WIRE INSTALLATION FOR NON-METAL PIPE

NOTES:

1. A 12 GAUGE OR THICKER TRACE WIRE SHALL BE INSTALLED ON NON-METAL WATER MAINS (PVC OR HDPE).
2. TRACE WIRE SHALL BE INSTALLED IN A CONTINUOUS FASHION. INSTALL TRACE WIRE ON TOP OF WATER MAIN AND SECURE TO MAIN EVERY 10' WITH DUCT TAPE.
3. WIRE NUT IS USED FOR CONNECTION TO EXISTING WIRE, CONNECTIONS BETWEEN ONE SPOOL OF WIRE TO ANOTHER, AND OTHER SIMILAR CONNECTIONS.
4. WHEN CONNECTING TRACE WIRE ENDS TOGETHER, STRIP 5/8" OF INSULATION FROM THE END OF EACH WIRE. INSERT THE TWO ENDS FIRMLY INTO THE DIRECT BURY WIRE NUT, TWIST THE WIRE NUT CLOCKWISE WHILE PUSHING THE WIRES FIRMLY INTO THE NUTS, AND TIE THE WIRES IN A KNOT.
5. LUGS ARE USED FOR CONNECTION OF TRACE WIRE AT TEES, CROSSES, AND AT LOCATIONS WHERE THE TRACE WIRE WILL BE BROUGHT TO THE SURFACE.
6. TAKE CARE TO PROTECT THE WIRE INSULATION AND REPAIR IT WITH ELECTRICAL TAPE IF THE COATING IS DAMAGED.
7. TRACE WIRE FOR DIRECT BURY INSTALLATION SHALL BE #12 AWG COPPER CLAD STEEL WIRE AS MANUFACTURED BY OPPERHEAD INDUSTRIES, OR APPROVED EQUAL. DIRECT BURY LUG SHALL BE MANUFACTURED BY KING INNOVATION OR APPROVED EQUAL.



DIRECT BURY WIRE NUT CONNECTION



DIRECT BURY WIRE LUG CONNECTION

5 - TRACE WIRE INSTALLATION FOR PVC WATER MAINS
SCALE: NTS

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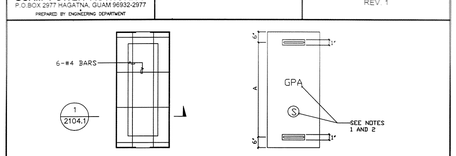
CONCRETE HANDHOLE COVER DETAIL | REF. 2104.1 | REV. 1



A 2104.1 HANDHOLE COVER
SCALE: NONE

EFFECTIVE DATE: 9/19/25 | ISSUED: | APPROVED: MRamache

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CONCRETE HANDHOLE COVER DETAIL | REF. 2104.2 | REV. 1

NOTES:
1. ALL LETTERING SHALL BE .3" WITH A $\frac{1}{4}$" EMBEDMENT.
2. INDICATE GPA ON EVERY HANDHOLE COVER WITH THE LETTER "P" FOR PRIMARY OR "S" FOR SECONDARY AND CENTERED AS SHOWN.
3. A=3'-5$\frac{3}{4}$", B=1'-4$\frac{3}{8}$" FOR 5'x4'x5' PRIMARY HANDHOLE.
4. A=1'-5$\frac{3}{4}$", B=1'-1$\frac{3}{8}$" FOR 2'x4'x3' SECONDARY HANDHOLE.
5. A=1'-5$\frac{3}{4}$", B=1'-2$\frac{3}{8}$" FOR 2'x2'x3' SECONDARY HANDHOLE.

ITEM	BILL OF MATERIALS
①	1/2" ø STEEL LIFTING DEVICE GALVANIZED
②	NUT, 1/2"ø HOLE
③	ROUND WASHER 2"ø WITH 5/8"ø HOLE
④	3" X 3" X 3/8"ø ANGLE IRON, HOT DIP GALVANIZED ALL AROUND
⑤	#4 BARS WELDED TO ANGLES
⑥	16-1/2"ø X 2" HEADED STUDS WELDED TO ANGLES.
⑦	3" THICK CONCRETE AT 3000 PSI. YIELD STRENGTH = GRADE 40

EFFECTIVE DATE: 9/19/25 | ISSUED: | APPROVED: MRamache

2 C-504 — CONCRETE HANDHOLE COVER
SCALE: NTS

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
⚠	REV DETAIL INDICATOR	ACS	ACS	05.29.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet (0 — 1")

Seal: AARON C. SUTTON, No 14859 (CIVIL), EXP. 04/30/2027, COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS
4/24/26
THIS WORK WAS PREPARED BY ME OR DONE UNDER MY DIRECT SUPERVISION

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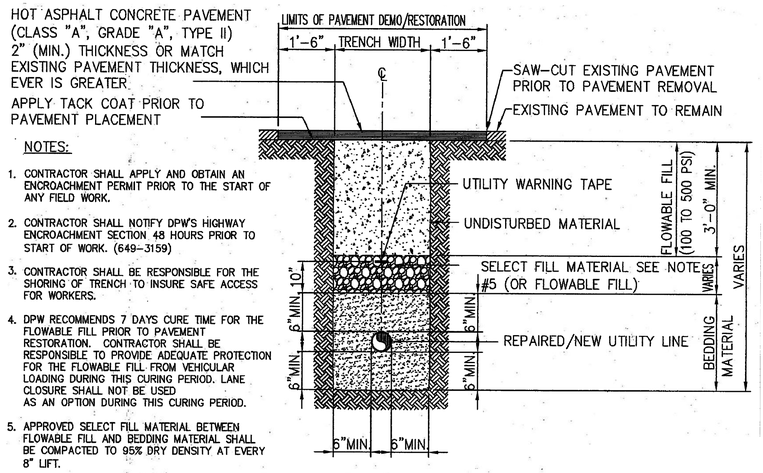
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title CIVIL DETAILS 4
Size ANSI D
Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN
Sheet No. C-504 | Sheet 33 of 38

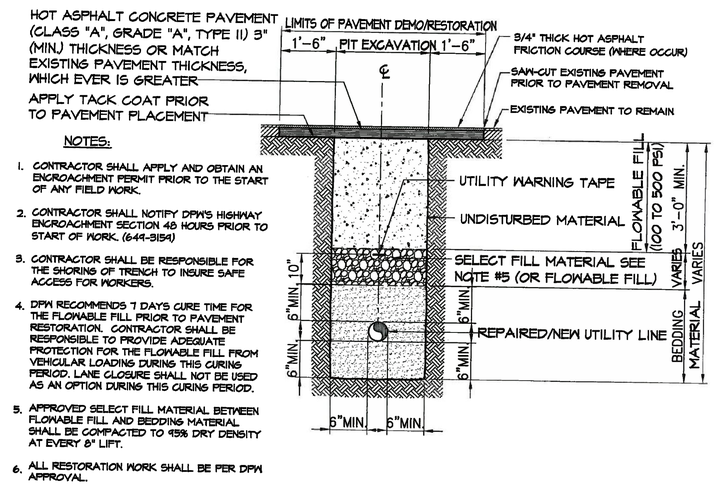
Plot Date: 1 June 2026 - 11:59 AM | Plotted By: Julius Bonifacio | Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-504.dwg



NOTES:

1. CONTRACTOR SHALL APPLY AND OBTAIN AN ENCROACHMENT PERMIT PRIOR TO THE START OF ANY FIELD WORK.
2. CONTRACTOR SHALL NOTIFY DPW'S HIGHWAY ENCROACHMENT SECTION 48 HOURS PRIOR TO START OF WORK. (649-3159)
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE SHORING OF TRENCH TO INSURE SAFE ACCESS FOR WORKERS.
4. DPW RECOMMENDS 7 DAYS CURE TIME FOR THE FLOWABLE FILL PRIOR TO PAVEMENT RESTORATION. CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE ADEQUATE PROTECTION FOR THE FLOWABLE FILL FROM VEHICULAR LOADING DURING THIS CURING PERIOD. LANE CLOSURE SHALL NOT BE USED AS AN OPTION DURING THIS CURING PERIOD.
5. APPROVED SELECT FILL MATERIAL BETWEEN FLOWABLE FILL AND BEDDING MATERIAL SHALL BE COMPACTED TO 95% DRY DENSITY AT EVERY 8" LIFT.
6. ALL RESTORATION WORK SHALL BE PER DPW APPROVAL.

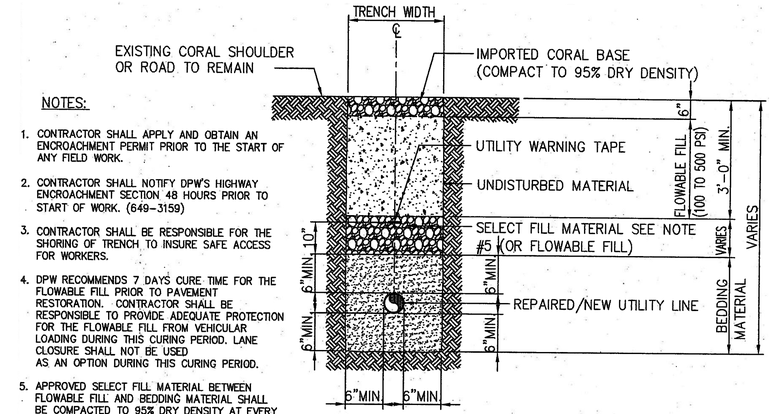
ROAD RESTORATION DETAIL
PAVED VILLAGE ROAD
NOT TO SCALE



NOTES:

1. CONTRACTOR SHALL APPLY AND OBTAIN AN ENCROACHMENT PERMIT PRIOR TO THE START OF ANY FIELD WORK.
2. CONTRACTOR SHALL NOTIFY DPW'S HIGHWAY ENCROACHMENT SECTION 48 HOURS PRIOR TO START OF WORK. (649-3154)
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE SHORING OF TRENCH TO INSURE SAFE ACCESS FOR WORKERS.
4. DPW RECOMMENDS 7 DAYS CURE TIME FOR THE FLOWABLE FILL PRIOR TO PAVEMENT RESTORATION. CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE ADEQUATE PROTECTION FOR THE FLOWABLE FILL FROM VEHICULAR LOADING DURING THIS CURING PERIOD. LANE CLOSURE SHALL NOT BE USED AS AN OPTION DURING THIS CURING PERIOD.
5. APPROVED SELECT FILL MATERIAL BETWEEN FLOWABLE FILL AND BEDDING MATERIAL SHALL BE COMPACTED TO 95% DRY DENSITY AT EVERY 8" LIFT.
6. ALL RESTORATION WORK SHALL BE PER DPW APPROVAL.

ROAD RESTORATION DETAIL
PAVED PRIMARY ROAD PIT EXCAVATION
NOT TO SCALE

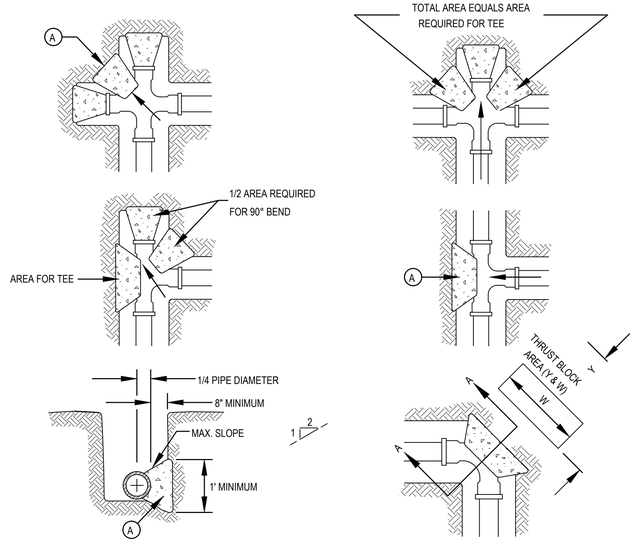


NOTES:

1. CONTRACTOR SHALL APPLY AND OBTAIN AN ENCROACHMENT PERMIT PRIOR TO THE START OF ANY FIELD WORK.
2. CONTRACTOR SHALL NOTIFY DPW'S HIGHWAY ENCROACHMENT SECTION 48 HOURS PRIOR TO START OF WORK. (649-3159)
3. CONTRACTOR SHALL BE RESPONSIBLE FOR THE SHORING OF TRENCH TO INSURE SAFE ACCESS FOR WORKERS.
4. DPW RECOMMENDS 7 DAYS CURE TIME FOR THE FLOWABLE FILL PRIOR TO PAVEMENT RESTORATION. CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE ADEQUATE PROTECTION FOR THE FLOWABLE FILL FROM VEHICULAR LOADING DURING THIS CURING PERIOD. LANE CLOSURE SHALL NOT BE USED AS AN OPTION DURING THIS CURING PERIOD.
5. APPROVED SELECT FILL MATERIAL BETWEEN FLOWABLE FILL AND BEDDING MATERIAL SHALL BE COMPACTED TO 95% DRY DENSITY AT EVERY 8" LIFT.
6. ALL RESTORATION WORK SHALL BE PER DPW APPROVAL.

ROAD RESTORATION DETAIL
CORAL ROAD OR SHOULDER
NOT TO SCALE

1 VAR TYPICAL TRENCHING AND ROAD RESTORATION DETAILS
SCALE: NTS



SECTION "A"

PIPE SIZE	WATER PIPE	
	TEE, DEAD END AND 90° BEND	45° AND 22 1/2° BENDS
4" & LESS	3 SQ. FEET	3 SQ. FEET
6"	4 SQ. FEET	3 SQ. FEET
8"	6 SQ. FEET	3 SQ. FEET
10"	9 SQ. FEET	5 SQ. FEET
12"	13 SQ. FEET	7 SQ. FEET
16"	23 SQ. FEET	12 SQ. FEET
18"	29 SQ. FEET	15 SQ. FEET

NOTES:

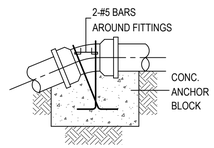
1. TABLE IS BASED ON 2000#/SQ. FT. SOIL. IF CONDITIONS ARE FOUND TO INDICATE SOIL BEARING IS LESS, THE AREAS SHALL BE INCREASED ACCORDINGLY.
2. AREAS FOR PIPE LARGER THAN 18" SHALL BE CALCULATED.
3. CONCRETE SHALL HAVE A MINIMUM COMPRESSION STRENGTH OF 2500 PSI.
4. THRUST BLOCK IS TO EXTEND TO UNDISTURBED SOIL.
5. SIZE MAY BE DECREASED FOR LESSER DEGREE BENDS AS DETERMINED BY ENGINEER.
6. KEEP CONCRETE CLEAR OF M.J. OR BELL AND SPIGOT JOINTS.
7. BLOCK IN A SIMILAR MANNER AT TEES, HYDRANTS, PLUG OR OTHER LOCATIONS AS REQUIRED.
8. WHEN NECESSARY ADDITIONAL THRUST RESTRAINT METHODS MAY BE USED, SUCH AS MECHANICAL JOINT RESTRAINTS, TIE-RODS RECOMMENDATIONS OR OTHER APPROVED METHODS.

CONSTRUCTION KEY NOTES:

A. LENGTH "Y & W" AS REQUIRED TO OBTAIN BEARING AREA AGAINST UNDISTURBED SOIL.

B. MINIMUM THRUST BLOCK AREA REQUIREMENTS FOR (Y & W) AS FOLLOWS:

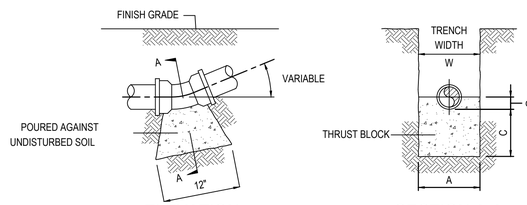
BEARING AREA IN SQUARE FEET						
PIPE SIZE	1/4 (90°)	1/8 (45°)	1/16 (22.5°)	1/32 (11.25°)	TEE	PLUG
6"/8"	4.20	2.30	1.20	1.80	3.00	3.00
10"	11.50	6.00	3.00	1.90	8.00	8.00
12"	16.00	9.00	4.50	2.50	11.50	11.50
16"	28.50	15.00	8.00	4.00	20.00	20.00



CONCRETE ANCHOR BLOCK DETAIL

NOTES:

1. EMBED END OF BARS A MINIMUM OF 12 INCHES INTO CONCRETE.
2. CONCRETE FOR ANCHOR BLOCKS SHALL BE 2,500 PSI.
3. ANCHOR BLOCK DIMENSION IS BASED ON INTERNAL PRESSURE.
4. THRUST BLOCKS NOT REQUIRED ON STEEL PIPE LINES WITH WELD OR FLANGED OR ON SOLVENT WELDED PVC PIPE.
5. 6" PIPE SHOWN FOR EACH BEND, TEE, AND PLUG ARE THE MIN. BEARING AREA.

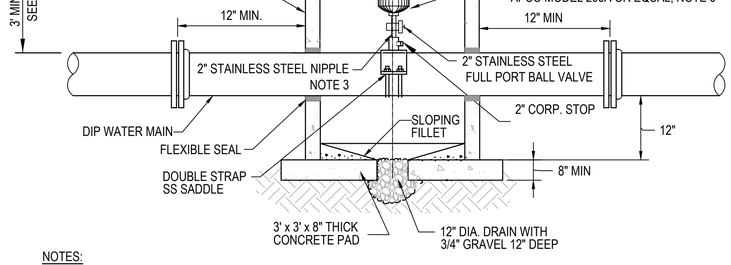


ELEVATION

SECTION A-A

2 VAR CONCRETE THRUST BLOCKING
SCALE: NTS

3 VAR VERTICAL THRUST BLOCKING
SCALE: NTS



NOTES:

1. ALL OPENINGS SHALL BE SEALED WITH WATERPROOF NON-SHRINKING GROUT.
2. PROVIDE ½" STAINLESS STEEL NIPPLES AND ELBOWS DOWN FACING WITH SCREEN ON OUTLET (20-MESH ST. STL.).
3. ADJUST VERTICAL ALIGNMENT OF PROPOSED WATER MAIN SO THAT HIGH POINT IS MINIMUM 3' BELOW FINISHED GRADE.
4. MINIMUM DEPTH OF PIPE SHALL BE INCREASED AS NECESSARY TO ENSURE VALVE VAULT IS FLUSH WITH GRADE AS SHOWN.
5. WITHIN PAVEMENT AND SHOULDER AREAS, VAULT SHALL BE TRAFFIC BEARING.
6. ARV OF 1" MAY BE PROVIDED IF APPROVED BY GWA. INSTALLATION OF 1" ARV IS SIMILAR TO THIS DETAIL.

4 VAR COMBINATION AIR RELEASE/VACUUM VALVE
SCALE: NTS

FOR CONSTRUCTION

No.	Issue	Author	Checked	Approved	Date
1	REV DETAIL INDICATOR	---	ACS	ACS	05.29.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

Seal

AARON C. SUTTON CERTIFICATE No 1469 (CIVIL) EXP. 04/30/2027 PROFESSIONAL ENGINEER
4/24/26
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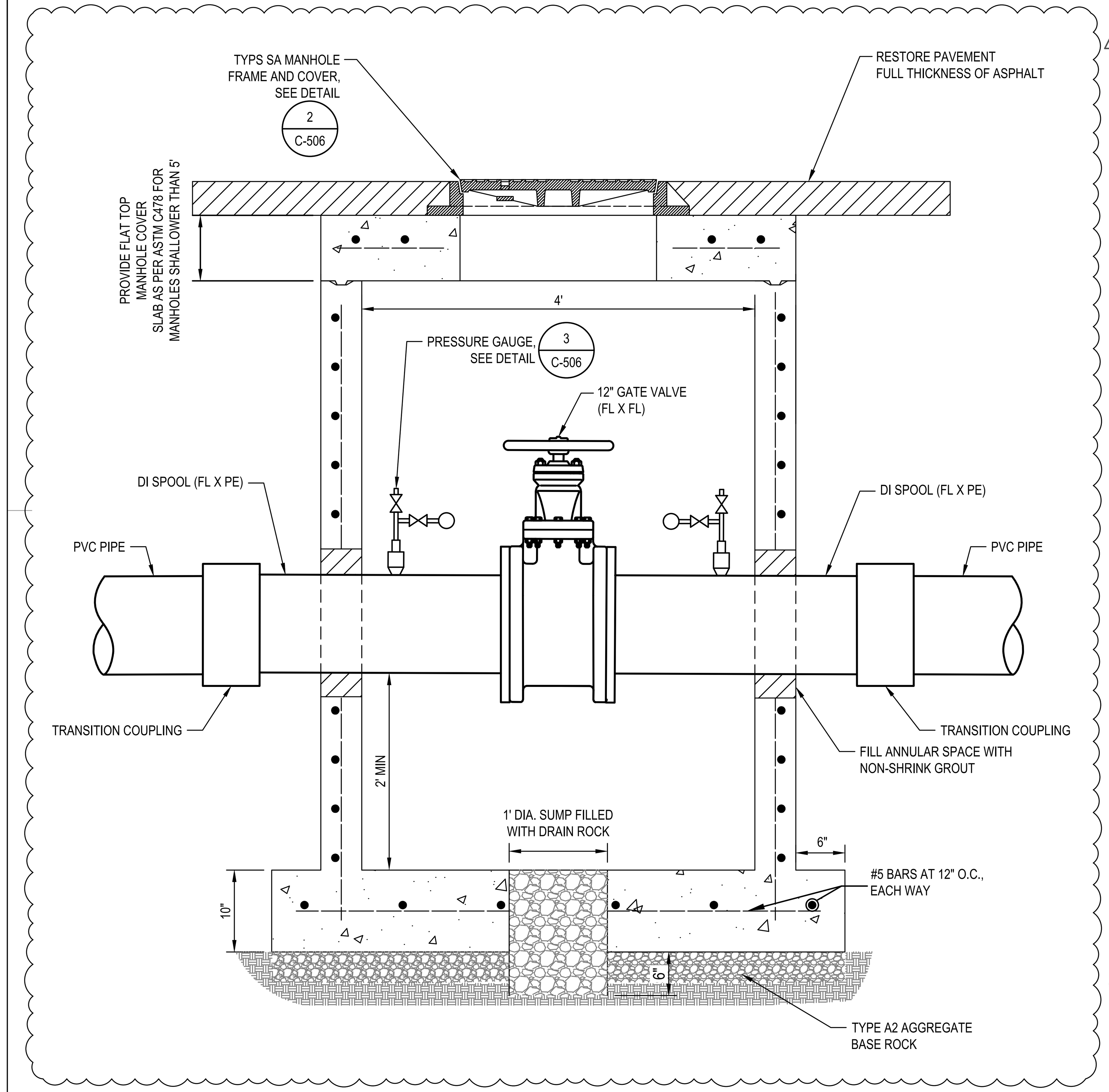
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title CIVIL DETAILS 5
Size ANSI D
Project No. 12582394
Date 04/24/2026
Scale AS SHOWN
Sheet No. C-505
Sheet 34 of 38

Plot Date: 29 May 2026 - 5:12 PM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-505.dwg



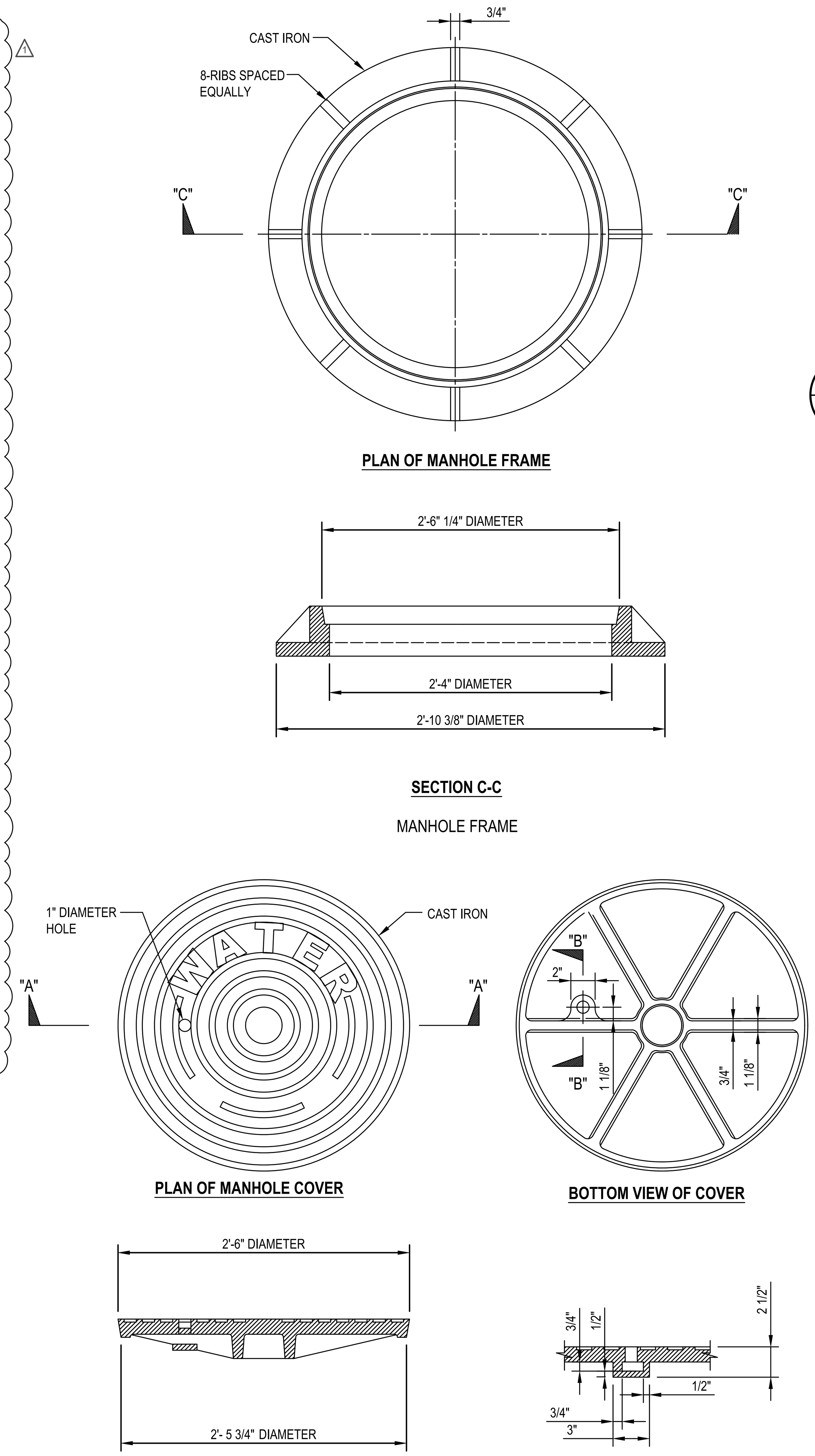
NOTES:

1. PRE-CAST SECTIONS MUST CONFORM TO ASTM C478 AND THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.
2. PRIOR TO MANUFACTURING, DESIGNS OTHER THAN THOSE SHOWN ON THIS SHEET MUST BE SUBMITTED FOR APPROVAL.
3. INSTALL PRE-CAST FLEXIBLE SEALING GASKET CONFORMING TO ASTM C990 AT ALL MANHOLE JOINTS.
4. TOP SLAB MUST BE DESIGNED FOR AASHTO HS-25 WHEEL LOADING.
5. STEEL INDICATED (A_S) IS MINIMUM REQUIRED.
6. REFER TO MANHOLE SIZING TABLE FOR MANHOLE DIAMETER AND WALL THICKNESS.
7. ALL REINFORCING BARS INTERFERING WITH PIPE MUST BE BENT TO PROVIDE A MINIMUM 1.5" CLEAR DISTANCE FROM THE WATERLINE PIPE.
8. THE PRE-CAST MANHOLE RISER SECTION MUST BE CAST WITH OPENINGS WHENEVER PIPES MUST PASS THROUGH THE WALL.
9. ANNULAR SPACE AT WALL PIPE PENETRATIONS MUST BE FILLED WITH NON-SHRINK GROUT, EXCEPT WHERE APPROVED RESILIENT CONNECTORS ARE USED.

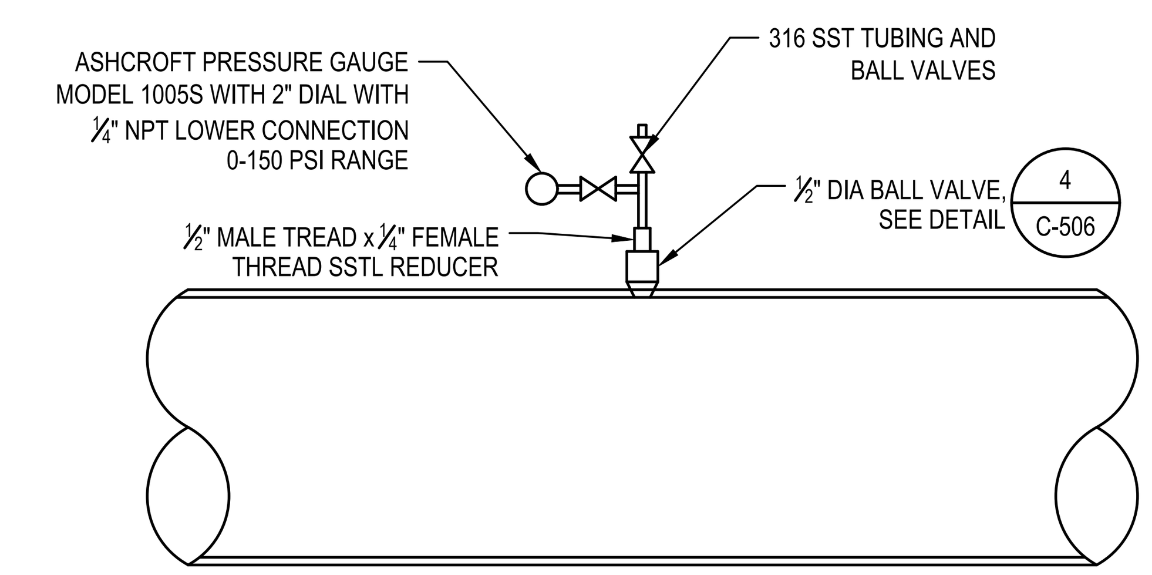
MANHOLE SIZING TABLE

PIPE SIZE	MANHOLE DIAMETER	WALL THICKNESS
≤ 21"	4'-0"	5"
24 - 30"	5'-0"	6"
36" - 42"	6'-0"	7"
48" - 54"	7'-0"	8"

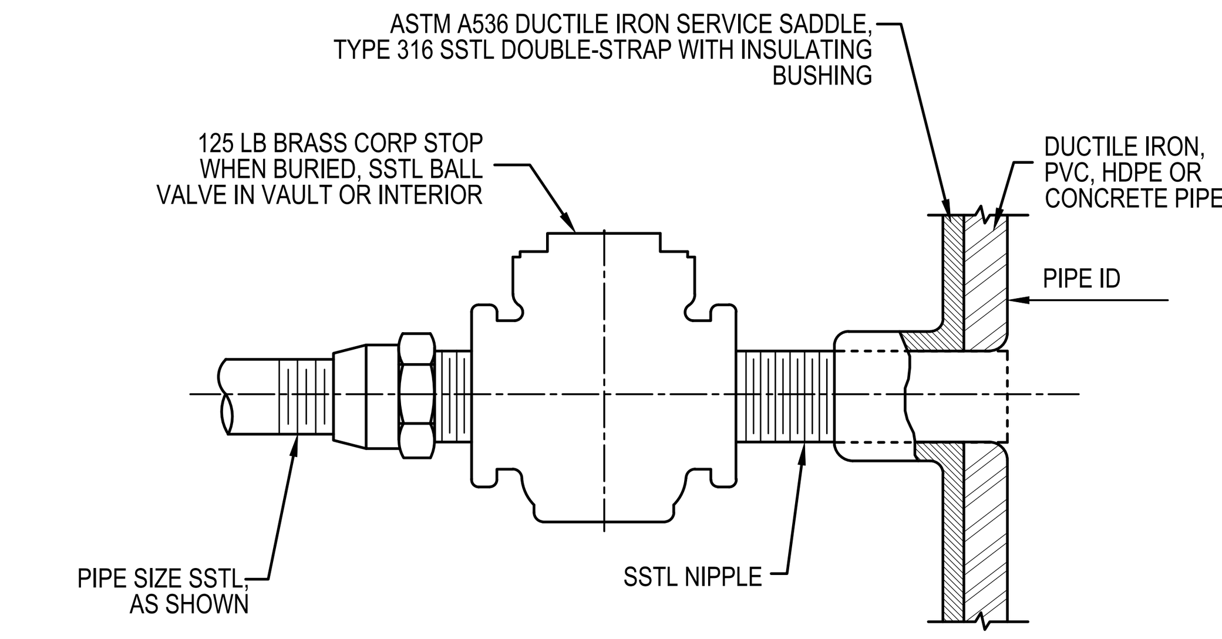
1 VAR — TESTING MANHOLE
SCALE: NTS



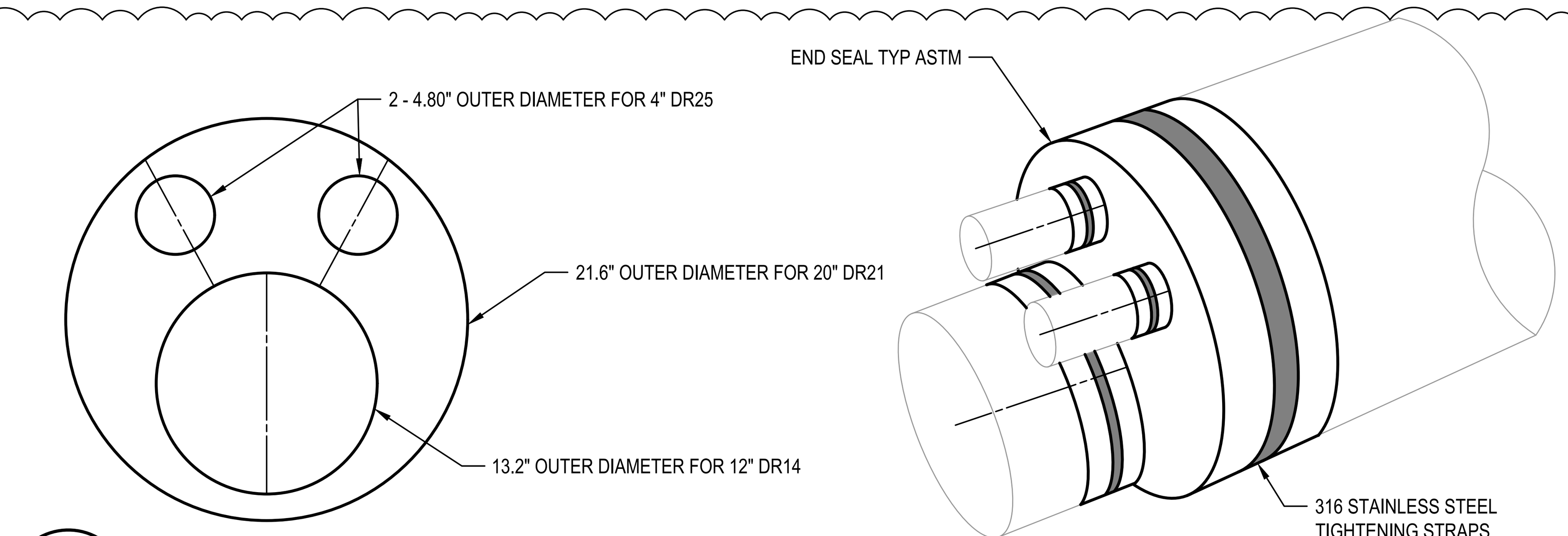
2 C-506 — TYPICAL MANHOLE COVER AND FRAME
SCALE: NTS



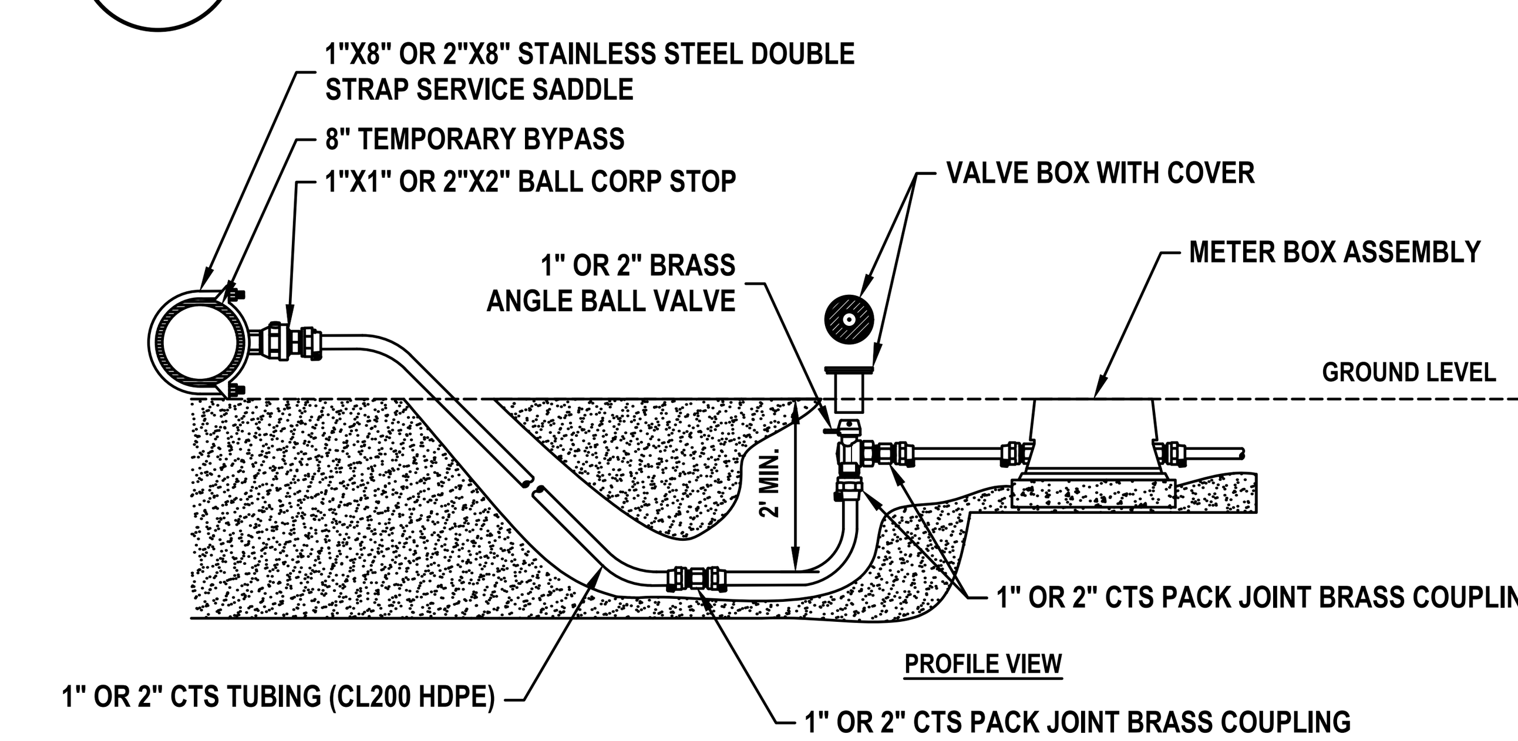
3 C-506 — PRESSURE GAUGE AND TAP DETAIL
SCALE: NTS



4 C-506 — PIPE CONNECTION FOR 2" AND SMALLER OUTLET PIPE
SCALE: NTS



5 VAR — MULTIHOLE TYPE ASTM CASING END SEAL
SCALE: NTS

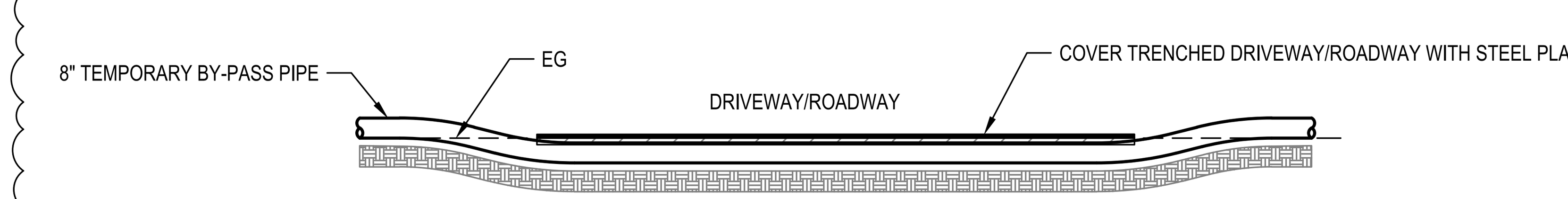


NOTES:

1. SEE SHEETS C-102, C-103, C-107, C-108, C-109, AND C-111 FOR 1" WATER SERVICE LATERALS.
2. SEE SHEET C-109 FOR 2" WATER SERVICE LATERAL.

6 - — WATER SERVICE LATERAL CONNECTION TO TEMPORARY BY-PASS
SCALE: NTS

NOTE: RESTORE DRIVEWAY SURFACE WHEN BY-PASS LINE IS REMOVED



7 C-509 — DRIVEWAY/ROADWAY CROSSING OF TEMPORARY BY-PASS PIPE
SCALE: NTS

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV DETAILS 1, 5, 6 & 7 AND TITLEBLOCK	ACS	ACS	05.14.26

Author --- | Drafting Check JB | Project Manager ACS
Designer ACS | Design Check NK | Project Director MGK

GUAM WATERWORKS AUTHORITY

Bar is one inch on original size sheet
0 1"

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4/24/26
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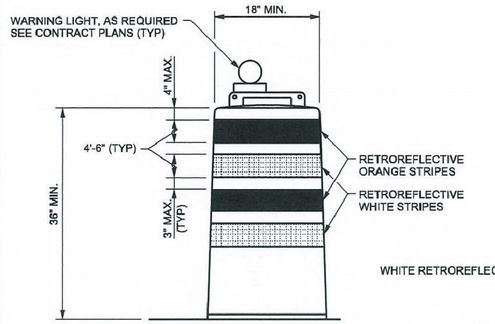
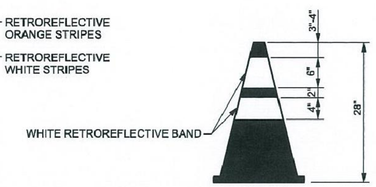
Client: GUAM WATERWORKS AUTHORITY
Project: ACP WATER LINE REPLACEMENT - AJAYAN
Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

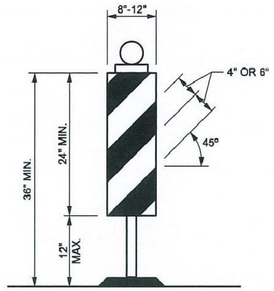
Title: CIVIL DETAILS 6
Size ANSI D
Sheet No. C-506 | Sheet 35 of 38



ORANGE TRAFFIC DRUMS

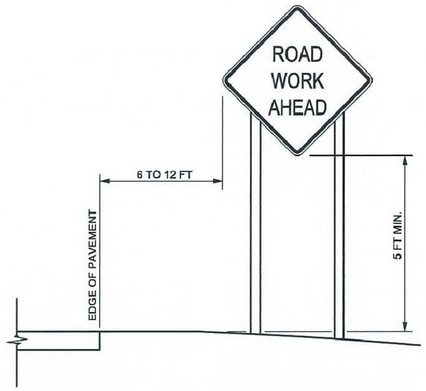


ORANGE CONES

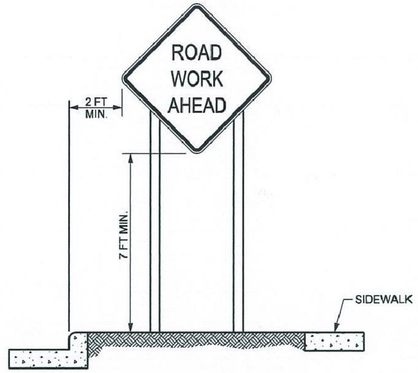


VERTICAL PANEL

CHANNELIZING DEVICES

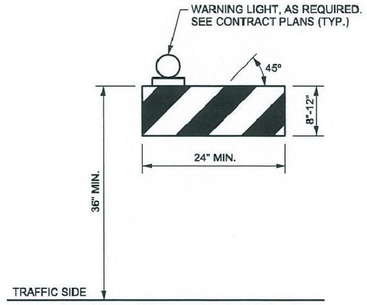


RURAL AREA

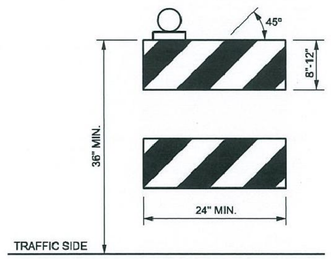


BUSINESS, COMMERCIAL, OR RESIDENTIAL AREA

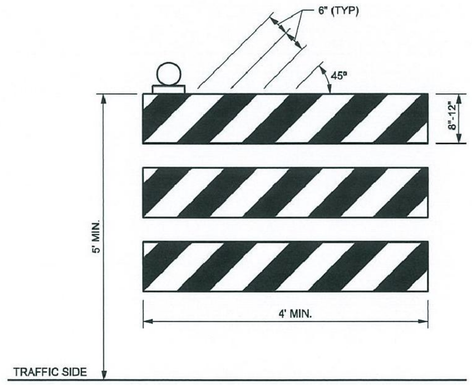
TYPICAL SIGN INSTALLATIONS



TYPE 1 BARRICADE



TYPE 2 BARRICADE



TYPE 3 BARRICADE

TRAFFIC BARRICADES

NOTES:

1. MARKINGS FOR BARRICADE RAILS SHALL BE RETROREFLECTIVE ORANGE AND WHITE STRIPES SLOPING DOWNWARD AT AN ANGLE OF 45 DEGREES IN THE DIRECTION OF TRAFFIC AS SHOWN.
2. TYPICAL RAIL STRIPE WIDTHS SHALL BE 6 INCHES. 4 INCH WIDE STRIPES MAY BE USED FOR RAIL WIDTHS LESS THAN 36".
3. BARRICADE SUPPORTS ARE NOT SHOWN. SUBMIT PRODUCT INFORMATION INDICATING NCHRP-350/MASH CRASH TESTED AND APPROVED.

GENERAL NOTE:

1. ALL WORK ZONE HARDWARE SUCH AS DRUMS, CONES, SIGN SUPPORTS, BARRICADES, AND BARRIERS MUST MEET THE CRASHWORTHY PERFORMANCE CRITERIA IN NCHR-350/MASH AND SHALL COMPLY WITH THE REQUIREMENTS OF THE CURRENT EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD).

SIGNED ORIGINAL ON FILE

DRAWING REVISIONS

REVISION	DATE	BY	DESCRIPTION

Guam Department of Public Works
542 North Marine Corps Drive
Tamuning, Guam 96913
Tel: (671) 646-3131
Fax: (671) 649-6178

CHANNELIZING DEVICES AND BARRICADES

APPROVED FOR USE ON DPW PROJECTS

CHIEF ENGINEER, HIGHWAYS
DEPARTMENT OF PUBLIC WORKS

DATE: 10.14.12

STANDARD NO. 635-01

FOR CONSTRUCTION

No.	Issue		Checked	Approved	Date
△	REV TITLEBLOCK		ACS	ACS	05.05.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

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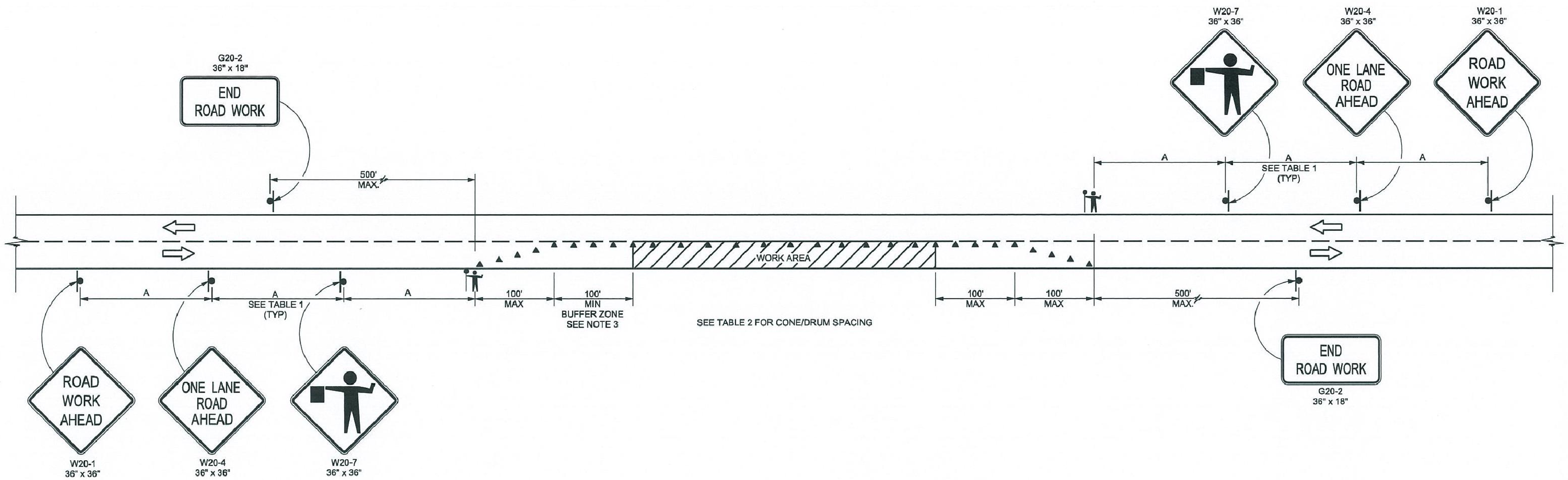
Client GUAM WATERWORKS AUTHORITY
Project ACP WATER LINE REPLACEMENT - AJAYAN
Title TRAFFIC CONTROL 1
Size ANSI D
Project No. 12582394
Date 04/24/2026
Scale AS SHOWN
Sheet No. C-507
Sheet 36 of 38

Plot Date: 20 May 2026 - 8:33 AM Plotted By: Julius Bonifacio Filename: G:\561\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-507.dwg



LEGEND:

- WORK AREA
- CHANNELIZING DEVICES
- FLAGGER WITH STOP/SLOW PADDLE
- SEQUENTIAL OR FLASHING ARROW
- TEMPORARY SIGN
- TRAFFIC FLOW

SIGNED ORIGINAL ON FILE

TABLE 1

SIGN SPACING	
ROAD TYPE	A (FT)
URBAN - SPEED 25 MPH OR LESS	100
URBAN - SPEED 30 MPH OR MORE	350
RURAL	500

TABLE 2

CONE/DRUM SPACING	
APPROACH SPEED (MPH)	SPACING (FT)
25 & BELOW	25
35	35
45	45

GENERAL NOTES:

1. PAVEMENT MARKINGS FOR TEMPORARY TRAFFIC CONTROL, IF REQUIRED, SHALL BE AS DIRECTED BY THE ENGINEER OR SHOWN IN THE CONTRACT PLANS.
2. THE SIGN LOCATION SPACINGS MAY BE VARIED FROM THE DIMENSIONS SHOWN DUE TO FIELD CONDITIONS INCLUDING ROAD ALIGNMENT, SIGHT DISTANCE, INTERSECTIONS, DRIVEWAYS, PERMANENT SIGNS OR OTHER OBSTRUCTIONS.
3. BUFFER ZONE CAN BE INCREASED AS DIRECTED BY THE ENGINEER FOR HORIZONTAL OR VERTICAL CURVES DUE TO SIGHT DISTANCE CONSIDERATION.

DRAWING REVISIONS

REVISION	DATE	BY	DESCRIPTION

public works
DIPATTAMENTON CHE'CHO PUPBLEKO

Guam Department of Public Works
542 North Marine Corps Drive
Tamuning, Guam 96913
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Fax: (671) 649-6178

LANE CLOSURE ON TWO LANE HIGHWAY

APPROVED FOR USE ON DPW PROJECTS
CHIEF ENGINEER, HIGHWAYS
DEPARTMENT OF PUBLIC WORKS Acting
DATE: 10-14-12
STANDARD NO. 635-02

FOR CONSTRUCTION

No.	Issue	Checked	Approved	Date
1	REV HDD CASING	ACS	ACS	05.05.26

Author --- Drafting Check JB Project Manager ACS
Designer ACS Design Check NK Project Director MGK

Misc.
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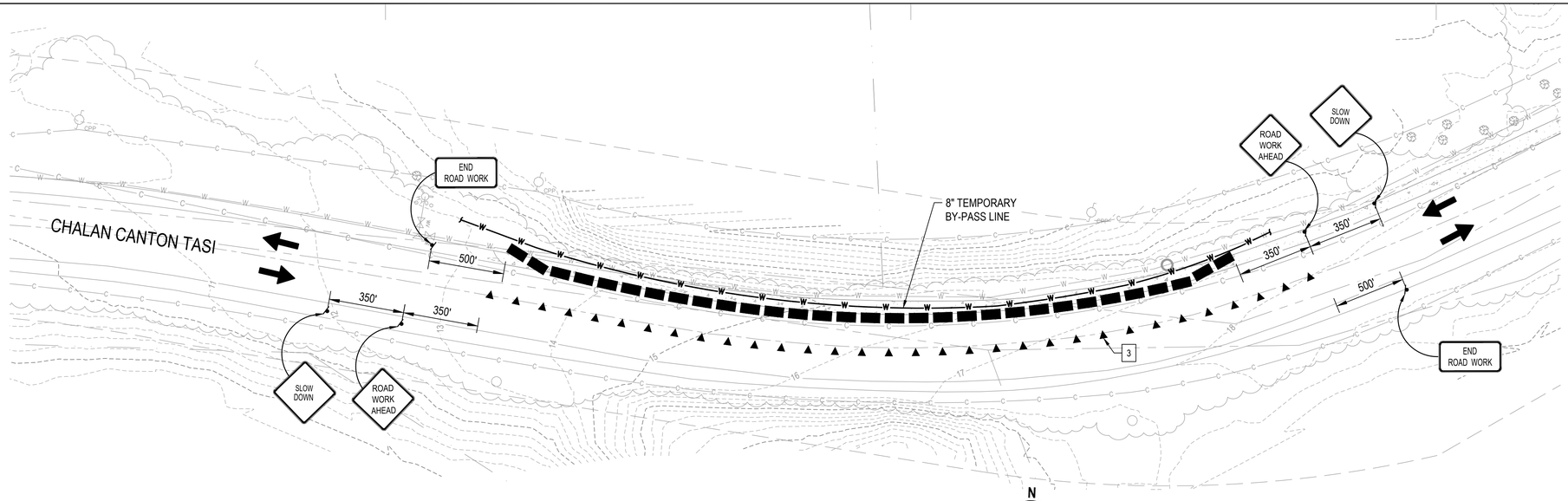
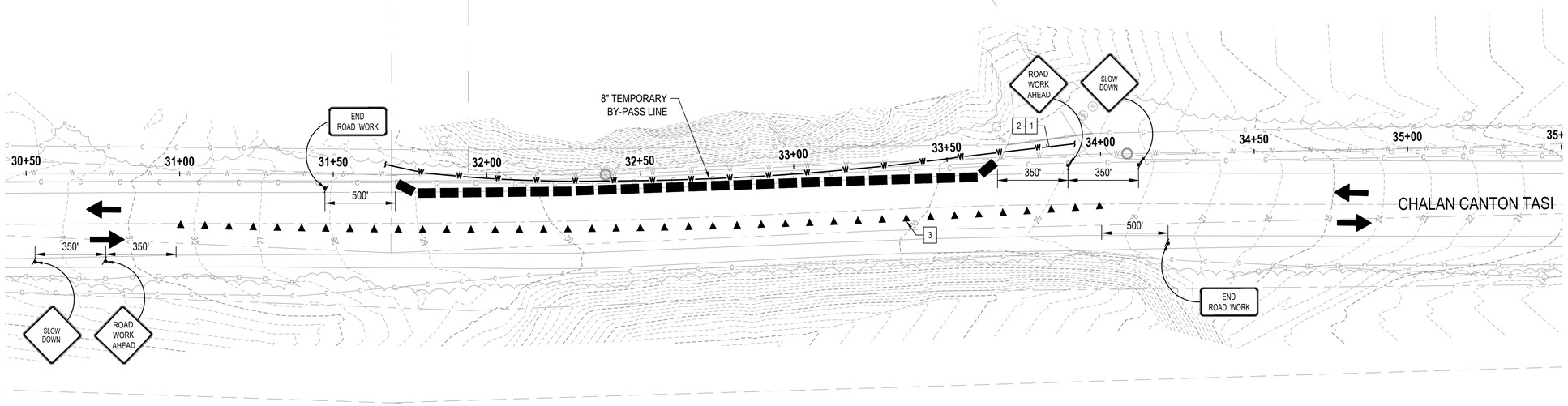
Project ACP WATER LINE REPLACEMENT - AJAYAN
Project No. 12582394 Date 04/24/2026 Scale AS SHOWN

Title TRAFFIC CONTROL 2
Size ANSI D
Sheet No. C-508
Sheet 37 of 38



1 TRAFFIC CONTROL PLAN 1 (STA 24+50 TO STA 27+00)

SCALE: 1" = 20'



2 TRAFFIC CONTROL PLAN 2 (STA 31+00 TO STA 34+00)

SCALE: 1" = 20'

GENERAL SHEET NOTES

1. SEE SHEETS C-507 AND C-508 FOR GENERAL NOTES ON TEMPORARY TRAFFIC CONTROLS.

KEYNOTES

1. (E) DRIVEWAY
2. TEMPORARY BY-PASS CROSSING DRIVEWAY, SEE DETAIL 7/C-506
3. TRAFFIC CONES SPACING AT 35'

LEGEND

- CONCRETE BARRIER
- TRAFFIC CONES
- TRAFFIC DIRECTION
- 8" TEMPORARY BY-PASS
- TRAFFIC SIGN

HORIZONTAL SCALE: 1" = 20' (0, 10', 20', 40')

FOR CONSTRUCTION

No.	Issue	Drafting Check	Checked	Approved	Date
1	ADD TRAFFIC CONTROL PLAN		ACS	ACS	05.12.26

Author --- | Drafting Check JB | Project Manager ACS
Designer ACS | Design Check NK | Project Director MGK

Misc. GUAM WATERWORKS AUTHORITY

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Client GUAM WATERWORKS AUTHORITY

Project ACP WATER LINE REPLACEMENT - AJAYAN

Title TRAFFIC CONTROL PLAN

Size ANSI D

Project No. 12582394 | Date 04/24/2026 | Scale AS SHOWN

Sheet No C-509 | Sheet 38 of 38

Plot Date: 29 May 2026 - 5:28 PM | Plotted By: Julius Bonifacio | Filename: G:\661\12582394\Digital_Design\ACAD\Sheets\CTPS Trial\12582394-ACP Waterline Replacement - Ajayan-C-509.dwg

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Contract description.
2. Substantial completion
3. Training Budget Bid Item
4. Order of precedence of contract documents
5. Contractor's use of Site.
6. Work sequence.
7. Permits.
8. Cultural resources
9. Unexploded Ordnance
10. Specification conventions.

1.2 CONTRACT DESCRIPTION

A. Work of the project comprises the construction of replacement of asbestos concrete pipe (ACP) waterline. It includes performing close tolerance pipe slurrification (CTPS) for a one-mile length between Liyog Bridge and Ajayan Bridge on Route 4. The work also includes installation of a duct bank for fiber optic lines comprised of two four-inch conduit encased in concrete with handholes. All work installed, disinfected and tested as shown and specified, and complete and operable in accordance with the contract documents.

B. Perform work of contract under fixed cost contract with Owner according to conditions of contract.

C. The work to be performed under this contract shall consist of furnishing plant, tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work or other operations required for the fulfillment of the contract in strict accordance with the contract documents. The work shall be complete, and all work, materials, and services not expressly indicated or called for in the contract documents, which may be necessary for the complete and proper construction of the work in good faith, shall be provided by the Contractor as though originally so indicated, at no increase in cost to GWA.

1.3 SUBSTANTIAL COMPLETION

A. Substantial Completion is hereby defined as “the time at which the full length of the new waterline and duct bank as defined in the base bid are operational” and can be used for the purpose for which they are intended. Substantial Completion will be awarded for the project as a whole. The project will be considered substantially complete upon completion of the waterline

and pipe connections, disinfection, testing, and the site is fully functional and operable, including other preparations and proof of Guam EPA acceptance, as necessary for owner's use of the waterline and fiber-optic duct bank.

B. Project Milestones: Include the milestones specified herein as a part of the progress schedule required under Section 013216 – Construction Progress Schedule. Following is a detailed description of the project milestones, excluding any delays due to abnormal weather in accordance with Paragraph 1.7 of Section 013216.

1. Base Bid Substantial Completion: The Contractor shall begin work upon issuance of the Notice to Proceed (NTP) and base bid work shall be substantially complete as specified no later than 210 calendar days from NTP.

C. GWA shall have the right to utilize or place into service any item of equipment or other usable portion of the work prior to completion of the work. Whenever GWA plans to exercise said right, the Contractor will be notified in writing by GWA, identifying the specific portion or portions of the work to be so utilized or otherwise placed into service.

1. It shall be understood by the Contractor that until such written notification is issued, all responsibility for care and maintenance of all the work shall be borne by the Contractor. Upon issuance of said written notice of Substantial Completion, GWA will accept responsibility for the protection and maintenance of all such items or portions of the work described in the written notice.

D. **Liquated Damages for Delays relative to Substantial Completion work:** See Contract Documents.

E. Final Completion: Final Completion is defined as completing and having GWA accept all work required under this Bid. Work includes warranty work, replacement work and warranty periods required by law or this bid. Final Completion shall be no later than 30 calendar days following Substantial Completion. Include the Final Completion date as a project milestone of the progress schedule required under Section 013216 – Construction Progress Schedule.

1.4 ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS

A. In case of discrepancy between the contract documents, the order of precedence from the highest to lowest is as follows:
1. General and Special Conditions
2. Technical Specifications
3. Project Plan Details
4. Project Plan Sheets
5. GWA Standard Plans and Details
6. DPW Standard Plans

1.5 CONTRACTOR'S USE OF SITE

A. Limit use of site to allow:

1. GWA, or another GWA contractor, may utilize any part of the site. The Contractor shall cooperate and coordinate with GWA or their contractors to facilitate GWA's operations and to minimize interference with the Contractor's operations at the same time. In any event, GWA and their contractors shall be allowed access to the site during the period of construction.
2. See other requirements in Article 5 of the Standard General Conditions of the Construction Contract.

B. Construction Operations:

1. Limited to areas indicated on Drawings.
2. The Contractor's use of the site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.
3. Contractor shall be responsible for all areas of the site used by him or their Subcontractors in the performance of the work. Contractor will exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to GWA or others. Contractor has the right to exclude from the site all persons who have no purpose related to the work or its inspection, and may require all persons on the site (except GWA's employees or representatives) to observe the same regulations as he requires of his employees.
4. GWA does not warrant the condition of any existing pipeline or facility. The Contractor is cautioned that any fit-ups and connections to existing facilities may require a substantial amount of fit-up work. The Contractor shall be solely responsible for performing all work and for furnishing all materials, labor and equipment necessary to complete the work. The Contractor shall make necessary survey measurements of existing facilities and submit detailed shop drawings prior to the shutdown or staging to ensure proper fit-up.
5. The Contractor shall incorporate the construction and schedule constraints of this section in preparing the construction schedules required under Section 013216 – Construction Progress Schedule. The schedules shall include the Contractor's activities necessary to satisfy all constraints of the contract documents.

C. Time Restrictions for Performing Work:

1. All work shall be performed during regular working hours, unless otherwise approved by GWA.
2. Access to the site is limited to the hours between 8:00 AM and 5:00 PM, Monday to Friday except for legal holidays, unless otherwise approved by GWA. The Contractor shall not permit the performance of work requiring special inspection or QC or QA testing on Saturday, Sunday or any legal holidays without GWA's written consent given after submitting prior written request to the Contracting Officer a minimum of 72 hours in advance.
3. The Contractor shall pay for the Construction Manager's cost for approved general observance, special inspection, and QC or QA testing that are performed on Saturday, Sunday, or any legal holidays.

D. Utility Outages and Shutdown:

1. The Contractor shall schedule and conduct activities to enable the existing facilities to operate continuously, unless otherwise specified.

2. Modifications to existing facilities, the construction of new facilities, and the connection of new to existing facilities may require the temporary outage of existing water system service. In such cases, the Contractor shall coordinate work with the Contracting Officer and GWA as described below. The Contractor shall complete the GWA Scheduled Outage Request Form.
3. The Contractor shall perform work continuously during critical connections and changeovers as required to prevent interruption of GWA's operations. When necessary, plan, design and provide various temporary services, utilities, connections, temporary piping, access, and similar items to maintain continuous operations of GWA's facility at no additional cost to GWA.
4. The Contractor shall not close lines, open or close valves, or take other action which would affect the operation of existing systems. Only GWA staff is authorized to operate existing equipment, valves, and systems; and such request by the Contractor will be considered within 48 hours after receipt of Contractor's written request.
5. In addition to the construction schedule required under Section 013216 – Construction Progress Schedule, the Contractor shall submit a detailed outage plan and time schedule for all construction activities which will make it necessary to remove a tank, pipeline, electrical circuit, equipment, structure, road or other facilities from service. The Contractor shall schedule all connections to existing facilities with GWA and the interruption to system operations and services shall be held to a minimum. This may require outages to be scheduled at off-peak times. The cost for overtime labor of GWA staff required during an outage shall be borne by the Contractor and considered part of the cost of the outage.
6. The outage plans shall be submitted to the Contracting Officer for acceptance and receive a favorable review before submitting the outage request to GWA. The outage plan shall describe the Contractor's method; the length of time required to complete said operation; any necessary temporary power, controls, instrumentation or alarms required to maintain control and monitoring for the water system; detailed shop drawing showing pipe lengths, fittings, couplings, and pipe profiles as a minimum; and the manpower and equipment which the Contractor shall provide in order to ensure minimum outage time and proper operation of associated water system. The GWA water system has older fittings that may be difficult to remove and cause delays to an outage. The Contractor shall verify and research existing fittings that are to be removed or modified as part of the new connection and account for possible difficulties and delays in the timing of the outage plan. Details of possible methods of removal shall be included in the outage plan. All costs for preparing and implementing the outage plans shall be at no increase in cost to GWA.
7. Outages and service connections shall be performed during the dry weather season, unless specifically allowed to occur during the wet weather season. The outage plans shall be coordinated with the construction schedule and shall meet the restrictions and conditions of this section.
8. The removal of the existing system from service and reconnect the pipelines to resume service shall be completed no more than **8 hours** for each shut down. The Contractor shall perform all cutting, patching, and connection to existing facilities with extreme care and take all precautions necessary to ensure that the existing facilities are not damaged. The Contractor shall be responsible for dewatering of the existing lines and disposal of water as required at no additional cost to GWA.
9. The Contractor shall not begin an alteration affecting existing facilities until specific written approval has been granted by GWA in each case. An outage request shall be submitted to GWA a minimum of 14 calendar days in advance of the time that such outages are required. No more than one outage request will be considered per week. The Contractor shall coordinate the planned procedures with GWA. GWA has the authority to

modify any proposed shutdown procedures if such procedures would adversely impact the water system operations.

10. The Contracting Officer shall be notified in writing at least seven (7) calendar days in advance of the required outage if the schedule for performing the work has changed or if revisions to the outage plan are required.
11. The Contractor shall provide written confirmation of the shutdown date and time two (2) working days prior to the actual shutdown.

1.6 REPORTS OF PHYSICAL CONDITIONS

A. Existing Structures: In the preparation of the contract documents, the Engineer has relied upon the following drawings of physical conditions in or relating to the existing surface and subsurface structures, which are at or contiguous to the site that have been utilized in the preparation of the contract documents:

1. Government of Guam Public Utility Agency of Guam, “Inarajan Wastewater System”
2. Government of Guam Public Utility Agency of Guam, “Malojloj – Inarajan Water Transmission Line”
3. Government of Guam Public Utility Agency of Guam, “Inarajan – Merizo Water Facilities”
4. Government of Guam Public Utility Agency of Guam, “Malojloj – Inarajan Water Supply Development Project”
5. Government of Guam Public Utility Agency of Guam, “Water Transmission Line, Quinene Road, Merizo”

B. These reports and drawings are not part of the contract documents. Neither GWA nor the Engineer makes any representation as to the completeness of the reports or drawings referred to above or the accuracy of any data or information contained therein. The Contractor may rely upon the accuracy of the technical data contained in such reports and drawings, except for such physical dimensions that can be field verified; however, the interpretation of such technical data, including any interpolation or extrapolation thereof, and opinions contained in such reports and drawings are not to be relied on by the Contractor.

C. Data and information made available in these documents are for the Contractor’s information. GWA assumes no responsibility for any interpretation of or conclusion drawn from the data or information by the Contractor.

1.7 WORK SEQUENCE

A. **Order of Work:** The work shall be performed in such order or precedence as determined by the Contractor, subject to the conditions and restraints specified in this section and the approval of the Contracting Officer.

B. Except as specifically noted below, the Contractor shall not operate any valves or turn off or on or manipulate any controls or equipment on existing facilities.

C. Work shall be scheduled, sequenced, and performed in a manner that minimizes disruption to the public.

D. **Major Construction Sequencing Elements:** The following list of main construction sequencing elements is not all inclusive and is not intended to be a comprehensive description of all work. The Contractor shall review the list and ensure that each item, if awarded, is adequately considered and addressed in his construction schedule and work plan. It is the responsibility of the Contractor to identify and complete all related work that is required to comply with the stated sequence.

1. Mobilize prior to start of work.
2. Pothole to locate existing waterline and utilities as needed to confirm locations, sizes, crossing elevations and connection points.
3. Implement the Storm Water Pollution Prevention Plan ("SWPPP") and the erosion and sediment control measures.
4. Begin construction of CTPS by installing bypass line and verifying type of pipe, service locations, fitting locations, and repair locations. Perform CTPS in phases, including completion of testing, disinfection and connection of service laterals before moving to the next phase.
5. Construct the fiber-optic duct bank in phases following the CTPS as shown and specified including testing and appurtenances to allow for substantial completion of the facilities within the timelines specified.
6. Complete all remaining work and project closeout, including pavement restoration, finished grading, restoration seeding and all other work as required.

1.8 PERMITS

A. Promptly furnish and pay fees for all necessary permits for construction of work including, but not limited to, the following:

1. Building permit.
2. Highway Encroachment permit
3. Stormwater and erosion control permit.
4. Dewatering permit.
5. Disposal permit.
6. Utility clearances
7. SHPO clearances

B. The Contractor shall abide by the conditions of all permits and shall obtain proof of satisfaction of conditions from issuers of permits prior to acceptance of the work by the Owner.

C. Permitting and scheduling of the work with DPW and GWA is the responsibility of the Contractor.

1.9 CULTURAL RESOURCES

A. In accordance to the National Historic Preservation Act of 1966, (16 U.S.C. 470) and Guam laws applicable to historic preservation, including, but not limited to, 21 G.C.A. Chapter 76, the following procedures are implemented to insure historic preservation and fair compensation to the Contractor for delays attendant to cultural resource investigations.

B. In the event of potential historical, architectural, archeological or cultural resources (herein after cultural resources) are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:

1. The Contracting Officer (authorized representative) shall issue a "Stop Work Order" directing the Contractor to cease all construction operations at the location of such potential cultural find.
2. Such "Stop Work Order" shall be effective until such Time as a qualified archaeologist can be called to assess the value of these potential cultural resources and make recommendations to the state Historical Preservation Officer. Any "Stop Work Order" shall contain the following:
    a. A clear description of the work to be suspended;
    b. Any instructions regarding issuance of further orders by the Contractor for material services;
    c. Guidance as to action to be taken on subcontractors;
    d. Any suggestions to the Contractor as to minimization of his cost;
    e. Estimated duration of the temporary suspension;
3. If the archeologist determines that the potential find is a true cultural resource, at the direction of the state Historic Preservation Officer, the Contracting Officer shall extend the duration of the "Stop Work Order" in writing, and the Contractor shall suspend work at the location of the find.

C. Equitable adjustment of the construction contract shall be made in the following manner:
1. Time Extension
    a. If the work temporarily suspended is on the "critical path," the total number of days for which the suspension is in effect shall be added to the number of allowable contract days.
    b. If a portion of work at the time of such suspension is not on the "critical path" but subsequently becomes work on the critical path, the allowable contract time will be computed from the date such work is classified as on the critical path.
2. Additional Compensation
    a. If, as a result of a suspension of the work, the Contractor sustain a loss which could not have been avoided by his judicious handling of forces, equipment, and (plant) or redirection of forces or equipment to perform other work on the contract, there shall be paid to the Contractor an amount as determined by the Contracting Officer to be fair and reasonable compensation for the Contractor's actual loss in accordance with the following:
        1) Idle Time of Equipment - Compensation for equipment idle time will be determined on a force account (time and materials) basis, and shall include the cost of extra moving of equipment and rental loss.
        2) Idle Time of Labor - Compensation for idle time of workers will be determined by the Engineer as "labor" less any actual productivity factor of this portion of the work force.
        3) Increased Cost of Labor and Materials - Increased costs of labor and materials will be compensated only to the extent such increases was in fact caused by the suspension, as determined by the Engineer.
    b. Compensation for actual loss due to idle time of either equipment or labor shall not include markup for profit.
    c. The hours for which compensation will be paid will be the actual normal working time during which such delay conditions exist, but will in no case exceed eight hours in any one day.

d. The days for which compensation will be paid shall be full or partial calendar days, excluding Saturdays, Sundays, and legal holidays, during the existence of such delay.

D. Archaeological Monitoring: Contractor shall provide archaeological monitoring per Guam SHPO requirements and the project Archaeological Monitoring and Data Recovery Plan (AMDRP). Monitoring shall include the following:
1. Fieldwork
   a. Preliminary recordation of identified archaeological site and features identified during archaeological monitoring
   b. Recovery of artifacts
   c. Preliminary Assessment of identified site types and associations
   d. Consultation with GWA and Guam SHPO regarding findings
2. Data Analysis
   a. Analysis of recovered artifacts
   b. Radiocarbon dating
   c. GPS data processing
   d. GIS database development
   e. Report map production
3. Report Preparation and Production
   a. Draft and Final Reports including research methods, results of investigations, results of analyses, site significance evaluations, and recommendation for additional work (if needed)
   b. Preparation of GHPO Site Inventory form

E. Notwithstanding any provision above, Contractors will follow regulations promulgated by the Guam State Historic Preservation Office. The Guam State Historic Preservation Office is located at the Department of Parks and Recreation, Historic Resources Division, 490 Chalan Palayso, Agana Heights, Guam.

1.10 UNEXPLODED ORDNANCE

A. Stop all work immediately if any material or object believed to be unexploded ordnance or material potentially presenting an explosive hazard is encountered and execute first response protocols immediately. Follow Article 5.06, paragraphs E and F, of the General Conditions. Coordinate with the appropriate Government agency.

B. The Contractor shall not blow-in-place or counter-charge any unexploded ordnance.

1.11 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to Contractor unless specifically noted otherwise.

B. Omissions of such words and phrases as “The Contractor shall,” “in conformity therewith,” “shall be,” “as shown on the Drawings,” “a,” “an,” “the,” and “all” are intentional in streamlined zs.

1. Omitted words shall be supplied by inference in the same manner as when a note appears on the Drawings.
2. Omission of such words shall not relieve the Contractor from providing the items and work described herein or indicated on the Drawings.
3. Words “shall be” are included by inference where colon (:) is used within sentences or phrases.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 011000

SECTION 012000 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Schedule of Values.

B. Application for Payment.

C. Change procedures.

D. Defect assessment.

1.2 SCHEDULE OF VALUES

A. This section defines the process whereby the Schedule of Values (lump sum price breakdown) shall be developed and incorporated into the cost loading function of the CPM Schedule as specified in Section 013216 – Construction Progress Schedule. Monthly progress payment amounts shall be determined from the monthly progress updates of the CPM Schedule activities.

B. The Schedule of Values shall be developed independent but simultaneous with the development of the CPM Schedule activities and logic.

C. Submit electronic file to Contracting Officer of schedule on most recent version of AIA G703 - Continuation Sheet for G702.

D. Submit Schedule of Values as electronic file to Contracting Officer for review within 21 calendar days after date established in Notice to Proceed. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, sufficient detailed breakdown shall be provided to meet this requirement. The Contracting Officer shall be the sole judge of acceptable numbers, details and description of values established. If, in the opinion of the Contracting Officer, a greater number of Schedule of Values items than proposed by the Contractor is necessary, the Contractor shall add the additional items so identified by the Contracting Officer.

E. Format: The minimum detail of breakdown of the major work components is indicated below. Greater detail shall be provided as directed by the Contracting Officer.

1. Mobilization – Limited to five percent of the contract total, no breakdown required. Include obtaining all permits, bond and insurance; moving all equipment onto the site; furnishing and erecting temporary facilities and other construction facilities; implementing erosion and sediment control measures; and implementing security requirements. Request for payment after complete and permits approved.
2. Section 013216 – Construction Progress Schedule, broken down by submittal.

3. Piping work shall be at the full length, from and to contract termination points. Piping work shall be broken down into pipe replacement, fire hydrant, service connections, valves, HDD waterway crossing, pressure testing, disinfection, and disposal of asbestos containing material.
4. The duct bank work shall be at the full length, from and to contract termination points. Duct bank work shall be broken down into conduit installation and handhole installation.
5. General civil site work shall be broken down into traffic control, potholing, removal and disposal of existing fittings and non-asbestos containing materials, site concrete, pavement restoration, clearing and grubbing, and any other items determined to be necessary for the establishment of pay and schedule activity items.
6. Closeout and demobilization – no breakdown required.
7. All other work not specifically included in the above items shall be broken down as necessary for establishment of pay and schedule activity items as may be directed by the Contracting Officer.

F. Revise schedule to list approved Change Orders with each Application for Payment.

1.3 APPLICATION FOR PAYMENT

A. Submit two (2) copies of each Application for Payment on most recent versions of AIA G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702.

B. Content and Format: Use Schedule of Values for listing items in Application for Payment.

C. Submit updated progress construction schedule with each Application for Payment.

D. Payment Period: Monthly, first through the end of the month.

E. Submit submittals with cover letter.

F. Substantiating Data: When Contracting Officer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:

1. Record Documents as specified in Section 017000 - Execution and Closeout Requirements, for review by Contracting Officer, which will be returned to Contractor.
2. Affidavits attesting to off-site stored products.
3. Construction Progress Schedule, revised and current as specified in Section 013300 - Submittal Procedures.
4. Certified Payroll Reports for the general contractor and all subcontractors.

1.4 DEFECT ASSESSMENT

A. Replace the work, or portions of the work, not conforming to specified requirements.

B. If, in the opinion of Contracting Officer, Engineer of Record or GWA, it is not practical to remove and replace the work, Contracting Officer will direct appropriate remedy or adjust payment.

C. Individual Specification Sections may modify these options or may identify specific formula or percentage sum/price reduction.

D. Authority of GWA to assess defects and identify payment adjustments is final.

E. Nonpayment for Rejected Products: Payment will not be made for rejected products for any of the following reasons:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond lines and levels of the required work.
5. Products remaining on hand after completion of the work.
6. Loading, hauling, and disposing of rejected products.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 012000

SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Preinstallation meetings.

F. Closeout meeting.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and work of various sections of the plans and specifications to ensure efficient and orderly sequence of installation of interdependent construction elements.

B. project communication and submission of documents between the Contracting Officer (Construction Manager) and the Contractor shall be as directed by the Contracting Officer and/or GWA.

C. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing operating equipment in service.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit as closely as practical; place runs parallel with lines of building. Use spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

1. Coordination Drawings: Prepare as required to coordinate all portions of work. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided or to function as intended. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important.

E. Coordination Meetings: In addition to other meetings specified in this section, hold coordination meetings with personnel and subcontractors to ensure coordination of work.

F. In finished areas, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections in preparation for Substantial Completion.

H. After Owner's occupancy of premises, coordinate access to site for correction of defective work and work not complying with contract documents, to minimize disruption of Owner's activities.

I. Contractor to submit list of sub-contractors for review and approval/denial with the bid per requirements of the General Conditions. The information should include company history, performance, relevant work, available equipment, and roles in the project.

1.3 PRECONSTRUCTION MEETING

A. GWA and its Contracting Officer will schedule and preside over a meeting after Notice of Award and prior to the commencement of work at the site.

B. Attendance Required: Contracting Officer (Construction Manager), GWA, appropriate governmental agency representatives selected by GWA, major subcontractors, and Contractor’s project manager and superintendent.

C. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the Contractor prior to the meeting date. However, the Contractor should be prepared to discuss all of the items listed below.

D. Minimum Agenda:

1. Status of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Building Permit acquisition
5. Submission of list of subcontractors, list of products, schedule of values, Progress Schedule, and preconstruction submittals.
6. Communication procedures.
7. Procedures and processing of requests for interpretations, field decisions, submittals, substitutions, Applications for Payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.
9. Critical work sequencing.
10. Maintaining record documents.
11. Use of site and storage areas, security, housekeeping, and GWA’s needs.
12. Construction Waste Management Plan.
13. Survey and building layout.
14. Temporary utilities
15. Major equipment deliveries and priorities.
16. Contractor’s assignments for safety and first aid.
17. Daily reports.

18. Procedures for testing.

E. Contracting Officer: Record minutes and distribute to participants within seven (7) days after meeting.

F. The Contractor and its subcontractors should plan on the conference taking no less than four (4) hours, to cover the items listed in Paragraphs C and D, and review the Plans and Specifications, in extensive detail, with the Contracting Officer and GWA.

1.4 PROGRESS MEETINGS

A. The Contracting Officer will schedule and administer meetings throughout progress of the work at maximum weekly intervals.

B. Contracting Officer will make arrangements for meetings, prepare agenda with copies for participants, and preside over meetings.

C. Attendance Required: Contracting Officer, job superintendent, major subcontractors and suppliers, and Owner, as appropriate to agenda topics for each meeting.

D. Minimum Agenda:

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems impeding planned progress.
5. Review of submittal schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of Progress Schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on Progress Schedule and coordination.
13. Other business relating to work.

E. Contracting Officer: Record minutes and distribute to participants within five (5) working days after meeting.

1.5 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene preinstallation meetings at project site before starting work of specific section.

B. Convene preinstallation meetings at project site two (2) days before starting work for GWA system outage.

C. Require attendance of parties directly affecting, or affected by, work of specific section.

D. Notify Contracting Officer four (4) working days in advance of meeting date.

E. Prepare agenda and preside over meeting:

1. Review conditions of installation, preparation, and installation procedures.
2. Review coordination with related work.

F. Record minutes and distribute to participants within four (4) working days after meeting.

1.6 CLOSEOUT MEETING

A. Schedule project closeout meeting with sufficient time to prepare for requesting Substantial Completion. Preside over meeting and be responsible for minutes.

B. Attendance Required: Contractor, Contracting Officer, major subcontractors, GWA, and others appropriate to agenda.

C. Notify Contracting Officer and GWA a minimum of four (4) working days in advance of meeting date.

D. Minimum Agenda:

1. Turn over of facilities and systems.
2. Operations and maintenance manuals.
3. Testing.
4. Operation and maintenance instructions for Owner's personnel.
5. Contracting Officer’s inspection of work.
6. Contracting Officer’s preparation of an initial "punch list."
7. Procedure to request Architect/Engineer/Contracting Officer inspection to determine date of Substantial Completion.
8. Completion time for correcting deficiencies.
9. Inspections by authorities having jurisdiction.
10. Transfer of insurance responsibilities.
11. Partial release of retainage.
12. Final cleaning.
13. Preparation for final inspection.
14. Closeout Submittals:

    a. project record documents.
    b. Operating and maintenance documents.
    c. Operating and maintenance materials.
    d. Affidavits.

15. Final Application for Payment.
16. Contractor's demobilization of site.
17. Maintenance.

E. Contracting Officer: Record minutes and distribute to participants within five (5) working days after meeting, to Owner, Contractor, and those affected by decisions made.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 013000

SECTION 013216 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. Bar chart schedules.

D. Review and evaluation.

E. Updating schedules.

F. Inclement Weather Provisions of the Schedule.

G. Acceptance.

H. Distribution.

1.2 SUBMITTALS

A. The Contractor shall submit proposed preliminary bar chart schedule at the Preconstruction Conference defining planned operations for first 60 days of work, with general outline for remainder of work. The chart shall be so prepared to show the accomplishment of the Contractor's early activities (mobilization, permits, submittals necessary for early material and equipment procurement, submittals necessary for long lead equipment procurement, CPM submittals, initial site work and other submittals and activities required in the first 60 days).

B. Participate in review of preliminary and complete bar chart schedule jointly with Contracting Officer.

C. Within 14 calendar days after joint review of proposed preliminary Gantt bar chart, submit hard copy draft of proposed complete Original CPM Schedule in PDF format and scheduling software files in a format compatible with Primavera P6 software. In addition, provide any related computerized schedule report tabulations for review. This submittal shall have already been reviewed and approved by the Contractor's project manager, project superintendent, and the project estimator prior to submission. The Gantt chart shall describe the activities to be accomplished and their chronological relationships and show the critical path. The Contractor's attention is directed to the requirement that the schedule shall contain sufficient detail and information to cost load the CPM schedule in accordance with the approved schedule of values. Include written certification that major subcontractors have reviewed and accepted proposed schedule.

D. Submit updated Gantt bar chart schedules at the end of each calendar month and at least seven (7) calendar days prior to each Application for Payment.

E. Submit one (1) hard copy and electronic files (PDF and schedule software files).

F. Submit network schedules under transmittal letter form specified in Section 013300 - Submittal Procedures.

G. Schedule Updates:

1. Overall percent complete, projected and actual.
2. Completion progress by listed activity and subactivity, to within five (5) working days prior to submittal.
3. Changes in work scope and activities modified since submittal.
4. Delays in submittals or resubmittals, deliveries, or work.
5. Adjusted or modified sequences of work.
6. Other identifiable changes.
7. Revised projections of progress and completion.

H. Narrative Progress Report:

1. Submit with each monthly submission of Progress Schedule.
2. Summary of work completed during the past period between reports.
3. Work planned during the next two (2) month period, specify critical activities.
4. Explanation of differences between summary of work completed and work planned in previously submitted report.
5. Current and anticipated delaying factors and estimated impact on other activities and completion milestones.
6. The status of major material and equipment procurement.
7. Corrective action taken or proposed.

1.3 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel specializing in CPM scheduling with two years' minimum experience in scheduling construction work of complexity comparable to the project, and having use of computer facilities capable of delivering detailed graphic printout within 48 hours of request.

B. Contractor shall submit a statement of computerized CPM capability within 14 calendar days after Notice to Proceed to verify that either (1) the Contractor has in-house capability qualified to use CPM techniques or (2) the Contractor will arrange for the services of a CPM consultant so qualified. In either event the statement shall identify the individual who will perform the CPM scheduling and shall describe the construction project experience. The statement shall also identify the contact persons for the referenced projects with current telephone and address information.

1.4 GANTT BAR CHART SCHEDULES

A. Format: Gantt bar chart Schedule, to include at least:

1. Identification and listing in chronological order of those activities reasonably required to complete the work, including:

a. Subcontract work.
b. Major equipment design, fabrication, factory testing, and delivery dates including required lead times.
c. Move-in and other preliminary activities.
d. Equipment and equipment system test and startup activities.
e. Project closeout and cleanup.
f. Work sequences, constraints, and milestones.

2. Listings identified by specification section number.
3. Identification of the following:

a. Horizontal time frame by year, month, and week.
b. Duration, early start, and completion for each activity and subactivity.
c. Critical activities and project float.
d. Subschedules to further define critical portions of work.

B. All float in the schedule shall belong to the project. The computerized schedule report tabulations shall include the following:

1. Report of activities sorted by activity number. Activity numbers, where practical, shall correlate to the areas designated in the contract drawings and further defined in Section 011000 - Summary.
2. Report of activities sorted by early start date.
3. Report of activities sorted by total float.
4. Report of activities sorted by responsibility code. Responsibility codes shall be established for the Contractor, Contracting Officer, GWA, subcontractors, suppliers, etc. These codes shall be identified in the bar chart.
5. A successor-predecessor report which shall identify the successor and predecessor activities for each activity and ties between schedule activities.

1.5 REVIEW AND EVALUATION

A. Participate in joint review and evaluation of schedules with Contracting Officer at each submittal.

B. The monthly progress schedule update submittal will be reviewed with the Contractor during the first monthly construction progress meeting after the end of each calendar month. The goal of these meetings is to enable the Contractor and the Contracting Officer to initiate appropriate remedial action to minimize any known or foreseen delay in completion of the work and to determine the amount of work completed since the last month's schedule update. The status of the work will be determined by the percent complete of each activity in the updated CPM schedule. These meetings are considered a critical component of the overall monthly schedule update submittal, and the Contractor shall have appropriate personnel attend. As a minimum, these meetings shall be attended by the Contractor's Project Manager and General Superintendent. The Contractor shall plan on the meeting taking no less than 2 hours per week. Within seven (7) workdays after the monthly progress meeting, the Contractor shall submit the revised CPM schedule, the revised CPM computerized tabulations as noted in this section, the revised successor/predecessor report, and the project narrative reports as defined above and the Contractor's application for payment. Within five (5) workdays of receipt of the revised submittals, the Contracting Officer will either accept or reject the monthly schedule update

submittal. If accepted, the percent complete in the monthly update shall be the basis for the Application for Payment to be submitted by the Contractor. If rejected, the update shall be corrected and resubmitted by the Contractor before the application for payment for the update period will be processed.

C. Items discussed at monthly construction progress meetings may include status of major project components (percent complete, amount of time ahead or behind schedule) and an explanation of how the project will be brought back on schedule if delays have occurred, progress made on critical activities, explanations for lack of work on critical path activities, explanations for schedule changes, a list of critical activities scheduled to be performed within the next two-month period, status of major material and equipment procurement, delays encountered during reporting period, and assessment of inclement weather delays and effects on progress of work.

D. After review, revise schedules incorporating results of review, and resubmit within 10 calendar days.

1.6 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update schedules to depict current status of work.

C. Identify activities modified since previous submittal, major changes in work, and other identifiable changes.

D. Upon approval of a change order, include the change in the next schedule submittal.

E. Neither the submission nor the updating of the Contractor’s original schedule submittal nor the submission, updating, change, or revision of any other report, curve, schedule, or narrative submitted to the Contracting Officer by the Contractor under this Contract, nor the Contracting Officer’s review or acceptance of any such report, curve, schedule, or narrative shall have the effect of amending or modifying, in any way, the Contract Times or milestone dates or of modifying or limiting, in any way, the Contractor’s obligations under this Contract. Only a signed, fully executed change order can modify contractual obligations.

F. Indicate changes required to maintain date of Substantial Completion.

G. Submit sorts as required to support recommended changes.

H. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and its effect.

I. GWA reserves the right to require that the Contractor adjust, add to, or clarify any portion of the schedule which may later be discovered to be insufficient for the monitoring of the work or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions, or clarifications.

1.7 ABNORMAL WEATHER LOST WORK DAY PROVISIONS OF THE SCHEDULE

A. See 00800 Supplementary Conditions, Article 4, SC-4.05, 2. Adverse weather conditions.

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

B. In addition to the provisions of paragraph 1.7.A. above, to be eligible for a delay the weather must be experienced at the project site during the Contract period and must be found to be abnormal weather actually causing a delay to the completion of the project. It will be the Contractor's responsibility to prove in writing that a critical path activity was negatively affected. Weather delays occurring after the required completion date, prior to the date of the Notice to Proceed, and during other non-workdays will not be considered for a time extension. Time extension on account of inclement weather on weekends or holidays shall be granted only if the Contractor confirms in writing at least seven (7) calendar days in advance their intention to work on weekends or holidays.

C. All inclement weather delays during the original contract time or any extended period, regardless of when they are encountered, shall be non-compensable.

1.8 ACCEPTANCE

A. Acceptance of the Contractor's schedule by the Contracting Officer and GWA will be based solely upon compliance with the requirements. By way of the Contractor assigning activity durations and proposing the sequence of the work, the Contractor agrees to utilize sufficient and necessary management and other resources to perform the work in accordance with the schedule. Upon submittal of a schedule update, the updated schedule shall be considered the "current" project schedule.

B. Submission of the Contractor's progress schedule to GWA or Contracting Officer shall not relieve the Contractor of total responsibility for scheduling, sequencing, and pursuing the work to comply with the requirements of the contract documents, including adverse effects such as delays resulting from ill-timed work.

1.9 DISTRIBUTION

A. Following joint review, distribute copies of updated schedules to Contractor's project site file, to subcontractors, Contracting Officer, and Owner.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

GWA ACP Waterline Replacement - Ajayan

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 013216

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Definitions.

B. Submittal procedures.

C. Proposed product list.

D. Product data.

E. Use of electronic CAD files of Project Drawings.

F. Shop Drawings.

G. Samples.

H. Other submittals.

I. Design data.

J. Test reports.

K. Certificates.

L. Manufacturer's instructions.

M. Manufacturer's field reports.

N. Contractor review.

O. Contracting Officer review.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's and Contracting Officer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Architect/Engineer's and Contracting Officer's responsive action. Submittals may be rejected for not complying with requirements.

C. PDF: Portable Document Format is an open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed layout document format.

D. FTP: File Transfer Protocol is a standard network protocol used for the transfer of files between computers over a network. A FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

E. Cloud: Cloud Computing: the practice of using a network of remote servers hosted on the internet to store, manage, and process data, rather than a local server or a personal computer.

F. CMS: Construction Management Software: this specification refers strictly to Web-Based systems.

1.3 SUBMITTAL PROCEDURES

A. Within 14 calendar days after date of Notice to Proceed, the Contractor shall submit the following preconstruction submittal items to the Contracting Officer for review

1. A preliminary schedule of shop drawings, samples, products and proposed substitutes ("or approved equivalent") submittals listed in the bid.
2. A schedule of submittals based on the Contractor's priority, planned construction sequence and schedule, long-lead items, and size of submittal package.
3. A list of all permits and licenses the Contractor shall obtain indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.
4. Warranties on equipment provided. Note, Contractor is the warranty administrator for all goods/services provided under this Bid.
5. A 60-day plan of operation in accordance with the submittal of the preliminary bar chart schedule in Section 013216 – Construction Progress Schedule.

B. Within 30 calendar days after date of Notice to Proceed, the Contractor shall submit the following submittal items to the Contracting Officer for review

1. CTPS equipment to be used.
2. PVC pipe.

C. Transmit each submittal with Contracting Officer-accepted form.

D. Number submittal transmittal forms so each submittal is assigned a unique number, beginning with the specification section most pertinent to the submittal followed by a hyphen and sequential numbers. Mark revised submittals with original number and sequential revision letter suffix "A", "B", 'C", etc.

E. Identify: Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification section number appropriate to submittal.

F. Apply Contractor's stamp, signed, certifying that the Contractor has reviewed, approved, verified the products required, field dimensions, adjacent construction work, and coordination of information is according to requirements of the work and contract documents.

G. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items in the same specification section using a single transmittal form will be permitted only when the items

taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the Contracting Officer. Pages shall be numbered and shall be in order.

H. Format:

1. Minimum sheet size shall be 8½ inches by 11 inches, and maximum sheet size shall be 24 inches by 36 inches.
2. Number every page in a submittal in sequence.
3. Collate and staple or bind, as appropriate, each copy of a submittal; the Contracting Officer will not collate sheets or copies.
4. Where product data from a manufacturer is submitted, clearly mark and/or notate which model is proposed, with complete pertinent data capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports.
5. Present a sufficient level of detail for assessment of compliance with the contract documents.
6. All digital submittals may be directed by the Contracting Officer and/or GWA. Digital files shall follow format requirements. Digital files shall be PDF or acceptable file format for the type of submittal.

I. Electronic File Format

1. Provide all submittals in electronic format, with exception of samples items.
2. Name the file in this format, SSSSSS_QQX, where:
    a. SSSSSS: 6-digit numeric section number to which the submittal pertains.
    b. QQ: 2-digit sequential number assigned by contractor unique to each original submittal.
    c. X: revision letter; omit if original.
    d. Example: 033000_01A
3. PDF: provide files in Adobe PDF format.
    a. Compile the submittal file as a single, complete document, to include Transmittal Form described within.
    b. Generate PDF files from original documents with bookmarks so that the text included in the PDF files is both searchable and can be copied.
    c. If documents are scanned, Optical Character Resolution (OCR) routines are required.
    d. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file.
    e. When required, the electronic file must include a valid electronic signature, or scan of a signature.
4. AutoCAD: where specified, provide files in AutoCAD 2022 format.
5. Microsoft Excel (MS Excel): where specified, provide files in (.xlsx) format.
6. Microsoft Word (MS Word): where specified, provide files in (.docx) format.

J. Schedule submittals to expedite project. Coordinate submission of related items.

K. Electronic Submittal: For all electronic communication, Contractor shall strictly adhere to protocol to be provided by Contracting Officer at Preconstruction Conference.

1. Email: Email electronic submittal documents fewer than 10MB to an email address as directed by the Contracting Officer. Provide electronic documents over 10MB on an optical disc, or through some form of FTP service.
2. Cloud: The Contracting Officer may setup an account with a commercially available cloud storage service provider specifically for this project. Folders will be created for each section number. Upload submittal in corresponding folders. Send e-mail (without attachments) notifying Contracting Officer that submittals are uploaded. Contractor is responsible for obtaining access to the cloud storage service for all Contractor personnel requiring access at no additional cost to Contracting Officer.
3. CMS: The Contracting Officer may purchase or provide access to a CMS. The Contracting Officer will provide training on the use of the system and the process for uploading submittals and other documents for the project.

L. For each submittal for review, allow a minimum of 21 working days excluding delivery time to and from Contractor.

M. Identify variations in contract documents and product or system limitations that may be detrimental to successful performance of completed work.

N. Allow space on submittals for Contractor and Architect/Engineer/Contracting Officer review stamps.

O. When revised for resubmission, identify changes made since previous submission.

P. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

Q. Submittals not requested will not be recognized nor processed.

R. Incomplete, Disorganized, or Improperly Numbered Submittals: Architect/Engineer or Contracting Officer will not review and will return marked “unreviewed”. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Architect/Engineer or Contracting Officer.

1.4 PROPOSED PRODUCT LIST

A. Within 30 calendar days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

A. Product Data: Action Submittal: Submit to Contracting Officer for review for assessing conformance with information given and design concept expressed in contract documents.

B. Post electronic submittals as PDF electronic files to project website or submit electronic submittals via email as PDF electronic files.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute according to "Submittal Procedures" article and for record documents described in Section 017000 - Execution and Closeout Requirements.

1.6 ELECTRONIC CAD FILES OF PROJECT DRAWINGS

A. Electronic CAD Files of Project Drawings: May only be used to expedite production of shop drawings for the project. Reproductions of the contract drawings as shop drawings is unacceptable. Use for other projects or purposes is not allowed.

B. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:

1. Use of files is solely at receiver's risk. Architect/Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in contract documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in contract documents, notify Architect/Engineer of discrepancy and use information in hard-copy drawings and specifications.
2. CAD files do not necessarily represent the latest contract documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
3. User is responsible for removing information not normally provided on shop drawings and removing references to contract documents. Shop drawings submitted with information associated with other trades or with references to contract documents will not be reviewed and will be immediately returned.
4. Receiver shall not hold Architect/Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.
5. Receiver shall understand that even though Architect/Engineer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
6. Receiver shall not hold Architect/Engineer responsible for such viruses or their consequences, and shall hold Architect/Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.

1.7 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to Contracting Officer for assessing conformance with information given and design concept expressed in contract documents.

B. The term “Shop Drawings” as used herein shall be understood to include design calculations, shop-prepared drawings, fabrication, and installation drawings, erection drawings, list, graphs, catalog sheets, data sheets, and similar items.

C. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. When required by individual specification sections, provide shop drawings signed and sealed by a professional engineer responsible for designing components shown on shop drawings.

1. Include signed and sealed calculations to support design.
2. Submit shop drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
3. Make revisions and provide additional information when required by authorities having jurisdiction.

E. Post electronic submittals as PDF electronic files to project website or submit electronic submittals via email as PDF electronic files.

F. After review, produce copies and distribute according to "Submittal Procedures" article and for record documents described in Section 017000 - Execution and Closeout Requirements.

1.8 SAMPLES

A. Samples: Action Submittal: Submit to Contracting Officer for assessing conformance with information given and design concept expressed in contract documents.

B. Samples for selection as specified in product sections:

1. Submit to Contracting Officer for aesthetic, color, and finish selection.
2. Submit Samples of finishes, textures, and patterns for GWA selection.

C. Submit samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each sample, with full project information, specified physical characteristics and Manufacturer’s name.

E. Submit three (3) samples or the number specified in individual specification sections; Contracting Officer will retain one (1) sample.

F. Samples, as required herein, shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the work. The Contractor shall schedule sample submittals for acceptance such that the Contractor has sufficient time to provide the products or materials without delay to the construction schedule after the Contracting Officer selects colors and textures and no less than 45 calendar days prior to ordering such material for delivery to the site.

G. Unless indicated otherwise, all colors and textures of items presented in sample submittals shall be from the manufacturer’s standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in contract times or price, the Contractor shall clearly indicate same on the transmittal page of the submittal.

H. Reviewed Samples that may be used in the work are indicated in individual specification sections.

I. Samples will not be used for testing purposes unless specifically stated in specification section.

J. After review, produce copies and distribute according to "Submittal Procedures" article and for record documents described in Section 017000 - Execution and Closeout Requirements.

1.9 OTHER SUBMITTALS

A. Closeout Submittals: Comply with Section 017000 - Execution and Closeout Requirements.

B. Informational Submittal: Submit data for Contracting Officer's knowledge as contract administrator or for Owner.

C. Submit information for assessing conformance with information given and design concept expressed in contract documents.

1.10 TEST REPORTS

A. Informational Submittal: Submit reports for Contracting Officer's knowledge as contract administrator or for Owner.

B. Submit test reports for information for assessing conformance with information given and design concept expressed in contract documents.

1.11 CERTIFICATES

A. Informational Submittal: Submit certification by manufacturer, installation/application subcontractor, or Contractor to Contracting Officer, in quantities specified for product data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Contracting Officer.

1.12 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit manufacturer's installation instructions for Contracting Officer's knowledge as contract administrator or for Owner.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to Contracting Officer in quantities specified for product data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.13 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for Contracting Officer's knowledge as contract administrator or for Owner.

B. Submit report within 5 days of observation to Contracting Officer for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in contract documents.

1.14 CONTRACTOR REVIEW

A. Review for compliance with contract documents and approve submittals before transmitting to Contracting Officer.

B. Contractor: Responsible for:

1. Determination and verification of materials including manufacturer's catalog numbers.
2. Determination and verification of field measurements and field construction criteria.
3. Checking and coordinating information in submittal with requirements of work and of contract documents.
4. Determination of accuracy and completeness of dimensions and quantities.
5. Confirmation and coordination of dimensions and field conditions at site.
6. Construction means, techniques, sequences, and procedures.
7. Safety precautions.
8. Coordination and performance of work of all trades.

C. Stamp, sign, and date each submittal to certify compliance with requirements of contract documents.

D. Do not fabricate products or begin work for which submittals are required until approved submittals have been received from Contracting Officer. Products and work started without the review of a submittal shall be subject to rejection and replacement at the Contractor’s expense.

1.15 CONTRACTING OFFICER REVIEW

A. The Contracting Officer or Architect/Engineer will review and accept, or take other appropriate action upon, the Contractor's submittals such as shop drawings, product data and samples, but only for the limited purpose of checking for general conformance with information given and the design concept expressed in the contract documents. Corrections or comments made on the submittal or shop drawings during review do not relieve the Contractor from compliance with the requirements of the contract documents, including, without limitation, the plans, specifications and applicable laws, codes and regulations. Review of a specific item shall not include review of an assembly of which the item is a component.

B. Do not make "mass submittals" to Contracting Officer. "Mass submittals" are defined as six or more submittals or items in one (1) day or 15 or more submittals or items in one (1) week. If "mass submittals" are received, Contracting Officer's review time stated above will be extended

as necessary to perform proper review. Contracting Officer will review "mass submittals" based on priority determined by Contracting Officer after consultation with Owner and Contractor.

C. Informational submittals and other similar data are for Contracting Officer's information, do not require Contracting Officer's responsive action, and will not be reviewed or returned with comment.

D. If a submittal is returned to the Contractor marked “No Exceptions Taken,” formal revision and resubmission of said submittal will not be required.

E. If a submittal is returned to the Contractor marked “Make Corrections Noted,” formal revision and resubmission of said submittal will not be required.

F. Resubmittals:

1. If a submittal is returned to the Contractor marked “Amend-Resubmit,” the Contractor shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the Contracting Officer.
2. Resubmittal of portions of multi-page or multi-drawing submittals will not be accepted: For example, if a shop drawing submittal consisting of 10 drawings contains one (1) drawing noted as “Amend-Resubmit,” the submittal as a whole is deemed “Amend-Resubmit,” and 10 drawings are required to be resubmitted.
3. Every change from a submittal to a resubmittal or from a resubmittal to a subsequent resubmittal shall be identified and flagged on the resubmittal.

G. Rejected Submittals:

1. If a submittal is returned to the Contractor marked “Rejected-Resubmit,” the Contractor shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the Contracting Officer.
2. The resubmittal of rejected portions of a previous submittal will not be accepted.

H. Submittals made by Contractor that are not required by contract documents may be returned without action.

I. Submittal approval does not authorize changes to Contract requirements unless accompanied by change order.

J. Owner may withhold monies due to Contractor to cover additional costs beyond the second submittal review.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality control.

B. Submittals.

C. Owner’s Quality Assurance.

D. Tolerances.

E. References.

F. Labeling.

G. Testing and inspection services.

H. Manufacturers' field services.

I. Quality Control Program.

J. Owner Inspection.

1.2 QUALITY CONTROL

A. Specific quality control requirements for the work are indicated throughout the contract documents. The requirements of this section are primarily related to performance of the work beyond furnishing of manufactured products.

B. The term “Quality Control” (QC) includes inspection, sampling, testing and associated requirements performed by the Contractor, as means by which Contractor ensures that the construction, to include that performed by subcontractors and suppliers, complies with the requirements of the contract documents.

C. The term “Quality Assurance” (QA) refers to similar inspection and testing performed by GWA or the Contracting Officer to review the quality control process.

D. Contractor shall have the primary responsibility for QC. GWA will perform its own QA for the sole purpose of checking the Contractor’s QC program. The Contractor shall not use GWA’s QA program to satisfy or assist with the Contractor’s QC program and shall perform all necessary testing and other QC functions required for submittals and construction to assure a quality project. If the Contractor does not perform the minimum QC functions as outlined in this section and the detailed specifications, GWA will perform said QC and retain sufficient money as required from each pay request to reimburse GWA for performing Contractor’s QC.

E. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

F. Comply with specified standards as the minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

G. Perform work using persons qualified to produce required and specified quality.

H. Products, materials, and equipment may be subject to inspection by Architect/Engineer, Contracting Officer and Owner at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of contract documents.

I. Supervise performance of work in such manner and by such means to ensure that work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

1.3 SUBMITTALS

A. QC Program: Contractor shall submit a QC program satisfactory to GWA not later than 30 calendar days after receipt of the Notice-to-Proceed and prior to the commencement of work at the site.

1.4 OWNER'S QUALITY ASSURANCE

A. All work is subject to GWA's quality assurance inspection and testing at all locations and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract documents.

B. GWA's quality assurance inspections and tests are for the sole benefit of GWA and do not:

1. Relieve contractor of responsibility for providing adequate quality control measures;
2. Relieve contractor of responsibility for damage to or loss of the material before acceptance;
3. Constitute or imply acceptance;
4. Relieve contractor from coordinating with Guam DPW for acceptance; or
5. Affect the continuing rights of GWA after acceptance of the completed work.

C. The presence or absence of a quality assurance inspector does not relieve Contractor from any contract requirement.

D. Unless otherwise indicated, all sampling and testing will be in accordance with the methods prescribed in the referenced standards, as applicable to the class and nature of the article or materials considered; however, GWA reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of the Contracting Officer will assure GWA that the quality of the workmanship is in full accord with the contract documents.

1.5 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict with contract documents, request clarification from Contracting Officer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.6 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current as of date for receiving bids except where specific date is established by code.

C. Obtain copies of standards and maintain on site when required by product specification sections.

D. When requirements of indicated reference standards conflict with contract documents, request clarification from Contracting Officer before proceeding.

E. Neither contractual relationships, duties, or responsibilities of parties in contract nor those of Contracting Officer shall be altered from contract documents by mention or inference in reference documents.

1.7 LABELING

A. Label Information: Include manufacturer's or fabricator's identification and the following information, as applicable, on each label:

1. Model number.
2. Serial number.
3. Performance characteristics.

1.8 TESTING AND INSPECTION SERVICES

A. Employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.

1. Before starting work, submit testing laboratory name, address, and telephone number, and names of full-time professional engineer and responsible officer.
2. Submit copy of report of laboratory facilities' inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

B. Contractor shall not use the same independent third party for its QC as GWA selects for its QA. GWA will provide the testing agency to be used for QA upon request.

C. Independent firm will perform tests, inspections, and other services specified in individual specification sections and as required by Architect/Engineer, Contracting Officer, Owner, or authorities having jurisdiction.

1. Laboratory: Authorized to operate at project location.
2. Laboratory Staff: Maintain full-time professional engineer on staff to review services.
3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

D. Testing, inspections, and source quality control may occur on or off project site. Perform off-site testing as required by Architect/Engineer or Owner.

E. Contractor shall interrupt the work when necessary to allow testing, including sampling, to be performed by GWA or the Contractor. Contractor shall have no claim for an increase in contract price or contract times due to such interruptions. When testing activities, including sampling, are performed in the field by the testing firm's laboratory personnel, Contractor shall furnish personnel and facilities to assist in the activities for both GWA's program and the Contractor's program.

F. Reports shall be submitted by independent firm to Contracting Officer, Contractor, and authorities having jurisdiction, in duplicate, indicating observations and results of tests and compliance or noncompliance with contract documents.

1. Submit final report indicating correction of work previously reported as noncompliant.

G. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.

1. Notify Contracting Officer and independent firm 48 hours before expected time for operations requiring services.
2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

H. Employment of testing agency or laboratory shall not relieve Contractor of obligation to perform work according to requirements of contract documents.

I. Retesting or re-inspection required because of nonconformance with specified or indicated requirements shall be performed by same independent firm on instructions from Contracting Officer. Payment for retesting or re-inspection will be borne the Contractor at no additional cost to GWA.

J. Payment for additional costs from QA testing agency or laboratory for retesting or re-inspection required because of nonconformance with specified or indicated requirements or when work by Contractor is not ready at the time specified for inspection or test will be charged to Contractor by deducting testing charges from contract sum/price.

K. If test results and the quality of work are questionable in the opinion of GWA, confirmation testing - in addition to QC testing - may be ordered by GWA. If confirmation testing is ordered by GWA and the work does not pass the test, costs for such testing shall be paid for by Contractor at no additional cost to GWA. If confirmation tests are satisfactory, the costs for confirmation testing will be paid for by GWA at no additional cost to the Contractor. Testing services conducted by GWA for their QA are for the sole benefit of GWA; however, test results will be provided to Contractor.

L. Agency Responsibilities:

1. Test Samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Contracting Officer and Contractor in performance of services.
3. Perform indicated sampling and testing of products according to specified standards.
4. Ascertain compliance of materials and mixes with requirements of contract documents.
5. Promptly notify Contracting Officer and Contractor of observed irregularities or nonconformance of work or products.
6. Perform additional tests required by Contracting Officer.
7. Attend preconstruction meetings and progress meetings, as requested.

M. Agency Reports: After each test, promptly submit two (2) copies of report to Contracting Officer, Contractor, and authorities having jurisdiction. When requested by Contracting Officer, provide interpretation of test results. Include the following:

1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specification section.
6. Location in project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with contract documents.

N. Limits on Testing Authority:

1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of contract documents.
2. Agency or laboratory may not approve or accept any portion of the work.
3. Agency or laboratory may not assume duties of Contractor.
4. Agency or laboratory has no authority to stop the work.

1.9 MANUFACTURER'S FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel, a regular employee of the manufacturer (not the local supplier), to observe site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, and commissioning as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Contracting Officer 30 calendar days after date established in Notice to Proceed. Observer is subject to approval of Contracting Officer.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

D. Refer to Section 013300 - Submittal Procedures, "Manufacturer's Field Reports" Article.

1.10 QUALITY CONTROL PROGRAM

A. Quality Control Program: The Contractor shall develop a detailed written QC Program for all work required under Divisions 0 thru 40, and it shall be reviewed and approved by the Contracting Officer prior to commencement of the work. The QC program shall be submitted to the Contracting Officer for approval per Section 013300 – Submittal Procedures. The Contractor shall appoint a full time QC Officer who will have the sole responsibility for monitoring the implementation of the QC Program.

B. The QC program manual as a minimum shall contain the following:

1. Project Organization Chart: Contractor shall provide an organizational flow chart and individual responsibilities with respect to QC, including:
    a. All essential Contractor personnel and subcontractors shall be outlined by title, function, and name.
    b. Field personnel responsible for QC functions shall be named.
    c. Job functions shall be provided detailing work responsibilities relating to QC.
    d. Qualifications and experience shall be provided for each individual named in Items a and b above.
2. Contractor shall name the independent testing laboratory/laboratories and show their organizational relationship, including all special inspectors required.
3. Policy for providing training and/or certifications to their personnel to perform QC functions.
4. Contractor shall provide a statement in their QC Program that the Contractor shall submit to the Contracting Officer for approval, the qualifications of any individual proposed as a new or alternate QC Officer during the course of the project.

C. Stop Work Authority: Contractor shall provide the names of the individuals who have authority to stop work, which does not comply with the contract requirements. Each location or activity of work shall have a field Quality Control Representative (who reports to the Quality Control Officer) with the “Stop Work Authority” overseeing the work.

D. Documentation and Records: Contractor shall describe the levels of responsibilities for documentation control and transmittal of records/information to the Contracting Officer, including but not limited to:

1. Submittal procedures,
2. As-built procedures,
3. Material and Equipment delivery and tracking procedures,
4. Test reporting and quantity tracking procedures,
5. Deficiency/Non-compliance reporting, resolution, and tracking procedures,
6. Transmittal procedures and time frames, and

7. Audit procedures and frequencies of QC Program.

E. Quality Control Reports: Contractor shall detail their procedures for reporting the QC testing and inspections activities and problem resolutions performed. The Contractor shall provide a description of each type of report and an example of each report form shall be included as an appendix to the QC program manual. The QC reports shall include at a minimum:

1. Daily QC reports,
2. Monthly reports summarizing all QC activities, testing, and reports, and
3. Final certified report.

F. Inspection and Testing Notification and Reporting: Contractor shall provide the procedure on how verbal and written notifications shall be issued to the Contracting Officer of inspections and testing to be performed on upcoming activities. Minimum time frames for notifications shall be outlined by the Contracting Officer. Contractor shall utilize 'Inspection Sign-Off' forms which shall be used at a minimum, for each of the major activities of work. "Inspection Sign-Off' forms shall include signatures from both the Contractor's QC representative and the Contracting Officer's representative(s). Contractor shall include, as an appendix to the QC Program Manual, copies of the Inspection and Testing Notification forms. At a minimum the Contractor shall include:

1. Notifications of inspections and/or testing forms
2. Inspection Sign-Off forms
3. Minimum 1-work week schedule of concrete pours, compaction testing, and special inspections, detailing location(s), quantity(ies), date(s), and approximate time(s) of pours

G. Contractor shall coordinate with Guam DPW for any required inspections by DPW personnel for acceptance of the project.

H. Inspection and Testing Procedures: Contractor shall provide written procedures defining methods of construction, control measures and the performance of inspections and testing for the different types of work. The procedures shall detail "Hold Points", where work shall not proceed until the required QC and/or GWA QA functions are performed and documentation shows the work meets the requirements of the contract. The procedures shall detail problem resolution steps in the event the work does not meet the contract specifications. Contractor shall state that new procedures shall be submitted to the Contracting Officer for approval, as deemed necessary by either the Contracting Officer or Contractor, during the course of the work. Procedures shall be provided for all major activities of work and shall be provided for more specific items of work, as deemed necessary by either the Contracting Officer or Contractor, to properly control the work. Major work activities shall include, but not be limited to:

1. Earthwork
2. Asphalt concrete
3. Portland cement concrete
4. Pipe installations
5. Mechanical installations
6. Equipment installations
7. Electrical installations
8. Instrumentation and control installations
9. Painting and protective coatings
10. All quality control activities required for Divisions 2 through 40 inclusive

I. Failing Inspections or Tests: Contractor shall provide procedure(s) detailing actions to be taken when tests show the Material or item of work does not meet the minimum contract requirements. In order to control failing QC and Quality Assurance inspections and/or testing, Contractor shall perform 'informational testing." Contractor shall detail how informational testing will be utilized prior to requesting any acceptance inspection and/or testing from GWA. Informational testing shall be performed by the Contractor to determine the amount of effort necessary to provide work which is in compliance with the contract documents. Informational testing shall be performed in addition to the minimum testing required by the contract and approved QC Program. Passing informational test(s), which represent the work being performed may be submitted as part of the minimum testing required by the contract and approved QC Program, only if GWA was given proper advance notification of the testing. Informational testing is not required to be submitted to GWA as part of the QC documentation but shall be made available for review at GWA's request.

J. Conflict Resolution: Contractor shall propose what procedures shall be followed whenever there is disagreement between the Contractor's Quality Control and GWA's Quality Assurance inspection and/or test results. Third party inspections and/or testing may be proposed under the following conditions:

1. The third party shall be a separate independent laboratory, meeting the minimum qualifications set forth above , not performing any additional work for the Contractor, subcontractors and/or suppliers.
2. The third party shall be agreed to by both the Contractor and GWA.
3. Costs for the third party testing shall be paid as follows:

    a. Initial inspection or test for the disputed work in question shall be included as part of contract, paid for by the Contractor.
    b. If the third party's inspection and/or test results reflect GWA's results, Contractor shall pay for any additional inspection(s) or testing performed by the third party after the initial inspection or test.
    c. If the third party's inspection and/or test results reflect the Contractor's results, GWA shall pay for any additional inspection(s) or testing performed by the third party after the initial inspection or test.

4. Compensation for third party conflict resolution, for each instance of conflict between the Contractor's and GWA's inspection and/or testing, shall be as provided in Items 1 through 3 above.

K. Subcontractor QC Programs: Contractor shall certify in writing that the Contractor is responsible for quality control on the project and the Contractor's QC Program shall govern over all the work, including all subcontractors. In the event a subcontractor has a QC Program, the Contractor shall include it as an appendix to the Contractor's QC Program. The subcontractor's QC Program shall at a minimum provide the requirements set forth in this specification, tailored to the subcontractor's scope of work. The Contractor shall detail each subcontractor's level of QC responsibilities within the Contractor's QC Program.

L. Testing and Inspection Quantities and Frequencies: Contractor shall include, as an appendix to the Contractor's QC Program, a list of all items of work and material to be inspected and/or tested for the work. The Testing and Inspection Quantities and Frequencies list shall be used to verify the minimum frequency of QC testing and/or inspections required are being performed.

In all cases the minimum testing frequencies required in the contract documents shall maintain precedence. The list shall include the following:

1. Estimated quantity of all material or work expected to be incorporated into the project
2. Type(s) of inspections, certifications and/or tests required
3. Expected minimum number of tests and/or inspections to be performed

M. Testing Timetable: Contractor shall provide a list of all tests expected to be performed by the Contractor, Independent testing laboratory, subcontractor, Special Inspector, or other denoted Quality Control field representative stating the time required to perform the test and/or inspection which includes the time required to obtain the results. The Testing Timetable list shall be referenced within the Contractor's Inspection and Testing Procedures as hold points until the results have been obtained and transmitted to the appropriate Quality Control representative and the Contracting Officer.

N. Program Revisions

1. QC is an on-going process throughout the duration of the work. Revisions, modifications, additions, and/or deletions to the procedures set forth in the approved QC Program may be necessary at any time during the life of the contract work. Such revisions, modifications, additions, and/or deletions to the procedures may be requested by the Contractor or ordered by the Contracting Officer.
2. Contractor shall submit for approval any revisions, modifications, additions, and/or deletions to the procedures. All revisions, modifications, additions, and/or deletions to the QC procedures shall be submitted in accordance with Section 013300 – Submittal Procedures. All work affected by any revisions, modifications, additions, and/or deletions to the procedures shall not be performed until they are approved by the Contracting Officer for incorporation into the Contractor's QC Program. No increase in contract times or Price shall be due the Contractor for any delays to the contract work caused by any such revisions, modifications, additions, and/or deletions to the QC procedures whether or not such changes were requested by the Contractor or ordered by the Contracting Officer.

O. Contractor's Quality Control Officer shall input a detailed daily Quality Control Report that summarizes all testing and quality control activities performed that day as part of the Contractor's Daily Report.

P. Progress Pay Estimate: The approval of the initial progress pay estimate is dependent on the acceptance of the Quality Control Program by GWA.

Q. Noncompliance Report

1. If any work is not performed in accordance with the contract documents, GWA may issue a Noncompliance Report (NCR). With the issuance of an NCR, GWA reserves the right to withhold payment for the work in question until such time as that work has been corrected and is in compliance with the contract documents.
2. Noncompliance reports shall be corrected immediately unless otherwise agreed to in writing with GWA.

R. Final Reporting: Contractor shall submit a final report cataloging all test results prior to final payment. The final report shall contain a certification by the testing laboratory indicating that all reports are included and were performed in accordance with the contract documents.

1.11 OWNER INSPECTION

A. Owner's Access: At all times during the progress of the work and until the date of final completion, afford GWA and Contracting Officer reasonable, safe, and proper facility for inspecting and performing testing for all work at the site or at the manufacturer facilities. Any observation, inspections, and/or testing performed by GWA shall not relieve the Contractor of the Contractor's obligations to perform the QC inspections, sampling and/or testing required under this contract. Contractor shall replace work rejected due to faulty design, inferior or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the contract documents, with satisfactory work at no additional cost to GWA. Contractor shall replace as directed, finished or unfinished work found not to be in strict accordance with the contract, even though such work may have been previously approved and payment made therefor.

B. Rejection: GWA and the Contracting Officer shall have the right to reject materials and workmanship which are defective or require correction. Contractor shall promptly remove rejected work and materials from the site.

C. Removal for Examination: Should it be considered necessary or advisable by GWA or GWA's authorized representatives, at any time before final acceptance of the work, to make examinations of portions of the work already completed, by removing or tearing out such portions, Contractor shall promptly furnish all necessary facilities, labor, and material, to make such an examination. If such work is found to be defective in any respect, Contractor shall defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, the cost of examination and restoration of the work will be considered a change in the work to be paid for in accordance with applicable provisions of the contract.

D. Operation Responsibility: Contractor shall assume full responsibility for the proper operation of equipment during tests, start-up and training sessions. Contractor shall make no claim for damage which may occur to equipment prior to the time when GWA accepts the work.

E. Rejection Prior to Warranty Expiration: If, at any time prior to the expiration of any applicable warranties or guarantees, equipment is rejected by GWA, Contractor shall repay to GWA all sums of money received for the rejected equipment on progress certificates or otherwise on account of the contract lump sum prices, and upon the receipt of the sum of money, GWA will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. Contractor shall not remove the equipment from the premises of GWA until GWA obtains from other sources equipment to take the place of that rejected. GWA hereby agrees to obtain other equipment within a reasonable time and the Contractor agrees that GWA may use the equipment furnished by the Contractor without rental or other charge until the other new equipment is obtained. After rejected equipment is replaced, Contractor shall remove rejected equipment from the site at no cost to GWA.

F. Work buried prior to examination by GWA or the Contracting Officer shall be re-excavated for examination at no additional cost to GWA.

G. Contractor shall reimburse GWA for the costs of any job site inspection and testing between the hours of 4:30 p.m. and 7:00 a.m. Monday through Saturday, and all day Sundays and legal holidays.

H. Special Inspection

1. Special inspections shall be provided by and the responsibly of the Contracting Officer /Owner and conducted in accordance with provisions of IBC 2009 Section 1704.
2. In addition to the inspection procedures and requirements of IBC 2009, the Contracting Officer/Owner shall employ one or more DPW - approved special inspector(s), as required by and acceptable to the DPW/building Official, who shall provide "special inspections" during construction.
3. Special inspection shall cover, but not be limited to, the following type of work:
   a. Concrete
   b. Anchor bolts installed in concrete
   c. Reinforcing steel
   d. Epoxy dowels and anchors
   e. Mechanical anchors
   f. Structural welding and high strength bolting
4. Special Inspector shall furnish signed testing and inspection reports to the Contracting Officer and the Contractor indicating the work inspected on a daily and/or weekly basis as the discretion. Discrepancies shall be brought to the immediate attention of the Contractor for correction, then, if uncorrected, to the Contracting Officer.
5. Final Report: Special Inspector shall submit a final report stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the construction documents and the applicable provisions of the building code.
6. On a weekly basis, the Contractor shall provide a two week look-ahead schedule specifically for work requiring special inspections. Special inspection requests shall be in writing and received by the Contracting Officer a minimum of two (2) full working days prior the desired inspections. Failure to provide two (2) full working days advance notice shall not be grounds for a delay claim or time extension.
7. The contractor shall cause the work to remain accessible and exposed for inspection purposes during the hours of 8:00 AM through 5:00 PM, Monday to Friday unless otherwise agreed to by the Contracting Officer.
8. The Contractor shall not permit the performance of work requiring special inspection or QA testing on Saturday, Sunday or any legal holidays without the written consent after submitting prior written request to the Contracting Officer a minimum of three (3) full working days in advance.
9. It shall be at the contractor's expense if removal and replacement of materials are required to allow inspection.
10. The special inspector shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by the contractor.
11. The contractor shall be solely responsible for final quality control review of work to ensure that items observed by the special inspector shall not have been moved, removed, displaced or dislodged by the various subcontractors working on the site between inspection and completion of work.
12. Contractor shall pay for all related costs such as re-work, including material replacement, and re-testing when non-conforming work has been found resulting from tests and inspections.
13. The special inspection final report shall document the required special inspections and corrections of discrepancies noted in the inspections. It is not a guarantee or warranty that

the final construction is in complete conformance with the construction documents nor the workmanship provisions of the building code.

14. Acceptance as a result of inspection shall not be construed as an acceptance of a violation of building code provisions or other ordinances of the Guam jurisdiction.
15. Substitution as a result of an inspection shall not be allowed. The contractor shall seek the approval of the engineer of record for any changes or substitutions.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 INSTALLATION

A. Inspection: The Contractor shall inspect materials or equipment upon the arrival on the site and immediately prior to installation and reject damaged and defective items.

B. Measurements: The Contractor shall verify measurements and dimensions of the work, as an integral step of starting each installation.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities:

1. Temporary electricity.
2. Temporary lighting for construction purposes.
3. Temporary water service.
4. Temporary sanitary facilities.

B. Construction Facilities:

1. Field offices and sheds.
2. Vehicular access.
3. Parking.
4. Progress cleaning and waste removal.
5. Project identification.
6. Fire-prevention facilities.

C. Temporary Controls:

1. Barriers.
2. Security.
3. Water control.
4. Dust control.
5. Erosion and sediment control.
6. Pollution control.

D. Removal of utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

A. Provide, maintain and pay for power service required from utility source as needed for construction operation.

B. Provide power outlets with branch wiring and distribution boxes located as required for construction operations. Provide suitable, flexible power cords as required for portable construction tools and equipment. Electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.

C. Provide main service disconnect and overcurrent protection at convenient location and meter.

D.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain lighting for construction operations conducted at night or under conditions of deficient daylight to insure proper work and to afford adequate facilities for inspection and safe working conditions.

1.4 TEMPORARY WATER SERVICE

A. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations. Coordinate with GWA for obtaining water service connection to existing water source and install backflow preventer per GWA standards. Allow three (3) week notice to GWA. Provide separate metering and reimburse Owner for cost of water used. Pay all fees for the water meter and all other charges for water use.

B. Extend branch piping with hose bibs located so that water is available by hoses with threaded connections.

C. The Contractor shall provide and operate all pumping facilities, pipelines, valves, hydrants, storage tanks, and all other equipment necessary for the adequate development and operation of the temporary water supply system. Water used for domestic purposes shall be free of contamination and shall conform to the requirements of Guam EPA for potable water. The Contractor shall be solely responsible for the adequate functioning of its water supply system and shall be solely liable for any claims arising from the use of same, including discharge or waste of water therefrom.

D. The Contractor shall not operate existing valves or fire hydrants.

1.5 TEMPORARY SANITARY FACILITIES

A. Provide and maintain fixed or portable chemical toilets wherever needed for the use of Contractor’s employees. Provide facilities at time of project mobilization. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for Construction and applicable safety laws of Guam.

B. Establish a regular weekly collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor’s operations shall be disposed of away from the site in a manner satisfactory to the Contracting Officer and in accordance with all laws and regulations pertaining thereto.

C. No permanent sewer connection shall be made by the Contractor.

1.6 FIELD OFFICES AND SHEDS

A. Provide field offices as needed for use by the contractor. Contractor is responsible to provide the location.

B. Storage Areas and Sheds: Size to storage requirements for products of individual sections, allowing for access and orderly provision for maintenance and inspection of products to suit requirements in Section 016000 - Product Requirements.

C. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings. Place six (6) inches thick compacted base rock around temporary structures and a path to the parking area to provide all-weather access.

D. Maintenance and Cleaning:
   1. Maintain walks free of mud, water, and the like.

1.7 VEHICULAR ACCESS

A. Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, and hospitals. Safe and adequate public transportation stops and pedestrian crossings at intervals not exceeding 300 feet shall be provided. The Contractor shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time.

B. Extend and relocate vehicular access as work progress requires and provide detours as necessary for unimpeded traffic flow.

C. Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the work hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No street shall be closed to the public without first obtaining permission of the Contracting Officer and proper governmental authority. Where excavation is being performed in primary streets or highways, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Toe boards shall be provided to retain excavated material if required by the Contracting Officer or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the Contractor to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.

D. Provide unimpeded access for emergency vehicles.

E. Provide and maintain access to control valves free of obstructions.

F. Provide means of removing mud from vehicle wheels before entering streets.

G. Investigate the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the work. It shall be the Contractor's responsibility to construct and maintain any haul roads required for its construction operations.

1.8 PARKING

A. Provide temporary gravel surface parking areas to accommodate construction personnel.

B. Locate as approved by Contracting Officer.

C. If site space is not adequate, provide additional off-site parking.

D. Tracked vehicles are not allowed on paved areas.

E. Designate 1 parking space for Contracting Officer.

F. Maintenance:

1. Maintain traffic and roads in sound condition free of excavated material, construction equipment, products, mud, and the like.
2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original condition.

G. Removal, Repair:

1. Remove temporary materials and construction at Substantial Completion.
2. Remove underground work and compacted materials to depth of 2 feet; fill and grade site as indicated and to the satisfaction of the Contracting Officer.
3. Repair existing and permanent facilities damaged by use, to original condition and to the satisfaction of the Contracting Officer.

H. Mud from site vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.9 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Collect and remove waste materials, debris, and rubbish from site weekly and dispose of off-site. Comply with Section 017419 - Construction Waste Management and Disposal.

1.10 PROJECT IDENTIFICATION

A. Project Identification Sign:

1. Two painted signs for the project installed at sites designated by GWA, 32-sq ft area, bottom 6 feet aboveground.
2. Content:

a. Project number, title, and GWA and CCU logos.
b. Names and titles of Contracting Officer and Engineer.
c. Name of Prime Contractor and major Subcontractors.

d. Other information per GWA and as shown on sample signs.

3. Graphic Design, Colors, and Style of Lettering: Designated by GWA.

B. Design sign and structure to withstand 100-mph wind velocity.

C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

D. Show content, layout, lettering, color, and sizes.

E. Sign Materials:

1. Structure and Framing: New wood, structurally adequate.
2. Sign Surfaces: Exterior grade plywood with medium-density overlay, minimum of 3/4 inches thick, single piece without joints.
3. Rough Hardware: Galvanized.
4. Paint and Primers: Exterior quality, two coats; sign background of white color.
5. Lettering: Exterior quality paint, colors as selected or precut vinyl self-adhesive products.

F. Installation:

1. Install project identification sign within 15 calendar days after date established by Notice to Proceed.
2. Erect at location of high public visibility adjacent to main entrance to site and acceptable to the Contracting Officer.
3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
4. Install sign surface plumb and level, with butt joints. Anchor securely.
5. Paint all exposed surfaces of sign, supports, and framing.

G. Maintenance: Maintain clean signs and supports; repair deterioration and damage.

H. Removal: Remove signs, framing, supports, and foundations at completion of project and restore area.

1.11 FIRE-PREVENTION FACILITIES

A. Prohibit smoking near equipment. Designate area on site where smoking is permitted. Provide approved ashtrays in designated smoking areas.

B. Establish fire watch for cutting, welding, and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

C. Portable Fire Extinguishers: NFPA 10; 10-pound capacity, 4A-60B: C UL rating.

1. Provide minimum of one (1) fire extinguisher in every construction trailer and storage shed.

1.12 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, and to protect existing facilities and adjacent properties from damage from construction operations.

1.13 SECURITY

A. Security Program:

1. Protect work from theft, vandalism, and unauthorized entry.
2. Initiate site security system and program at project mobilization which shall provide adequate 24-hour security for the construction facilities and stored and installed material at the site. The Contracting Officer shall be the judge of what is considered adequate security. Considerations will include, but not be limited to, the following:

    a. Provide and maintain temporary security fences as necessary to protect the work and Contractor-furnished products not yet installed.
    b. Provide off-site approved and bonded storage area.
    c. Remove temporary fences and restore site to original condition at completion of the work.

3. Maintain program throughout construction period until Owner's acceptance precludes need for Contractor's security. This includes non-working hours, weekends, and holidays.
4. Provide the Contracting Officer with a list of 24-hour emergency phone numbers.
5. The Contractor is wholly responsible for the security of the construction facilities, storage compound and laydown areas, and for all their plant, material, equipment and tools at all times. This includes the contents of the Contracting Officer and GWA field office in the event of theft.

B. Entry Control:

1. Restrict entrance of persons and vehicles to project site and existing facilities.
2. Allow entrance only to authorized persons with proper identification.
3. Maintain log of workers and visitors and make available to Owner on request.
4. Maintain the program throughout the construction period.

C. Security Service:

1. Employ uniformed guard service to provide guards on site during nonworking hours, weekends, and holidays as needed.

1.14 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain necessary pumping equipment.

B. Protect site from puddles or running water. Provide water barriers as required to protect site from soil erosion.

1.15 DUST CONTROL

A. Execute work by methods that minimize raising dust from construction operations.

B. Provide positive means to prevent airborne dust from dispersing into atmosphere.

1.16 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from excavation and stockpiles. Prevent erosion and sedimentation.

B. Minimize surface area of bare soil exposed at one time.

C. Provide temporary measures including berms, silt fence, fiber rolls, and other devices to prevent water flow.

D. Periodically inspect earthwork to detect evidence of erosion and sedimentation. Promptly apply corrective measures.

E. Comply with sediment and erosion control plan indicated on drawings.

1.17 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.

B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials before Final Application for Payment and final inspection.

B. Remove underground installations to minimum depth of 2 feet. Grade site as indicated on drawings.

C. Clean and repair all damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

GWA ACP Waterline Replacement - Ajayan

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Equipment electrical characteristics and components.

1.2 PRODUCTS

A. At minimum, comply with specified requirements and reference standards.

B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.

C. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that manufacturer's production capacity can provide sufficient product, on time, to meet project requirements.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Comply with delivery requirements in Section 017419 - Construction Waste Management and Disposal.

B. Transport and handle products according to manufacturer's instructions.

C. Products shall be transported by methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.

D. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products according to manufacturer's instructions and by methods and means, which will prevent damage, deterioration, and loss including theft.

B. Store products with seals and labels intact and legible.

C. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.

D. For exterior storage of fabricated products, place products on sloped supports aboveground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products; use methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Products complying with specified reference standards or description.

B. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit Request for Substitution for any manufacturer not named, according to Article 7 of the General Conditions.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 016000

SECTION 017000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Field engineering.

B. Closeout procedures.

C. Asset Register

D. Project record documents.

E. Operation and maintenance data.

F. Manual for materials and finishes.

G. Manual for equipment and systems.

H. Spare parts and maintenance products.

I. Product warranties and product bonds.

J. Maintenance and Guarantee.

K. Execution.

L. Cutting and patching.

M. Protecting installed construction.

N. Final cleaning.

1.2 FIELD ENGINEERING

A. Employ Guam licensed and registered land surveyor and acceptable to Contracting Officer.

B. Locate, verify and protect survey control and reference points. Promptly notify Contracting Officer of discrepancies discovered.

C. Control datum for survey is indicated on Drawings.

D. Verify setbacks, easements, and right-of-way lines in relation to the work prior to and after construction; confirm Drawing dimensions and elevations.

E. Provide field engineering services. Establish elevations, lines, and levels using recognized engineering survey practices.

F. Submit copy of site drawing and certificate signed by Guam licensed and registered land surveyor certifying elevations and locations of the work are in conformance with contract documents.

G. Maintain complete and accurate log of control and survey work as work progresses.

H. On completion of foundation walls and major site improvements, prepare certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

I. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

J. Promptly report to Contracting Officer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

K. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Contracting Officer.

1.3 CLOSEOUT PROCEDURES

A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire work or for portions of work:

1. Submit maintenance manuals, project record documents, and other similar final record data in compliance with this section.
2. Complete facility startup, all testing and disinfection.
3. Conduct inspection to establish basis for request that work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
4. Obtain and submit releases enabling Owner's full, unrestricted use of project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
6. Discontinue or change over and remove temporary facilities and services from project site, along with construction tools, mockups, and similar elements.
7. Perform final cleaning according to this section.

B. Substantial Completion Inspection:

1. When Contractor considers work to be substantially complete, submit to Contracting Officer:

    a. Written certificate that work, or designated portion, is substantially complete.
    b. List of items to be completed or corrected (initial punch list).

2. Within seven (7) days after receipt of request for Substantial Completion, Contracting Officer will make inspection to determine whether work or designated portion is substantially complete.

3. Should Contracting Officer determine that work is not substantially complete:

    a. Contracting Officer will promptly notify Contractor in writing, stating reasons for its opinion.
    b. Contractor shall remedy deficiencies in work and send second written request for Substantial Completion to Contracting Officer.
    c. Contracting Officer will re-inspect work.
    d. Redo and Inspection of Deficient work: Repeated until work passes Contracting Officer's inspection.

4. When Contracting Officer finds that work is substantially complete, Contracting Officer will:

    a. Prepare Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified and amended by Contracting Officer and Owner (final punch list).
    b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.

5. After work is substantially complete, Contractor shall:

    a. Allow Owner occupancy of project under provisions stated in Certificate of Substantial Completion.
    b. Complete work listed for completion or correction within time period stipulated.

C. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.

1. When Contractor considers work to be complete, submit written certification that:

    a. Contract documents have been reviewed.
    b. Work has been examined for compliance with contract documents.
    c. Work has been completed according to contract documents.
    d. Work is completed and ready for final inspection.

2. Submittals: Submit following:

    a. Final punch list indicating all items have been completed or corrected.
    b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
    c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
    d. Accounting statement for final changes to contract Sum.
    e. Contractor's affidavit of payment of debts and claims on AIA G706 - Contractor's Affidavit of Payment of Debts and Claims.
    f. Contractor affidavit of release of liens on AIA G706A - Contractor's Affidavit of Release of Liens.
    g. Consent of surety to final payment on AIA G707 - Consent of Surety to Final Payment Form.

3. Perform final cleaning for Contractor-soiled areas according to this section.

D. Final Completion Inspection:

1. Within seven (7) calendar days after receipt of request for final inspection, Contracting Officer will make inspection to determine whether work or designated portion is complete.
2. Should Contracting Officer consider work to be incomplete or defective:

a. Contracting Officer will promptly notify Contractor in writing, listing incomplete or defective work.
b. Contractor shall remedy stated deficiencies and send second written request to Contracting Officer that work is complete.
c. Contracting Officer will re-inspect work.
d. Redo and Inspection of Deficient Work: Repeated until work passes Contracting Officer's inspection.

1.4 ASSET REGISTER

A. Complete an asset register from a GWA supplied template. Submit for review prior to requesting Certificate of Substantial Completion.

B. Assets to include are vaults, buildings, valves, control valves, meters, major electrical components, instrumentation components, and other items as GWA requires.

C. Data for each asset may include location, size, number, manufacturer and model, material type, cost, recommended frequency for inspection, maintenance, rehab and replacement.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain on each respective site one (1) set of the following record documents; record actual revisions to the work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the contract.
5. Reviewed Shop Drawings, product data, and Samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:

1. Include contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the work, and change orders.
2. Include locations of concealed elements of the work.
3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
5. Identify and locate existing buried or concealed items encountered during project.
6. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
7. Field changes of dimension and detail.
8. Details not on original Drawings.

F. Submit marked-up paper copy documents and PDF electronic files of marked-up documents to Contracting Officer with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit in PDF composite electronic indexed file.

B. Submit data bound in 8-1/2 x 11-inch text pages, three (3) D side ring binders with durable plastic covers at the 75 percent construction completion point. An additional (1) percent of the contract price will be retained from any monies due the Contractor as progress payments if not submitted meeting the requirements of this section. The aforementioned amount will be retained by GWA as the agreed, estimated value of the approved Technical Manual. Any such retention of money for failure to submit the approved Technical Manual on or before the 75 percent construction completion point shall be in addition to the retention of any payments due to the Contractor under the General Provisions.

C. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of project, and subject matter of binder when multiple binders are required.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

F. Contents: Prepare table of contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Contracting Officer, Contractor, subcontractors, and major equipment suppliers.
2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Include the following:

    a. Significant design criteria.
    b. List of equipment.

c. Parts list for each component.
d. Operating instructions.
e. Maintenance instructions for equipment and systems.

3. Part 3: Project documents and certificates, including the following:

a. Shop Drawings and product data.
b. Certificates.
c. Photocopies of warranties.

1.7 MANUAL FOR MATERIALS AND FINISHES

A. Submit two (2) copies of preliminary draft or proposed formats and outlines of contents before start of work. Contracting Officer will review draft and return one (1) copy with comments.

B. For equipment or component parts of equipment put into service during construction and operated by Owner, submit documents within ten (10) working days after acceptance.

C. Submit one (1) copy of completed volumes before Substantial Completion. Draft copy be reviewed and returned after Substantial Completion, with Contracting Officer comments. Revise content of document sets as required prior to final submission.

D. Submit five (5) sets of revised final volumes within ten (10) working days after final inspection.

E. Submit in PDF composite electronic indexed file of final manual within ten (10) working days after final inspection.

F. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations.

G. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

H. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

I. Additional Requirements: As specified in individual product specification sections.

J. Include listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.8 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two (2) copies of preliminary draft or proposed formats and outlines of contents before start of work. Contracting Officer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten (10) working days after acceptance.

C. Submit one (1) copy of completed volumes before Substantial Completion. Draft copy will be reviewed and returned after Substantial Completion, with Contracting Officer comments. Revise content of document sets as required prior to final submission.

D. Submit five (5) sets of revised final volumes within ten (10) working days after final inspection.

E. Submit in PDF composite electronic indexed file of final manual within ten (10) working days after final inspection.

F. Each Item of Equipment and Each System: Include description of unit or system and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

G. Operating Procedures: Include startup, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.

H. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

I. Include servicing and lubrication schedule and list of lubricants required.

J. Include manufacturer's printed operation and maintenance instructions.

K. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

L. Include Contractor's coordination drawings with color-coded piping diagrams as installed.

M. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Additional Requirements: As specified in individual product specification sections.

O. Include listing in table of contents for design data with tabbed dividers and space for insertion of data.

1.9 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to place in location as directed by Owner; obtain receipt prior to final payment.

1.10 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers within ten (10) working days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include table of contents and assemble in three (3) D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten (10) working days after acceptance.
2. Make other submittals within ten (10) working days after date of Substantial Completion, prior to final Application for Payment.
3. For items of work for which acceptance is delayed beyond Substantial Completion, submit within ten (10) working days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.11 MAINTENANCE AND GUARANTEE

A. The Contractor shall comply with the maintenance and guarantee requirements contained in the General Provisions.

B. Furnish service of components indicated in specification sections during warranty period.

C. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Replace earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the Contractor which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the Contractor shall have obtained a statement in writing from the affected private owner or public agency releasing GWA from further responsibility in connection with such repair or resurfacing.

E. Make all repairs and replacements promptly upon receipt of written order from GWA. If the Contractor fails to make such repairs or replacements promptly, GWA reserves the right to do the work and the Contractor and its surety shall be liable to GWA for the cost thereof.

F. Warranty Repair Priority

1. The nature of the warranty issue and its impact on operations will be evaluated by the Owner and a Response Priority assigned to the notice as followings:
2. First Priority Code 1 – Contractor to provide on-site inspection to evaluate the situation and determine the course of action within four (4) hours, initiate the work within six (6) hours and work continuously to completion or relief.

3. Second Priority Code 2 – Perform on-site inspection to evaluate the situation and determine the course of action within eight (8) hours, initiate the work within 24 hours and work continuously to completion or relief
4. Third Priority Code 3 – Necessary work to be initiated within three working days and work performed during standard work hours each subsequent day to completion or relief.

G. Contractor's Response to Construction Warranty Requirements

1. Following the oral or written notification by the Owner, the Contractor shall respond to construction warranty service requirements in accordance with the assigned response priority code. The Contractor shall submit a report within seven (7) calendar days after completion of activities on any warranty item that has been repaired during the warranty period.
2. If the Contractor does not perform the construction warranty items within the time frames specified above, the Owner retains the right to perform the work and recover all costs from the Contractor or its surety.

H. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

I. The Contractor shall provide a bond to guarantee performance of the provisions contained in the General Provisions.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify that utility services are available with correct characteristics and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance according to manufacturer's instructions.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.3 EXECUTION

A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one (1) set of manufacturer's installation instructions at project site during installation and until completion of construction.

B. When manufacturer's installation instructions conflict with contract documents, request clarification from Contracting Officer before proceeding.

C. Verify that field measurements are as indicated on approved shop drawings or as instructed by manufacturer.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1. Secure work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Contracting Officer for final decision.

E. Allow for expansion of materials and building movement.

F. Climatic Conditions and Project Status: Install each unit of work under conditions to ensure best possible results in coordination with entire project.

1. Isolate each unit of work from incompatible work as necessary to prevent deterioration.
2. Coordinate enclosure of work with required inspections and tests to minimize necessity of uncovering work for those purposes.

G. Mounting Heights: Where not indicated, mount individual units of work at industry recognized standard mounting heights for particular application indicated.

1. Refer questionable mounting heights choices to Contracting Officer for final decision.
2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.

H. Adjust operating products and equipment to ensure smooth and unhindered operation.

I. Clean and perform maintenance on installed work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.4 CUTTING AND PATCHING

A. Employ skilled and experienced installers to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements affecting:

1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.

3. Efficiency, maintenance, or safety of element.
4. Visual qualities of sight-exposed elements.
5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching including excavation and fill to complete work and to:

1. Fit the several parts together, to integrate with other work.
2. Uncover work to install or correct ill-timed work.
3. Remove and replace defective and nonconforming work.
4. Remove samples of installed work for testing.
5. Provide openings in elements of work for penetrations of mechanical and electrical work.

D. Execute work by methods to avoid damage to other work and to provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore work with new products according to requirements of contract documents.

G. Fit work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

J. Identify hazardous substances or conditions exposed during the work to Contracting Officer for decision or remedy.

3.5 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Use durable sheet materials to protect finished floors and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

3.6 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

1. Employ experienced personnel or professional cleaning firm.

B. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.

C. Clean debris from roofs, gutters, downspouts, and drainage systems.

D. Clean site; sweep paved areas, rake clean landscaped surfaces, seed disturbed soil.

E. Lubricate all equipment in accordance with the manufacturers' recommendations.

F. Remove waste and surplus materials, rubbish, and construction facilities from site.

G. Final acceptance of the work by GWA will be withheld until the Contractor has satisfactorily performed the final cleanup of the site.

END OF SECTION 017000

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Construction waste management plan.
2. Construction waste recycling.
3. Construction waste adaptive reuse.

1.2 PLAN REQUIREMENTS

A. Develop and implement construction waste management plan as approved by Contracting Officer.

B. Intent:

1. Divert construction, demolition, and land-clearing debris from landfill disposal.
2. Redirect recyclable material back to manufacturing process.
3. Generate cost savings or increase minimal additional cost to project for waste disposal.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures contains requirements for submittals.

B. Construction Waste Management Plan: Submit construction waste management plan, within 14 calendar days after the date established in the Notice to Proceed, describing methods and procedures for implementation and monitoring compliance including the following:

1. Recycling and adaptive reuse processing facilities and waste type each facility will accept.
2. Construction waste materials anticipated for recycling and adaptive reuse.
3. On-site sorting and site storage methods.

1.4 CONSTRUCTION WASTE MANAGEMENT PLAN

A. Implement construction waste management plan at start of construction.

B. Review construction waste management plan at preconstruction meeting and progress meetings specified in Section 013000 - Administrative Requirements.

C. Distribute approved construction waste management plan to subcontractors and others affected by plan requirements.

D. Oversee plan implementation, instruct construction personnel for plan compliance, and document plan results.

E. Purchase products to prevent waste by:

1. Ensuring correct quantity of each material is delivered to site.
2. Choosing products with minimal or no packaging.
3. Requiring suppliers to use returnable pallets or containers.
4. Requiring suppliers to take or buy back rejected or unused items.

1.5 CONSTRUCTION WASTE RECYCLING

A. Use source separation method or comingling method suitable to sorting and processing method of selected recycling center. Dispose nonrecyclable trash separately into landfill.

B. Source Separation Method: Recyclable materials separated from trash and sorted into separate bins or containers, identified by waste type, prior to transportation to recycling center.

C. Comingling Method: Recyclable materials separated from trash and placed in unsorted bins or container for sorting at recycling center.

D. Materials suggested for recycling include:

1. Packing materials including paper and cardboard.
2. Recyclable plastics.
3. Metals.
4. Equipment oil.

1.6 CONSTRUCTION WASTE ADAPTIVE REUSE

A. Arrange with processing facility for salvage of construction material and processing for reuse. Do not reuse construction materials on-site except as allowed by Contracting Officer.

B. Materials suggested for adaptive reuse include:

1. Concrete and crushed concrete.
2. Masonry units.
3. Lumber suitable for re-sawing or refinishing.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE COLLECTION

A. Collect construction waste materials in marked bins or containers and arrange for transportation to recycling centers or adaptive salvage and reuse processing facilities.

B. Maintain recycling and adaptive reuse storage and collection area in orderly arrangement with materials separated to eliminate co-mingling of materials required to be delivered separately to waste processing facility.

C. Store construction waste materials to prevent environmental pollution, fire hazards, hazards to persons and property, and contamination of stored materials.

D. Cover construction waste materials subject to disintegration, evaporation, settling, or runoff to prevent polluting air, water, and soil.

3.2 CONSTRUCTION WASTE DISPOSAL

A. Deliver construction waste to waste processing facilities.

B. Dispose of construction waste not capable of being recycled or adaptively reused by delivery to landfill, incinerator, or other legal disposal facility.

END OF SECTION 017419

SECTION 028213.33 - ASBESTOS ABATEMENT FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal of ACM-contaminated pipeline coatings.
2. Cutting of pipelines containing or coated with ACM.
3. Monitoring of work area during cutting and cleaning operations.

B. Related Requirements:

1. Section 331116 - Site Water Utility Distribution Piping: Coordination of pipe, valves, and appurtenances during removal operations.

1.2 DEFINITIONS

A. ACM: Asbestos-containing material.

1.3 REFERENCE STANDARDS

A. Occupational Safety and Health Administration (OSHA):

1. 29 CFR Part 1926 - Safety and Health Regulations for Construction.
2. 40 CFR Part 763, Subpart E, Appendix E, Section 1- Polarized Light Microscopy.
3. 42 CFR Part 84, Subpart K - Non-Powered Air-Purifying Particulate Respirators.

B. U.S. Environmental Protection Agency:

1. National Emission Standards for Hazardous Air Pollutants (NESHAPs).

1.4 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information on respirators and air monitor.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Qualifications Statements:

1. Submit qualifications for contractor, on-site representative, and disposal firm.

1.6 QUALITY ASSURANCE

A. Perform work according to NESHAPs, OSHA, and Guam EPA standards.

1.7 QUALIFICATIONS

A. Contractor: Company specializing in repairing, modifying, cleaning, or removing AC pipe or ACM-coated pipe as specified in this section with minimum three years' experience.

B. On-Site Representative: Person trained in performing work of this section with minimum three years' experience.

C. Disposal Firm: Company specializing in packaging and hauling ACM to disposal site.

D. Active Waste Disposal Site: Solid waste disposal site permitted to accept ACM waste.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Respirators Not in Use:

1. Store in sanitary location that protects respirators from dust, sunlight, heat, excessive moisture, and potentially damaging chemicals.
2. Place in plastic bags or closed containers.

PART 2 - PRODUCTS

2.1 RESPIRATORS

A. Furnish materials according to Guam EPA standards.

B. Description:

1. Comply with 42 CFR Part 84, Subpart K.

2. Type: Half-face mask; reusable after washing.
3. Maintenance: Replaceable filters and cartridges only.
4. Single-use respirators are not acceptable.

C. Filters: Top air inlet.

D. Performance and Design Criteria:

1. Application: Asbestos abatement for concentrations up to 10 times permissible exposure limit (PEL).
2. Design: Low profile.

PART 3 - EXECUTION

3.1 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for application preparation.

B. Perform ACM removal without damage to or contamination of adjacent work or existing area.

C. Perform cleaning operations without taking pipeline out of service.

3.2 APPLICATION

A. Removal of Pipe:

1. Cutting and Disposal:
   a. Transport removed piping to a central staging area to cut for transport or disposal.
   b. Deposit pipeline pieces in leakproof metal collection box secured with tarpaulin covers.
   c. Transport filled boxes to an approved landfill outside of Guam.
   d. A licensed and certified asbestos supervisor will accompany transport vehicles to manage transport process.
   e. Maintain supply of fresh water near cutting operation to keep freshly cut areas of ACM damp while cutting piping.
   f. Individually wrap each joint of piping and pipe ends prior to loading.

B. Application Standards: Perform work according to NESHAPs, OSHA, and Guam EPA standards.

END OF SECTION 028213.33

SECTION 030100 - MAINTENANCE OF CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete reinforcement repair.
2. Concrete surface repair.
3. Concrete crack repair.

B. Related Sections:

1. Section 033000 - Cast-In-Place Concrete.

1.2 REFERENCES

A. ASTM International:

1. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
4. ASTM C33 - Standard Specification for Concrete Aggregates.
5. ASTM C109/C109M - Standard Test Method for Compressive strength of Hydraulic Cement Mortars (Using 2-in. or (50 mm) Cube Specimens).
6. ASTM C150 - Standard Specification for Portland Cement.
7. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
8. ASTM C293 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading).
9. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
10. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
11. ASTM C1042 - Standard Test Method for Bond Strength of Latex Systems Used With Concrete by Slant Shear.
12. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
13. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
14. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

C. Samples: Submit three color samples for patches exposed to view in finished construction and required to match existing.

D. Manufacturer's Instructions: Submit mixing and application instructions.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of structural reinforcement repairs, type of repair, and date of repair.

C. Operation and Maintenance Data: Procedures for submittals.

1.5 QUALITY ASSURANCE

A. Perform welding work in accordance with AWS D1.4.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Design reinforcement splices under direct supervision of Professional Engineer experienced in design of this work and licensed in Guam.

1.7 MOCK-UP

A. Section 014000 - Quality Requirements: Requirements for mockup.

B. Prepare one mockup of each type of injection and patching procedure.

C. Locate where directed by Architect/Engineer.

D. Incorporate accepted mockup as part of work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Comply with instructions for storage, shelf life limitations, and handling.

PART 2 - PRODUCTS

2.1 EPOXY ADHESIVE INJECTION MATERIALS

A. Epoxy Adhesive: Two-part epoxy adhesive containing 100 percent solids, meeting ASTM C881, Type IV, Grade 1, Class C requirements.

2.2 EPOXY MORTAR MATERIALS

A. Epoxy Mortar: Three-part epoxy binding resin and aggregate mortar mixture.

B. Epoxy Binding Resin: Two part epoxy resin containing 100 percent solids meeting ASTM C881, Type IV, Grade 1, 2, or 3, Class C requirements.

C. Aggregate: Type recommended by mortar manufacturer.

2.3 CEMENTITIOUS MORTAR MATERIALS

A. Cementitious Mortar: Packaged patching mortar meeting ASTM C1107 requirements.

B. Bonding Agent: Two part epoxy resin containing 100 percent solids meeting ASTM C881, Type V, Grade 3, Class C requirements.

2.4 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60, Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, uncoated.

2.5 MIXING EPOXY MORTAR

A. Mix epoxy mortars to consistency for purpose intended.

B. Mix components in clean equipment or containers. Conform to pot life and workability limits.

2.6 MIXING CEMENTITIOUS MORTAR

A. Mix cementitious mortar to consistency required for purpose intended.

B. Exclude bonding agent as additive to mix.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive work.

C. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

A. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination; wire brush using water; rinse surface and allow to dry.

B. Flush out cracks and voids with water to remove laitance and dirt.

C. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than depth of crack to be filled or port size diameter no greater than thickness of crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.

D. For areas patched with epoxy mortar, remove broken and soft concrete until the concrete is sound. Sound concrete is defined as concrete showing broken aggregate faces at the surface of the concrete. Remove corrosion from steel. Clean surfaces mechanically; rinse with water.

E. Remove corrosion and/or clean exposed reinforcement steel surfaces. Mechanically cut away damaged portions of bar.

3.3 REPAIR WORK

A. Repair reinforcement in accordance with Engineers recommendations.

B. Repair exposed structural, shrinkage, and settlement cracks of concrete by epoxy injection method.

C. Repair spalling. Fill voids flush with surface.

3.4 INJECTION - EPOXY RESIN

A. Inject epoxy resin adhesive into prepared ports under pressure using equipment appropriate for particular application.

B. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.

C. Remove temporary seal and excess adhesive.

D. Clean surfaces adjacent to repair and blend finish.

3.5 APPLICATION - EPOXY MORTAR

A. Trowel apply mortar mix flush with surrounding areas. Tamp into place filling voids at spalled areas.

B. For patching honeycomb, trowel mortar onto surface, work mortar into honeycomb to bring surface flush with surrounding area. Finish trowel surface to match surrounding area.

C. Cover exposed steel reinforcement with epoxy mortar, and complete repair in accordance with Engineers recommendations.

3.6 APPLICATION - CEMENTITIOUS MORTAR

A. Apply coating of bonding agent to concrete surfaces in accordance with manufacturer's recommendations. Provide full surface coverage.

B. Apply cementitious mortar by steel trowel flush with surrounding areas. Tamp into place filling voids at spalled areas. Work mix into honeycomb.

C. Damp cure cementitious mortar for three days.

3.7 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

END OF SECTION 030100

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete.
2. Shoring, bracing, and anchorage.
3. Architectural form liners.
4. Form accessories.
5. Form stripping.

B. Related Requirements:

1. Section 032000 - Concrete Reinforcing: Reinforcing steel and required supports for cast-in-place concrete.
2. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frame, slabs-on-grade, and other concrete components associated with building.
3. Section 042000 - Unit Masonry:
   a. Positioning of recessed reglets for brick veneer masonry anchors.
   b. Product requirements for masonry accessories for placement by this Section.
4. Section 055000 - Metal Fabrications: Product requirements for metal fabrications for placement by this Section.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest & Paper Association:

1. AF&PA - National Design Specification (NDS) for Wood Construction.

C. American Society of Mechanical Engineers:

1. ASME A17.1 - Safety Code for Elevators and Escalators.

D. APA - The Engineered Wood Association:

1. APA/EWA PS 1 - Voluntary Product Standard - Structural Plywood.

E. ASTM International:

1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

F. West Coast Lumber Inspection Bureau:

1. WCLIB - Standard No. 17 Grading Rules for West Coast Lumber.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate work of this section with other sections of in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information on void form materials and installation requirements.

C. Shop Drawings:

1. Indicate:
   a. Formwork, shoring, and reshoring.
   b. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
   c. Means of leakage prevention for concrete exposed to view in finished construction.
   d. Sequence and timing of erection and stripping, assumed compressive strength at time of stripping, height of lift, and height of drop during placement.
   e. Vertical, horizontal, and special loads according to ACI 347, and camber diagrams when applicable.
   f. Notes to formwork erector showing size and location of conduits and piping embedded in concrete according to ACI 318.
   g. Procedure and schedule for removal of shores and installation and removal of reshores.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Delegated Design Submittals:

1. Submit signed and sealed shop drawings with design calculations and assumptions for formwork, shoring and reshoring. Structural or civil engineer shall be licensed in Guam.
2. Indicate loads transferred to structure during process of concreting, shoring, and reshoring.
3. Include structural calculations to support design.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 QUALITY ASSURANCE

A. Perform work according to ACI 347, 301, and 318.

B. For wood products furnished for work of this section, comply with AF&PA.

1.6 QUALIFICATIONS

A. Licensed Professional: Professional engineer experienced in design of specified work and licensed on Guam.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept void forms on site in manufacturer's original packaging and inspect for damage.

C. Store materials off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Design, engineer, and construct formwork, shoring, and bracing according to ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line, and dimension as indicated on drawings.

2.2 WOOD FORM MATERIALS

A. Plywood:

1. Species: Douglas fir or Southern Pine.
2. Edges: Clean and true.

B. Lumber Forms:

1. Applications: Edge forms and unexposed finish concrete.
2. Boards:
    a. Description:
        1) Shiplapped or tongue and groove.
        2) Surface boards on four sides.

b. Material: "Construction" grade or better Douglas fir or Southern Pine according to WCLIB Standard No. 17.
c. Width: 8 inches.

C. Plywood Forms:

1. Application: Exposed finish concrete.
2. Description:
   a. Comply with APA/EWA PS 1.
   b. Panels: Full size, 4 by 8 feet.
   c. Label each panel with grade trademark of APA/EWA.
3. Plywood for Surfaces to Receive Membrane Waterproofing:
   a. Minimum Thickness: 5/8 inch.
   b. Grade: APA/EWA "B-B Plyform Structural I Exterior."
4. Plywood with "Smooth Finish" Indicated on drawings:
   a. Minimum Thickness: 3/4 inch.
   b. Grade: APA/EWA "HD Overlay Plyform Structural I Exterior."

2.3 PREFABRICATED FORMS

A. Preformed Steel Forms:

1. Description: Matched, tightly fitted, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
2. Minimum Thickness: 16 gage.

B. FRP Forms: Matched, tightly fitted, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

C. Pan:

1. Material: Steel.
2. Configuration: Size and profile as required.

D. Tubular Column:

1. Description: Round spirally wound laminated fiber or wood.
2. Surface Treatment: Release agent, non-reusable.
3. Sizes: As indicated on drawings.

E. Steel Forms:

1. Description: Sheet steel, suitably reinforced.
2. Design: For particular use as indicated on drawings.

F. Form Liners: Smooth, durable, grainless, and non-staining hardboard unless otherwise indicated on drawings.

G. Framing, Studding, and Bracing: Stud.

2.4 FORMWORK ACCESSORIES

A. Form Ties:

1. Type: Cone.
2. Material: Galvanized.
3. Length: Fixed.
4. Furnish waterproofing washer.
5. Back Break Dimension: 3/16” less than cone length.
6. Free of defects capable of leaving holes larger than 1 inch in concrete surface.

B. Spreaders:

1. Description: Standard, non-corrosive metal-form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face.
2. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Release Agent:

1. Description: Colorless mineral oil that will not stain concrete or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.

D. Corners:

1. Type: Chamfer
2. Size: ¾ inch
3. Lengths: Maximum possible.

E. Dovetail Anchor Slot:

1. Material: Galvanized steel.
2. Thickness: 22 gage.
3. Filling: Foam.
4. Fasten slot to concrete formwork according to manufacturer instructions, and insert foam filler to prevent concrete from entering slot during pour.

F. Flashing Reglets:

1. Material: Galvanized steel.
2. Thickness: 22 gage.
3. Lengths: Maximum possible.
4. Furnish alignment splines for joints.
5. Filling: Foam.
6. Fasten flashing reglet to concrete formwork according to manufacturer instructions, and insert foam to prevent concrete from entering reglet during pour.

G. Vapor Retarder:

1. Description: Polyethylene sheet.
2. Thickness: 8 mils.

H. Bituminous Joint Filler: Comply with ASTM D1751.

I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify lines, levels, and centers before proceeding with formwork.

C. Verify that dimensions agree with drawings.

D. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect/Engineer before proceeding.

3.2 INSTALLATION

A. Earth Forms: Not permitted.

B. Formwork:

1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless indicated otherwise on drawings.
4. Positioning:
    a. Carefully verify horizontal and vertical positions of forms.
    b. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.
6. Erect formwork, shoring, and bracing to achieve design requirements according to ACI 301, 318, and 347.
7. Stripping:
    a. Arrange and assemble formwork to permit dismantling and stripping.
    b. Do not damage concrete during stripping.
    c. Permit removal of remaining principal shores.
8. Obtain approval of Architect/Engineer before framing openings in structural members not indicated on drawings.
9. Install fillet and chamfer strips on external corners of beams, joists, and columns,
10. Install void forms according to manufacturer instructions.

11. Do not reuse wood formwork more than three times for concrete surfaces to be exposed to view.
12. Do not patch formwork.
13. Leave forms in place for minimum number of days according to ACI 347.

C. Form Removal:

1. Do not remove forms or bracing until: concrete has reached a compressive strength of 2500 psi as determined by testing field cured test specimens, and form removal has been approved by the Engineer.
2. Loosen forms carefully; do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
3. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged.
4. Discard damaged forms.
5. Form Release Agent:
   a. Apply according to manufacturer instructions.
   b. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
   c. Do not apply form release agent if concrete surfaces are indicated to receive special finishes or applied coverings that may be affected by agent.
   d. Soak inside surfaces of untreated forms with clean water, and keep surfaces coated prior to placement of concrete.
6. Form Cleaning:
   a. Clean forms as erection proceeds to remove foreign matter within forms.
   b. Clean formed cavities of debris prior to placing concrete.
   c. Flush with water or use compressed air to remove remaining foreign matter.
   d. Ensure that water and debris drain to exterior through cleanout ports.
7. Reuse and Coating of Forms:
   a. Thoroughly clean forms and reapply form coating before each reuse.
   b. For exposed work, do not reuse forms with damaged faces or edges.
   c. Apply form coating to forms according to manufacturer instructions.
   d. Do not coat forms for concrete indicated to receive "scored finish."
   e. Apply form coatings before placing reinforcing steel.

D. Forms for Smooth Finish Concrete:

1. Use steel, plywood, or lined-board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full-sized sheets of form liners and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Apply forming and strip wood forms in a manner to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

E. Architectural Form Liners:

1. Erect architectural side of formwork first.

2. Attach form liner to forms before installing form ties.
3. Install form liners square, with joints and pattern aligned.
4. Seal form liner joints to prevent grout leaks.
5. Dress joints and edges to match form liner pattern and texture.

F. Forms for Surfaces to Receive Membrane Waterproofing:

1. Use plywood or steel forms.
2. After erection of forms, tape form joints to prevent protrusions in concrete.

G. Framing, Studding, and Bracing:

1. Maximum Spacing of Studs:
   a. Boards: Maximum 16 inches o.c.
   b. Plywood: 12 inches o.c.
2. Size framing, bracing, centering, and supporting members for sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement, and accidental impact.

H. Form Anchors and Hangers:

1. Do not use anchors and hangers leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural-steel members to minimize twisting or rotation of member.
3. Penetration of structural-steel members is not permitted.

I. Inserts, Embedded Parts, and Openings:

1. Install formed openings for items to be embedded in or passing through concrete work.
2. Locate and set in place items required to be cast directly into concrete.
3. Install accessories straight, level, and plumb, and ensure that items are not disturbed during concrete placement.
4. Joints:
   a. Install waterstops continuous without displacing reinforcement.
   b. Heat-seal joints watertight.
5. Openings:
   a. Provide temporary ports or openings in formwork as required to facilitate cleaning and inspection.
   b. Locate openings at bottom of forms to allow flushing water to drain.
6. Close temporary openings with tight-fitting panels, flush with inside face of forms, and neatly fitted such that joints will not be apparent in exposed concrete surfaces.

J. Form Ties:

1. Provide sufficient strength and quantity to prevent spreading of forms.
2. Place ties at least 1 inch away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless indicated otherwise on drawings.

K. Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

L. Construction Joints:

1. Install surfaced pouring strip where construction joints intersect on exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Appearance:
   a. Show no overlapping of construction joints.
   b. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true, and sharp.

M. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Ensure that conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 regarding size and location limitations.

N. Openings for Items Passing through Concrete:

1. Frame openings in concrete where indicated on drawings.
2. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other Sections.
3. Coordinate work to avoid cutting and patching of concrete after placement.
4. Perform cutting and repairing of concrete required as result of failure to provide required openings.

O. Screeds:

1. Set screeds and establish levels for tops of and finish on concrete slabs.
2. Slope slabs to drain where required or as indicated on drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms; remove freestanding water.

P. Screed Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle-, pad-, or base-type screed supports that will not puncture membrane.
2. Staking through membrane is not permitted.

Q. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.
2. Clean forms and surfaces against which concrete is to be placed.
3. Remove chips, sawdust, and other debris.
4. Thoroughly blow out forms with compressed air just before concrete is placed.

3.3 TOLERANCES

A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances according to ACI 117.

B. Camber:

1. According to ACI 318.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Inspection:

1. Inspect erected formwork, shoring, and bracing to ensure that work complies with formwork design and that supports, fastenings, wedges, ties, and items are secure.
2. Notify Construction Manager after placement of reinforcing steel in forms but prior to placing concrete.
3. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Form materials, waterstops, and accessories required to form cast-in-place concrete.
2. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frame, slabs on grade, and other concrete components associated with building.
3. Section 260526 - Grounding and Bonding for Electrical Systems: Grounding concrete reinforcement.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.
5. ACI SP-66 - ACI Detailing Manual.

B. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

C. ASTM International:

1. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM A704 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
4. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
5. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

6. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
7. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
8. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
9. ASTM A996 - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
10. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

D. Concrete Reinforcing Steel Institute:

1. CRSI 10-MSP - Manual of Standard Practice.
2. CRSI 10PLACE - Placing Reinforcing Bars.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate work of this section with placement of formwork, formed openings, and other work.

1.4 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Indicate bar sizes, spacings, locations, splice locations, and quantities of reinforcing steel and welded wire fabric.
2. Indicate bending and cutting schedules.
3. Indicate supporting and spacing devices.
4. Invoices showing compliance to Buy-American requirements per Section 016000 – Product Requirements.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Submit certified copies of mill test report of reinforcement materials analysis.

E. Welder Certificates: Certify welders and welding procedures employed on work, verifying AWS qualification within previous 12 months.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statement:

1. Welders: Qualify procedures and personnel according to AWS D1.1.

1.6 QUALITY ASSURANCE

A. Perform work according to CRSI 10-MSP, ACI 301, ACI 318.

B. Prepare shop drawings according to ACI SP-66.

1.7 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months for employed weld types.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on shop drawings.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel:

1. Comply with ASTM A615.

2. Yield Strength: 60 ksi.
3. Reinforcement Bars: Deformed.
4. Finish: Galvanized or Uncoated.

B. Welded Plain Wire Fabric:

1. Comply with ASTM A1064.
2. Configuration: Flat sheets.
3. Finish: Galvanized.

2.2 FABRICATION

A. Fabricate concrete reinforcement according to CRSI 10-MSP.

B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks, and seismic hooks as indicated on drawings.

C. Form reinforcement bends with minimum diameters according to ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8-inch-diameter continuous deformed bar or wire.

F. Weld reinforcement according to AWS D1.4.

G. Galvanized Reinforcement: Clean surfaces, weld, and re-protect welded joint according to CRSI 10PLACE.

H. Splicing:

1. If not indicated on drawings, locate reinforcement splices at point of minimum stress.
2. Obtain approval of splice locations from Engineer of Record.

2.3 SHOP FINISHING

A. Galvanized Finish for Steel Bars:

1. Comply with ASTM A767, Class I.
2. Hot-dip galvanized after fabrication.

2.4 ACCESSORY MATERIALS

A. Tie Wire:

1. Minimum 16 gage, annealed type.

B. Chairs, Bolsters, Bar Supports, and Spacers:

1. Size and Shape: To strengthen and support reinforcement during concrete placement conditions.
2. Furnish load-bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather-Exposed Concrete Surfaces:

1. Material: Plastic-coated steel.
2. Size and Shape: To meet project conditions.

D. Reinforcing Splicing Devices:

1. Type: Mechanical set screw or threaded; Type 2.
2. Size: To fit joined reinforcing.

2.5 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Certificate of Compliance:

1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating work performed at fabricator's facility conforms to Contract Documents.
2. Specified shop tests are not required for work performed by approved fabricator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Place, support, and secure reinforcement against displacement beyond specified placing tolerance.

B. Do not deviate from required position beyond specified tolerance.

C. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.

D. Do not displace or damage vapor retarder.

E. Accommodate placement of formed openings.

F. Spacing:

1. Space reinforcement bars with minimum clear spacing according to ACI 318 equal to one bar diameter but not less than 1 inch.
2. If bars are indicated in multiple layers, place upper bars directly above lower bars.

G. Maintain minimum concrete cover around reinforcement according to ACI 318 as follows:

1. Footings and Concrete Formed against Earth: 3 inches.
2. Concrete Exposed to Earth or Weather:
   a. No. 6 Bars and Larger: 2 inches.
   b. No. 5 Bars and Smaller: 1-1/2 inches.
3. Slabs, Walls, and Joists Not Exposed to Weather or in Contact with Ground:
   a. No. 14 Bars and Larger: 1-1/2 inches.
   b. No. 11 Bars and Smaller: 3/4 inch.
4. Beams and Columns: 1-1/2 inches.

H. Bond and ground reinforcement as specified in Section 260526 - Grounding and Bonding for Electrical Systems.

3.2 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. General: Install reinforcement within tolerances according to ACI 117.

C. Masonry Foundation Walls: Install reinforcement within tolerances according to ACI 530/530.1.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Perform field inspection and testing according to ACI 318.

C. Provide unrestricted access to work and cooperate with appointed inspection and testing firm.

D. Reinforcement Inspection:

1. Placement Acceptance: Inspect specified and ACI 318 material requirements and specified placement tolerances.
2. Welding: Inspect welds according to AWS D1.1.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Weldability Inspection: Inspect for reinforcement weldability if formed from steel other than ASTM A706.
5. Continuous Weld Inspection: Inspect reinforcement according to ACI 318.
6. Periodic Weld Inspection: Inspect other welded connections.

3.4 SCHEDULE

A. Reinforcement for Foundation, Wall Framing Members, roofs, and Slabs on Grade: Deformed bars, uncoated.

B. Reinforcement for Vault Floor, Walls and Top Slab: Deformed bars, uncoated.

C. Reinforcement for Concrete Pavement: Deformed bars, uncoated.

GWA ACP Waterline Replacement - Ajayan

END OF SECTION 032000

SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 WORK OF THIS SECTION

A. The work of this section includes providing finished cast-in-place structural concrete, including mixing, transporting, placing, curing, repairing and finishing.

B. The following types of concrete shall be covered in this section:

1. Structural Concrete: Concrete to be used in all cases except where indicated otherwise.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. 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.

B. Federal Specifications:

1. UU-B-790-A(Int.Amd.1) Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).

C. Commercial Standards:

1. ACI 117 - Standard Tolerances for Concrete Construction and Materials
2. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete
3. ACI 301 - Specifications for Structural Concrete for Buildings
4. ACI 305 - Hot Weather Concreting
5. ACI 309 - Consolidation of Concrete
6. ACI 318 - Building Code Requirements for Reinforced Concrete
7. ACI 350 - Environmental Engineering Concrete Structures
8. ASTM C 31 - Practices for Making and Curing Concrete Test Specimens in the Field
9. ASTM C 33 - Specification for Concrete Aggregates
10. ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens
11. ASTM C 40 - Test Method for Organic Impurities in Line Aggregate for Concrete
12. ASTM C 88 - Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulphate
13. ASTM C 94 - Specification for Ready-Mixed Concrete
14. ASTM C 114 - Method for Chemical Analysis of Hydraulic Cement
15. ASTM C 117 - Standard Test Method for Materials Finer than 75-mm (No. 200) Sieve in Mineral Aggregates by Washing
16. ASTM C 131 - Test Method for Resistance Degradation of small-size coarse aggregate by abrasion and impact in the Los Angeles Machine
17. ASTM C 136 - Method for Sieve Analysis of Fine and Coarse Aggregate
18. ASTM C 143 - Test Method for Slump of Portland Cement Concrete
19. ASTM C 150 - Specification for Portland Cement

20. ASTM C 156 - Test Method for Water Retention by Concrete Curing Materials
21. ASTM C 157 - Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
22. ASTM C 192 - Method of Making and Curing Concrete Test Specimens in the Laboratory
23. ASTM C 260 - Specification for Air-Entraining Admixtures for Concrete
24. ASTM C 309 - Specifications for Liquid Membrane-Forming Compounds for Curing Concrete
25. ASTM C 311 - Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
26. ASTM C 494 - Specification for Chemical Admixtures for Concrete
27. ASTM C 618 - Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
28. ASTM C 1077 - Standard Practice for Laboratories Testing and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
29. ASTM C 1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
30. ASTM C 1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
31. ASTM C 1293 - Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
32. ASTM D 1751 - Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
33. ASTM D 2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate
34. ASTM E 1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

1.3 SUBMITTALS

A. General: Submittals shall be in accordance with the requirements of Section 013300 – Submittal Procedures.

1. Mix Designs: Prior to beginning the work and within 14 days of the notice to proceed, preliminary concrete mix designs shall be submitted which shall show the proportions and gradations of all materials proposed for each class and type of concrete. The mix shall be designed and sealed by a professional engineer registered in Guam. The mix designs shall be submitted to the Construction Manager for review and approval prior to performing trial batch testing to confirm conformance with specifications.
2. Trial Batch Testing: Supply material representative of those to be used in production batches to an independent testing laboratory, acceptable to the Construction Manager, and meeting the requirements of ASTM C1077. Submit results of trial batch testing to Construction Manager for review and approval prior to placing concrete. All costs related to such testing shall be borne by the Contractor.
3. Provide the following submittals in accordance with ACI-301:
    a. Mill tests for cement.
    b. Admixture certification. Chloride ion content must be included.
    c. Aggregate gradation and certification.
    d. Materials and methods of curing.
4. Certified Delivery Tickets: Where ready-mix concrete is used, the Contractor shall provide certified weighmaster delivery tickets at the time of delivery of each load of

concrete. Contractor's certificate with each delivery ticket shall show the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

5. Aggregate: Submit test report indicating the aggregates proposed for use in concrete meet the requirements of ASTM C 33, Class 1N.
6. Fly Ash: If used, the Contractor shall submit Certificate of Compliance signed by the supplier identifying the type of fly ash and stating that the fly ash complies with ASTM C 618 and these specifications together with all supporting test dates prior to the use of the fly ash, and shall also submit a copy of the Fly Ash Chemical Analysis Report. The supporting data shall also contain test results confirming that the fly ash in combination with the cement and water to be used meets all strength requirements and is compatible with air-entraining agents and other admixtures.
7. Concrete placement drawings identifying time between adjacent pours, and location of each type of construction joint to be used.
8. Bonding Agent:
    a. Manufacturer's Certification of Compliance, including statement that product is suitable for and will meet job requirements including surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
    b. Manufacturer's recommendations for application specific to this project. Have information available on project site.
9. Bond Breaker: Manufacturer's data, recommendations, and instructions for specific use on this project.
10. Curing Compound: Manufacture's product sheet, recommendations, and instructions for specific use on this project.
11. Contractor shall coordinate and obtain and submit to Construction Manager admixture manufacturers' certifications that state their products are compatible with other admixtures proposed to be used.

1.4 TESTING

A. General:

1. Tests on component materials and for compressive strength and water-soluble chloride ions content of concrete shall be performed by an independent laboratory meeting the requirements of ASTM C1077 and acceptable to the Construction Manager.
2. Contractor shall be responsible for field quality control testing of concrete. Construction Manager may perform Construction Quality Assurance testing to monitor the results of the Contractor's independent laboratory.

B. Compression Tests:

1. Compression test specimens shall be taken during construction from the first placement of each class of concrete indicated herein and at intervals thereafter as selected by the Construction Manager to insure continued compliance with these Specifications. Each set of test specimens shall be a minimum of 5 cylinders.

2. Compression test specimens for concrete shall be made in accordance with ASTM C 31. Specimens shall be either 6-inch diameter by 12-inch long or 4-inch diameter by 8-inch long cylinders.
3. Compression tests shall be performed in accordance with ASTM C 39. One test cylinder shall be tested at 7 days, two test cylinders shall be tested at 28-days (3 test cylinders shall be tested at 28 days if 4x8 inch cylinders are used). The remaining cylinders shall be held to verify test results, if needed.

C. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318-11, Section 5.6, "Evaluation and Acceptance of Concrete," and as indicated herein.
2. A statistical analysis of compression test results shall be performed according to the requirements of ACI 214.
3. If the average compressive strength of any concrete falls below the specified strength, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.
4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any 3 consecutive tests being below the indicated compressive strength is 1 in 100. The required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard deviation.
5. All concrete which fails to meet the ACI requirements and these Specifications, is subject to removal and replacement at no additional cost to Owner.

D. Water-Soluble Chloride Ion Content Test: Test in accordance to ASTM C1218.

E. Fly Ash: For each class of fly ash, all testing and sampling procedures shall conform with these

F. s and ASTM C 311, including the restriction that one sample weighing 4 pounds shall be taken from at least each bulk shipment of fly ash delivered to Guam.

G. Construction Tolerances: Construction tolerances shall meet the requirements of ACI 117.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Cement (when packaged), air entraining agent, admixtures, curing compounds, joint filers and joint sealants, damp proofing agents, and adhesives shall be delivered in original, unbroken packages, and containers bearing the name of the manufacturer, the description of the contents, and dates of manufacture and expiration.

B. Storage: Products shall be carefully stored in a manner that shall prevent damage, segregation, and in an area that is protected from the elements. Admixtures shall be stored in accordance with the manufacturer’s recommendations.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. General:

1. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the work shall comply with the requirements of ACI 301, as applicable.

C. Storage of materials shall also conform to the requirements ACI 301.

D. Materials for concrete shall conform to the following requirements:

1. Cement shall be standard brand Portland cement conforming to ASTM C 150 Type II including Table 1A optional requirements. A minimum of 85 percent of cement by weight shall pass a 325 screen. Portland cement shall contain not more than 0.60 percent alkalies. The term "alkalies" referred to herein is defined as the sum of the percentage of sodium oxide and 0.658 times the percentage of potassium oxide (Na20 + 0.658 K20). These oxides shall be determined in accordance with ASTM C 114. A single brand of cement shall be used throughout the work, and prior to its use, the brand shall be acceptable to the Construction Manager. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports for each shipment of cement to be used shall be submitted to the Construction Manager regarding compliance with these specifications.
2. Water for mixing and curing shall be potable, clean, and meet the requirements of ASTM C1602. The water shall be considered potable, for the purposes of this section only, if it meets the requirements of the local governmental agencies.
3. Aggregates shall be obtained from pits acceptable to the Construction Manager, shall be non-reactive, and shall conform to ASTM C 33, Class 1N. Maximum size of coarse aggregate shall be as indicated herein.
    a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4-inch.
        1) Natural gravels, a combination of gravels and crushed gravels, crushed stone, or a combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
        2) Aggregates shall be free of materials or aggregate types that cause popouts, discoloration, staining, or any other defects on the surface of the concrete. Process aggregates to remove these materials or import aggregates free of these materials. Performance history showing that an aggregate source produces these problems shall also be used to reject the aggregates.

b. Fine aggregates shall be natural or manufactured sand or a combination of natural and manufactured sand that are hard and durable. The sand shall meet the fine aggregate requirements of ASTM C33.

c. Combined aggregates shall be well graded from coarse to fine sizes, and shall be uniformly graded between screen sizes to produce a concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

d. The combined aggregates shall be tested for aggregate-alkali reactivity. The percentages of fine and coarse aggregate shall meet the percentages shown in the submitted concrete mix design.

1) When tested in accordance with ASTM C1260 or ASTM C1567, the maximum expansion allowed will be 0.10% after 16 days after casting.

2) When tested in accordance with ASTM C1293 the maximum expansion allowed is 0.04% after one year of testing.

4. Ready-mix concrete shall conform to the requirements of ASTM C 94.

5. Admixtures: All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations.

a. Air-entraining agent meeting the requirements of ASTM C 260, may be used.

b. Set controlling and water reducing admixtures: Admixtures may be added at the Contractor's option to control the set, effect water reduction, and increase workability. The addition of an admixture shall be at the Contractor's expense. The use of an admixture shall be subject to acceptance by the Construction Manager and shall be submitted and approved prior to use. Admixtures specified herein shall conform to the requirements of ASTM C 494.

1) Set controlling admixture shall be either with or without water-reducing properties. Where air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture shall be used in conformance with ASTM C 494, Type B, D, or G.

2) Normal range water reducer shall conform to ASTM C 494, Type A. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.

3) Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

4) Provide uniform use of admixture on any one structure. Variation in finish appearance due to use of admixture is not allowed.

c. High Range Water Reducer (Superplasticizers):

1) High range water reducer (HRWR) shall conform to ASTM C 494, Type F or G.

2) If the high range water reducing agent is added to the concrete at the batch plant, it shall be a second generation type. High range water reducer shall be added to the concrete after all other ingredients, including low range water reducer, have been mixed and initial slump has been verified.

3) If the high range water reducer is added to the concrete at the job site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches ± 1/2-inch prior to adding the high range water reducing admixture at the job site.

4) Hold slump of 5 inches or greater for the time required for placement into the structure.

d. Shrinkage-reducing admixture designed to reduce the surface tension of pore water, not with expansive properties may be used provided that compensation be implemented to recover the amount of compressive strength loss due to the addition of this admixture. The use of this type admixture together with associated compensation for strength loss shall be done at no additional cost to Owner.
e. Calcium Chloride: Calcium chloride will not be permitted to be used in concrete.
f. Fly ash/pozzolan shall conform to ASTM C 618 Class F, including the requirements of Table 1A, therein, and the following supplementary requirements:
   1) Loss on Ignition, Maximum: 3 percent.
   2) SO3 Content, Maximum: 3 percent.
   3) Moisture Content, Maximum: 1 percent.
   4) R = (CaO - 5%)/(Fe2O3), Maximum: 1.5.

2.2 CURING MATERIALS

A. Materials for curing concrete as indicated herein shall conform to the following requirements and ASTM C 309.

1. All curing compounds shall be water based concrete curing compound; Sodium silicate compounds shall not be allowed. Only water based curing compounds shall be used.
2. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.
3. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.
4. Polyethylene-coated burlap for use as concrete curing blanket shall be 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.
5. Curing mats for use in Curing Method 6 as indicated in Paragraph 3.10.G shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

2.3 NON-WATERSTOP JOINT MATERIALS

A. Materials for non-waterstop joints in concrete shall conform to the following requirements:

1. Preformed joint filler for non-water retaining applications shall be a non-extruding, resilient, bituminous type conforming to the requirements of ASTM D 1751.
2. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture

infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants.

2.4 MISCELLANEOUS MATERIALS

A. Floor sealer/hardener shall be a colorless, aqueous solution of zinc and/or magnesium fluosilicate or of sodium silicate. The solution shall be delivered ready for use in the manufacturer's original sealed containers. Each gallon of the fluosilicate solution shall contain not less than 2 pounds of crystals.

B. Dampproofing agent shall be an asphalt emulsion.

C. Bonding agents shall be epoxy adhesives meeting the requirements of ASTM C881, Type IV or Type V.

D. Vapor Retarder (formerly Vapor Barrier): Shall comply with the requirements of ASTM E1745, Class A, and shall have a thickness of not less than 10 mils. Provide manufacturer's recommended mastics and gusset tape.

2.5 CONCRETE DESIGN REQUIREMENTS

A. General: Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities indicated. The exact proportions in which these materials are to be used for different parts of the work shall be determined by the Contractor during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface.

The concrete mix design shall be based on the requirements of ACI 301-10, Section 4.2.3.4.a or Section 4.2.3.4.b. If the mixes are based on the requirements of ACI 301-10 Section 4.2.3.4.b, the range of water/cementitouos materials ratio shall spread across the specified water/cementitous materials ratio. At least one mix shall be made with a water/cementitous materials below 0.40, and at least one mix shall be made with a water/cementitous materials ratio above 0.40.

The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to Owner. All changes shall be subject to review by the Construction Manager.

The trial batch shall be prepared using the aggregates, cement, admixtures, and other ingredients proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 6 compression test and one water-soluble chloride ion specimens from each batch. The cost of laboratory trial batch tests for each indicated concrete strength will be borne by the Contractor. The Contractor shall

furnish and deliver the materials in steel drums at no cost. Any additional trial batch testing required shall be performed at the expense of the Contractor at no increase in cost to Owner.

The determination of compressive strength will be made by testing test sample cylinders of the size specified; made, cured and tested in accordance with ASTM C 192 and ASTM C 39. One test cylinder shall be tested at 7 days, and three test cylinders shall be tested at 28-days. The average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall meet the requirements of ACI 301-10, Table 4.2.3.3.b.

B. Water-Cement Ratio and Compressive Strength: The minimum compressive strength, maximum aggregate size, and maximum water/cement ratio of concrete shall be as indicated in the following table:

Type of Work	Min. 28-Day Compr. Strength (psi)	Max Size Aggregate (in)	Max W/C Ratio (by weight)
Structural Concrete:			
Roof, floor slabs,	4,000	1	0.40
Walls and all other concrete items not specified elsewhere.			
12" and thicker walls,	4,000	1½	0.40
slabs on grade and footings.			

C. High Range Water Reducer (Superplasticizers):

1. Use type as recommended by manufacturer in the applicable temperature ranges allowed.
2. Use mid-range water reducer in all concrete for this project. Use superplasticizer to obtain required properties not attainable by mid-range water reducer.
3. Accomplish variations in slump, and air content for flowable mixes by increasing or reducing superplasticizer dose at the ready-mix plant only. Adjust the slump at the jobsite by adding admixtures for a particular load when approved by the Construction Manager then the plant dose shall be adjusted to meet the specifications for the rest of the placement. This additional dosage at the jobsite shall be through an approved dispenser, supplied by the admixture manufacture.
4. Effect on slump: Maintain required slump throughout time of concrete placement and consolidation. Discontinue use of superplasticizer if it fails to maintain slump in required range.
5. Meet design strengths, slumps, water-cement ratio, and other requirements as specified at slump required for placement.
6. Use water reducers in combination with superplasticizers as required for mixing.

D. Adjustments to Mix Design: The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish and the Contractor shall be entitled to no additional compensation because of such changes.

E. Fly ash/pozzolan: Fly ash/pozzolan shall be used as a partial cement replacement in concrete as follows:

1. Fly ash shall replace not more than 25 percent by weight of the Portland cement in the design mix.

F. Combined Aggregate Grading:

1. The combined aggregate gradation shall be used to calculate a coarseness factor (CF) and a workability factor (WF). The CF is described by the formula [Q/(Q+I)]x100. The large particles (Q) shall be the percent of aggregate retained on all sieves 3/8 in. and larger. The intermediate particles (I) shall be the percent of aggregate passing the 3/8 in. sieve and retained on the No. 8 sieve, or simply, the amount retained on the No. 3/8 in. sieve divided by the amount retained on the No. 8 sieve multiplied by 100. The fine particles (WF) shall be the percent finer than the No. 8 sieve when the cementitious material is 564 lbs. The WF shall be adjusted (W-adj.) by 2.5% percent for each 94 lb of cementitious materials change above or below 564 lb of cementitious materials.
2. The CF and WF shall be plotted on a chart to establish a trend line based on the formula [-(CF/7) + 43 < y < -(CF/7) + 48].
3. The CF shall not be greater than 75 nor less than 40. The plot of the WF and the CF for acceptance mixtures shall be a single point approximately four to six points above the trend line.

2.6 CONSISTENCY

A. The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation, and which can be compacted by the vibratory methods herein indicated to give the desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

	SLUMP (Inches)	
Part of Work	Prior to Adding Superplasticizer	After Adding Superplasticizer
Footings and slabs	Between 2 and 5 inches	5 - 9
Other Work	Between 2 and 5 inches	5 - 9

Slump of concrete containing high range water reducing agent shall not be more than 9 inches.

2.7 WATER-SOLUBLE CHLORIDE ION LIMITATION

A. Maximum water-soluble chloride ions shall not exceed 0.06% by weight of the cementitious material in the mix.

2.8 MEASUREMENT OF CEMENT AND AGGREGATE

A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the Contractor and acceptable to the Construction Manager.

B. Weighing tolerances:

Material	Percent of total weight
Cement	1
Aggregates	3
Admixtures	3

2.9 MEASUREMENT OF WATER

A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the Construction Manager and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any indicated amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in *the water line to the mixer. The operating mechanism must be such that leakage will not occur when the valves are closed.

2.10 READY-MIXED CONCRETE

A. At the Contractor's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as indicated herein and in accordance with ASTM C 94, including the following supplementary requirements. Add admixtures at the plant only through equipment furnished and/or approved by the admixture manufacturer. Test fly ash in accordance with ASTM C 311.

B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within 1-1/2 hours after the addition of water to the cement and aggregates or before the drum has been revolved 250 revolutions, whichever is first. This limitation may be waived by the Construction Manager if the concrete is of such slump after the 1-1/2 hour time has been reached that it can be placed without the addition of water to the batch.

C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the resettable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

E. Truck mixers shall meet the uniformity requirements of ASTM C94-13a, Table A1.1, when the concrete is sampled in accordance with ASTM C94-13a, Section 12.5.1.

F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a certified weighmaster delivery ticket furnished to the Construction Manager in accordance with the paragraph in Part 1 titled "Certified Delivery Tickets."

G. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Construction Manager.

PART 3 - EXECUTION

3.1 PROPORTIONING AND MIXING

A. Proportioning: Proportioning of the concrete mix shall conform to the requirements of ACI 301 provided the maximum slump for any concrete shall not exceed 5 inches, except where the use of high range water reducer is permitted which increases the maximum slump to 9 inches.

B. Mixing: Mixing of concrete shall conform to the requirements of ASTM C94.

C. Slump: Maximum slumps shall be as indicated.

D. Retempering: Retempering of concrete or mortar which has partially hardened will not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

A. General: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete or mud mat, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete or mud mat thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete or mud mat.

B. Joints in Concrete Up to 60 Days Old: Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the Construction Manager, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material and roughened to a minimum ¼-inch amplitude. Such

cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

C. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work; provided that construction joints shall be made only where acceptable to the Construction Manager. Where this occurs in tankage area, a water stop shall be provided at the construction joint.

D. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the Construction Manager at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

E. All inserts or other embedded items shall conform to the requirements herein.

F. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where indicated on drawings or shop drawings and shall be acceptable to the Construction Manager before any concrete is placed. Accuracy of placement of all these items is the responsibility of the Contractor.

G. Casting New Concrete Against Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydroblasting or sand-blasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the Construction Manager.

H. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall the Contractor allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the Construction Manager.

I. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

J. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing.

K. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

L. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.3 HANDLING, TRANSPORTING, AND PLACING

A. General: Placing of concrete shall conform to the applicable requirements of Section 5 of ACI 301-10 and the requirements of this section. No aluminum materials shall be used in conveying any concrete.

B. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by the Contractor and at no additional cost to Owner.

C. Unauthorized Placement: No concrete shall be placed except in the presence of a duly authorized representative of the Construction Manager. The Contractor shall notify the Construction Manager in writing at least 24 hours in advance of placement of any concrete.

D. Placement in Wall Forms: Concrete shall not be dropped through reinforcement steel or into any deep form, whether reinforcement is present or not, causing separation of the coarse aggregate from the mortar on account of repeatedly hitting rods or the sides of the form as it falls, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without segregation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at all places of deposit is visible from the deck or runway.

E. Casting New Concrete Against Old: An epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is installed.

F. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the Contractor's conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of an acceptable type. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.

G. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the pour. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

H. Temperature of Concrete: The temperature of all concrete, except concrete deposited in wall or column forms, when it is being placed shall be not more than 95 degrees F without the approval of the Construction Manager.

I. Hot Weather Concrete Placement:

1. Hot weather concrete placement shall comply with ACI 305-10.
2. Hot weather is defined as any combination of high air temperature, low relative humidity and wind velocity that results in a rate of evaporation of 0.2 pounds per square foot per hour based upon the evaporation rate figure 4.2 in ACI 305-10.
3. If conditions meet the above criteria for "hot weather", the Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 95 degrees F.
4. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.
5. Concrete deposited in wall or column forms shall not be allowed to exceed 100 degrees F under any conditions.
6. Fog spray shall be used during finishing operations whenever necessary to avoid surface plastic shrinkage cracking. Fog spray shall also be used after finishing and before the specified curing is commenced to avoid surface plastic shrinkage cracking.

3.4 PUMPING OF CONCRETE

A. General: If the pumped concrete does not produce satisfactory end results, the Contractor shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the site during pumping.

C. The minimum diameter of the hose (conduits) shall be in accordance with ACI 304.2R.

D. Pumping equipment and hoses (conduits) that are not functioning properly shall be replaced.

E. Aluminum conduits for conveying the concrete will not be permitted.

F. Proportioning: Minimum compressive strength, cement content, and maximum size of aggregates shall be as indicated herein.

G. Water and slump requirements shall conform to the requirements of this section.

H. Cement and admixtures shall conform to the requirements of this section.

I. Field Control: Concrete samples for slump, air content and test cylinders will be taken at the placement (discharge) end of the line.

3.5 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the work shall be acceptable to the Construction Manager. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown and as specified. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 3 days for all structures before the contiguous unit or units are placed.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

C. Limit size of each pour regardless whether slabs or walls, to allow for volume change due to shrinkage to take place.

3.6 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be Group 3 (per ACI 309) high speed power vibrators (8000 to 10,000 vibrations per minute) of an immersion type in sufficient number and with a number of standby units determined by the size of the pour. As a minimum one standby unit is required.

B. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as indicated. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein indicated within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 FINISHING CONCRETE SURFACES

A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions indicated are

defined as tolerances and were indicated above. Tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. Formed Surfaces: No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as indicated.

1. Surface holes larger than 1/2-inch in diameter or deeper than 1/4-inch are defined as surface defects in basins and exposed walls.

C. Unformed Surfaces: After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation is necessary to prevent drying shrinkage cracks. The classes of finish indicated for unformed concrete surfaces are designated and defined as follows:

1. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
2. Finish U2 - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where indicated or as determined by the Construction Manager.
3. Finish U3 - After the floated surface (as indicated for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.
4. Finish U4 - Steel trowel finish (as indicated for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise indicated. The resulting surface shall be rough enough to provide a nonskid finish.

D. Unformed surfaces shall be finished according to the following schedule:

UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Slabs which are water bearing with slopes 10 percent and less	U3
Sloping slabs which are water bearing with slopes greater than	

10 percent	U4
Slabs not water bearing	U4
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U3
Top surface of walls	U3

E. Floor Sealer Hardener (Surface Applied):

1. Floors to receive hardener shall be cured, cleaned, and dry with all work above them completed. Not less than 60 days shall have elapsed between casting floors and application of sealer/hardener. Apply zinc and/or magnesium fluosilicate evenly, using 3 coats, allowing 24 hours between coats.
2. The first coat hall be 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength. Each coat shall be applied so as to remain wet on the concrete surface for 15 minutes. If sodium silicate is used, it shall be applied evenly, using 3 coats, allowing 24 hours between coats, and the material shall be applied full strength at the rate of one gallon per 300 square feet. Approved proprietary hardeners shall be applied in conformance with the manufacturer's instruction. After the final coat is completed and dry, surplus hardener shall be removed from the surface by scrubbing and mopping with water.
3. Floor hardener shall be applied where indicated.

3.8 ETCHED FINISH

A. Graphic and Figure Finish: Apply a medium abrasive wet blasted finish (1/8" maximum) on concrete surfaces where indicated to create each graphic or figure. Texture of concrete surfaces shall be uniform after wet blasting and shall match finish as specified.

B. Perform abrasive wet blasting in as continuous an operation as possible, utilizing the same work crew to maintain a continuity of finish on each surface of area of work. Coordinate scheduling so that a minimum time elapses between blasting operations and application of water repellent sealant system.

C. Use an abrasive grit or sand of the proper type and gradation as required to remove the surface latency and define the aggregate and surrounding matrix surfaces to match approved mockup panels. The abrasive shall not affect the color of the finished surface.

D. Diameters of air and water lines and hoses shall be in accordance with the recommendations of the manufacturer of the abrasive blasting equipment.

E. Abrasive wet blast to graphic template edges carefully to maintain uniform sharp edges. Blasting shall be accompanied by an air hose to remove residues as surfaces are cut to enable examination of surfaces.

F. Protect adjacent and surrounding surfaces, finishes and assemblies from abrasive blasting operations.

G. Any areas lacking the specified appearance (consistent with the approved mockup panel) shall be replaced of re-coated to the satisfaction of the Construction Manager without additional cost.

H. Abrasive blasting operations shall be performed in accordance with the most current requirements of Guam Environmental Protection Agency.

3.9 CURING AND DAMPPROOFING

A. General: All concrete shall be cured for not less than 14 days after placing, in accordance with the methods indicated herein for the different parts of the work, and described in detail in the following paragraphs:

Surface to be Cured or Dampproofed	Method
Unstripped forms	1
Wall sections with forms removed	4 or 6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4
Slabs not on grade	6

B. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 14 days of placing the concrete, curing shall be continued in accordance with Method 6, herein.

C. Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

D. Method 3: The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

E. Method 4: The surface shall be sprayed with a liquid curing compound.

1. Curing compound shall not be used on concrete surfaces to be coated, waterproofed, moistureproofed, or where any coverings are to be bonded.
2. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly.
3. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

4. Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
5. Where curing compound is indicated, it shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces, and within 2 hours after removal of forms from contact with formed surfaces. Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as indicated herein.
6. At all locations where concrete is placed adjacent to a panel which has been coated with curing compound, the previously coated panel shall have curing compound reapplied to an area within 6 feet of the joint and to any other location where the curing membrane has been disturbed.
7. Prior to final acceptance of the work, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage surface finish.

F. Method 5:

1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4, herein. Not less than one hour nor more than 4 hours after the coat of curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3 inches and fastened together with a waterproof cement to form a continuous watertight joint. The Contractor shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.
2. The curing blankets shall be left in place during the 14-day curing period and shall not be removed until after concrete for adjacent work has been placed. Should the curing blankets become torn or otherwise ineffective, the Contractor shall replace damaged sections. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket.

G. Method 6: This method applies to both walls and slabs.

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 14 consecutive days beginning immediately after the concrete has reached final set or forms have been removed.
2. Until concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.

3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes and to be substantially in contact with the concrete surface. All edges shall be continuously held in place.
4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.
5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, any dry spots shall be rewetted, and curing compound shall be immediately applied in accordance with Method 4, herein.
6. The Contractor shall dispose of excess water from the curing operation to avoid damage to the work.

H. Dampproofing:

1. The exterior surface of all buried wall surfaces and roof slabs shall be dampproofed as follows.
2. Immediately after completion of curing the surface shall be sprayed with a dampproofing agent consisting of an asphalt emulsion. Application shall be in 2 coats. The first coat shall be diluted to 1/2 strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the indicated material, undiluted, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Dampproofing material shall be as indicated herein.
3. As soon as the asphalt emulsion, applied as indicated herein, has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used which produces a uniformly coated white surface and which so remains until placing of the backfill. Should the whitewash fail to remain on the surface until the backfill is placed, the Contractor shall apply additional whitewash.

3.10 PROTECTION

A. The Contractor shall protect all concrete against injury until substantial completion as determined by Construction Manager.

B. Fresh concrete shall be protected from damage due to rain, The Contractor shall provide such protection shall be provided while the concrete is still plastic and whenever such precipitation is imminent or occurring.

3.11 BACKFILL AGAINST WALLS

A. Do not backfill against walls until concrete has obtained compressive strength equal to the specified 28-day compressive strength.

B. Place backfill simultaneously on both sides of wall where required to prevent differential pressures.

3.12 FIELD TESTS

A. Evaluation and Acceptance of Concrete:

1. Contractor shall provide all tests as specified in this section, unless indicated otherwise. Construction Manager may make or have tests made to determine compliance with Specifications for quality assurance.
2. Evaluation will be in accordance with ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318-11), Chapter 5 and these Specifications. Where the term "building official" is used, the term shall be redefined to "Construction Manager".
3. Contractor's Responsibilities:
    a. Cooperate in making of such tests by furnishing necessary labor to assist testing agencies and/or Construction Manager in obtaining, handling, and protecting and/or curing samples at jobsite.
    b. Provide concrete for testing of slump, air content, and for making cylinders from the point of discharge into forms. When concrete is pumped, samples used shall be taken from discharge end of pump hose.
    c. Contractor shall conduct segregation tests as specified hereinafter.
    d. Specimens shall be made, cured, and tested in accordance with ASTM C31 and ASTM C39.
4. Frequency of testing may be increased at discretion of Construction Manager.
5. Concrete testing shall be paid for by the Contractor.

B. Concrete Tolerances:

1. Measure and inspect walls for compliance with tolerances specified in ACI 117.

3.13 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Construction Manager. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein indicated shall be promptly executed by the Contractor at his own expense.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not permitted to be used to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to weaken the bond of shotcrete. The material used for repair shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this section, as applicable, using methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

3.14 PATCHING IN CONCRETE

A. Patching Cracks:

1. Leaking cracks or cracks in exposed surfaces shall be epoxy pressure-injected by qualified applicators using two-component epoxy as approved.
2. Develop patching techniques and mixes with grout manufacturer on the mockup panel, a concrete test panel at least 4 feet by 8 feet in area constructed for this purpose, or a portion of as-cast surface of concrete, requiring patching, selected by the Construction Manager for this purpose.
3. Dress surface of patches that will remain exposed to view to match color and texture of adjacent surfaces.
4. Patching of concrete shall provide an acceptable and structurally sound surface finish uniform in appearance or upgrade the finish by other means until acceptable.
5. Provide patching to correct defects due to unacceptable aggregates and other ingredients.
6. Patching material shall be certified by manufacturer, prior to use, that it contains no chlorides or other chemicals causing corrosion.

B. Concrete Finish Tolerances:

1. Where work does not meet specified tolerances, repair or replace rejected work.
2. Obtain written approval of repair method used on the mockup panels or other panels specified hereinbefore, before proceeding with work.
3. Repair work or work on an alternate finish solution is assumed to be the result of poor workmanship in not achieving specified quality of finish. No additional compensation for time or cost will be allowed for such work.

C. Sand Blasting: Concrete areas specified to receive sandblasting shall have all repair work complete prior to start of sandblasting:

D. Patching Small Holes:

1. Holes, which are less than 12 inches in their least dimension and extend completely through concrete members, shall be filled as specified herein.
2. Small holes in members which are water-bearing or in contact with soil or other fill material shall be filled with non-shrink grout. Where a face of the member is exposed to view, the non-shrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall then be patched according to the Paragraph above.

3. Small holes through all other concrete members shall be filled with non-shrink grout, with exposed faces treated as above.

E. Patching Large Holes:

1. Holes which are larger than 12 inches in their least dimension, shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as indicated herein.
2. Holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall, unless indicated otherwise.
3. Large holes in members which are water bearing or in contact with soil or other fill, shall have a hydrophilic type waterstop material placed around the perimeter of the hole, unless there is an existing waterstop in place.
4. Prior to filling with concrete the prepared surface shall be wetted sufficiently in advance of concreting and be surface saturated dry at the time of repair.

3.15 CARE AND REPAIR OF CONCRETE

A. The Contractor shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the contract documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

END OF SECTION 033000

SECTION 260533 - RACEWAYS AND BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes all raceways not limited to conduit and tubing, surface and buried raceways, wireways, outlet boxes, pull boxes, junction boxes, hand holes and concrete manholes.

1.2 RELATED SECTIONS

A. Section 260500: Common Work Results for Electrical

B. Section 260519: 600-Volt Power Conductors and Cables

C. Section 260526: Grounding and Bonding for Electrical Systems

D. Section 260553: Identification for Electrical Systems

1.3 REFERENCES - CODES AND STANDARDS

A. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated.

C. ANSI C80.6 American National Standard for Electrical Intermediate Metal Conduit.

D. ASTM A48 Standard Specification for Grey Iron Castings.

E. NECA (National Electrical Contractor’s Association) – “Standard of Installation.”

F. NEMA FB 1 (National Electrical Manufacturers Association) – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

G. NEMA OS 1 (National Electrical Manufacturers Association) – Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

H. NEMA OS 2 (National Electrical Manufacturers Association) – Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

I. NEMA RN 1 (National Electrical Manufacturers Association) – Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

J. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit.

K. NEMA TC 3 (National Electrical Manufacturers Association) – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

L. NEMA TC 6 - Non-Metallic Conduit.

M. NEMA TCB 2(National Electrical Manufacturers Association) - Guidelines for the Selection and Installation of Underground Nonmetallic Raceways

N. NEMA 250 (National Electrical Manufacturers Association) – Enclosures for Electrical Equipment (1,000 Volts Maximum).

O. NETA (International Electrical Testing Association) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

P. NFPA 70 National Electrical Code (NEC). Latest approved edition

Q. NICET (National Institute for Certification in Engineering Technologies).

R. UL 1 Flexible Metal Conduit

S. UL 6 Rigid Metal Conduit

T. UL 514B Conduit, Tubing and Cable Fittings.

U. UL 651 Rigid Non-Metallic Conduit

V. UL 797 Electrical Metallic Tubing

W. UL 1242 Intermediate Metal Conduit

1.4 SYSTEM DESCRIPTION

A. Raceway, boxes and manholes located as indicated on drawings and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway, boxes and manholes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.

C. In Slab above Grade: Provide galvanized rigid steel conduit. Provide cast or concrete-tight sheet metal boxes.

D. Exposed Dry Locations: Provide galvanized rigid steel conduit. Provide cast metal boxes.

E. Concealed Dry Locations: Provide electrical metallic tubing. Provide cast or sheet metal boxes.

F. Locations subject to Corrosive Atmospheres (chemical storage rooms, coastal areas, highly alkaline environments, etc.): Provide PVC coated, galvanized rigid steel or intermediate steel conduit. Provide PVC coated cast or sheet metal boxes.

G. Hazardous Locations (Per NEC Article 500): PVC Coated rigid metallic conduit. Cast malleable iron boxes with threaded hubs for conduit entry. Provide properly installed conduit seals at hazardous boundaries.

1.5 CONDUIT APPLICATION

A. Acceptable raceway systems and their limitations of use are summarized in the following table:

Location	**RMC**	**SSRC**	**RNC**	**LFMC**
Exterior locations: Wet or subject to physical damage.	Yes	Yes	No	No (note 3)
Exterior locations: Damp and not subject to physical damage.	Yes	Yes	No	Yes
Interior locations: Wet or subject to physical damage.	Yes	Yes	No	No (note 3)
Interior locations: Exposed and not subject to physical damage.	Yes	Yes	No	Yes
Interior locations: Totally concealed.	Yes	No	No (note 4)	Yes
Underground:	Yes	No	Yes	No

B. Notes for Conduit Application Table:

1. RMC = rigid metallic conduit, SSRC = stainless steel rigid conduit; RNC = rigid nonmetallic conduit, LFMC = liquid-tight flexible metal conduit.
2. For the purposes of these specifications, locations subject to physical damage include, but are not limited to, those areas less than 6 feet above the finished floor or grade.
3. Stainless steel conduit is required in vaults and exposed aboveground areas on the reservoirs.
4. Liquid-tight flexible metal conduit may also be use in wet or damp, exterior or interior locations not subject to physical damage, where used for flexible equipment connections in lengths not exceeding 3 feet.
5. Rigid nonmetallic conduit may also be used above grade, where totally concealed in walls, for transitions from underground up to a height of 24 inches above the concrete sill.
6. The use of liquid-tight flexible metal conduit is limited to lengths not exceeding 6 feet for flexible connections to equipment and lighting fixtures, or where necessitated by structural obstacles and explicitly approved by the Owner’s Representative.

1.6 BOX APPLICATION

A. Provide raceway, boxes and manholes located as indicated on drawings and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements and for a complete wiring system.

1.7 CONDUIT SIZE

A. Minimum acceptable conduit sizes are summarized in the following table:

	Minimum Size
Underground, site wiring	1”
Underground • Building wiring Aboveground • Equipment or panel feeders • Telecommunications	3/4”
Aboveground • Lighting or branch circuit wiring • Fire alarm • Security	3/4”
Other	3/4”

1.8 SUBMITTALS

A. Manufacturer’s Installation Instructions: Submit application conditions and limitations of use stipulated by product testing agency having jurisdiction. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

B. Submit detailed conduit routing plan, for review and approval, prior to installation as follows:

1. Exposed and/or concealed in building walls for conduits larger than 2-inch outside diameter.
2. All underground conduits (3/4-inch and larger) whether run alone or in duct banks; concealed in floor slabs, equipment pads and concrete slabs.

C. Product Data: Submit for the following:

1. Rigid Metallic Conduit.
2. Stainless steel rigid conduit
3. Liquid tight flexible metal conduit (LFMC).
4. Nonmetallic conduit.
5. Raceway fittings.

6. Conduit bodies.
7. Surface raceway.
8. Pull boxes, junction boxes and manholes.

D. Manufacturer's Installation Instructions:
1. Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.
2. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
3. In accordance with Division 01 submittal procedures.

1.9 CLOSEOUT SUBMITTALS

A. Project Record Documents:

1. Accurately record actual routing of conduits. Provide record (as-built) drawings marked in red to show actual routing of the underground raceway and cable when different from the original contract drawings. Prepare on new, clean set of contract drawings.
2. Record actual locations and mounting heights of outlet, pull boxes, junction boxes and manholes.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect all raceways and conduits from corrosion and entrance of debris by storing above grade with adequate support to prevent sagging or bending over time and provide appropriate covering from weather and direct sunlight.

PART 2 PRODUCTS

2.1 CONDUIT

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Rigid Metallic Conduit (RMC), couplings and elbows shall be hot-dip galvanized, rigid mild steel in accordance with ANSI C80.1 and UL 6A. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate. Conduit shall be formed with continuous welded seams with a uniform wall thickness, in minimum 10-foot lengths, with threaded ends.

C. Stainless Steel Rigid Conduit (SSRC), couplings and elbows shall be 316L stainless steel conduit to ASTM A312, to meet the demands of a corrosive environment in accordance with ANSI C80.1 and UL 6A. The conduit interior and exterior surfaces shall be polished to a standard "brite" finish to increase corrosion resistance. Conduit shall be formed with continuous welded seams with a uniform wall thickness, in minimum 10-foot lengths, with standard NPT threaded ends.

D. Liquid-Tight Flexible Metal Conduit (LFMC) shall be plastic-jacketed, galvanized steel, "Sealtite" Type EF for general service areas or Type HC for high-temperature when used under raised floor or in air plenums. LFMC shall not be used as a substitute for factory made elbows, or field made bends expected of a journeyman electrician. Conduit shall be UL listed.

E. Non-Metallic Conduit shall be as follows:

1. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Schedule 40: Conduit shall be 90 degree Celsius, polyvinyl chloride in conformance with NEMA TC-2 and UL 651 requirements.
3. Spacers used in duct bank installations shall be high impact plastic, interlocking bases, and intermediate type spacers. Place spacers between 6 and 10 feet apart.

F. Rigid aluminum conduits and flexible aluminum or non-metallic conduits are not permitted on this project, unless specifically required by the Authority Having Jurisdiction.

2.2 RACEWAY FITTINGS

A. Couplings and Thread Protectors. Each length of threaded conduit shall be provided complete from the manufacturer with a coupling on one end and a thread protector on the other. The thread protector shall have sufficient mechanical strength to protect the threads during normal handling and storage, and shall remain intact on threads until conduit is installed.

B. Metal Conduit Fittings shall conform to the requirements of UL 514B where this standard applies. Galvanized malleable iron or galvanized steel fittings shall be used with steel conduit. Threaded fittings shall engage a minimum of five threads made up wrench-tight and be compatible with conduit. EMT fittings shall be steel compression type, UL approved for rain tight applications and setscrew type with insulated throat for indoor applications.

C. Liquid-Tight Flexible Conduit (LFMC) Fittings shall be galvanized steel, T&B 53XX series insulated throat, and shall bear the UL label. Die-cast malleable fittings are not acceptable.

D. Flexible Metal Conduit (FMC) Fittings shall be galvanized steel similar to T&B “Tite-Bite”.

E. Non-Metallic Conduit Fittings shall be of same material and strength characteristics as the conduit and shall be solvent welded as recommended by manufacturer. End bells shall be plastic, high impact, tapered to fit. Where conduit transition from non-metallic to metallic is required, provide non-metallic female “terminal” adapter. Non-metallic “male” adapters are not acceptable.

F. Special Fittings. Conduit sealing, explosion proof, dust proof, and other types of special fittings shall be provided as required and shall be consistent with the area and equipment with which they are associated. Fittings installed outdoors or in damp locations shall be sealed and gasketed. Outdoor fittings shall be of heavy cast construction. Hazardous area fittings and conduit sealing shall conform to NEC requirements for the area classification.

G. Bushings shall be provided for the termination of all conduits not terminated in hubs, couplings or insulated throat connectors. Grounding type insulated bushings with insulating inserts in metal housings shall be provided for conduit 1-1/4 inches and larger. Standard bushings shall be galvanized steel or malleable iron in all sizes.

H. Locknuts. One interior and one exterior locknut shall be provided for all conduit terminations not provided with threaded hubs and couplings. Locknuts shall be designed to securely bond with the conduit to the box when tightened. Locknuts shall be so constructed that they will not be loosened by vibration.

I. Connectors and other fittings used for raceway entrances into enclosures shall meet the minimum requirements of the NEMA rating of the enclosure.

J. Unions. Watertight conduit unions shall not be used without approval by the Owner's Representative.

K. Raintight Conduit terminating hubs, where indicated on the drawings or required by these specifications, shall be Myer's rigid conduit hubs, or approved equal.

2.3 CONDUIT BODIES

A. Aluminum conduit bodies shall be die-cast copper-free aluminum alloy A360. Aluminum conduit bodies shall be finished with powder-coated paint. Cover shall be die-cast or stamped aluminum or steel.

B. Malleable iron conduit bodies shall be malleable iron Form 5 or Form 7 with tensile strength meeting ASTM A48, Class 30A requirements. Malleable iron conduit bodies subject to corrosive atmospheres (chemical storage rooms, coastal areas, highly alkaline environments, etc.) shall be finished with an epoxy powder coating. Cover shall be malleable iron.

C. All conduit bodies' entrances shall be machined NPT threads with a smooth, rounded, internal conduit stop bushing.

D. All conduit bodies shall be equipped with a sealed and gasketed cover. Cover shall be secured using stainless steel captive machine screws or stainless steel camming type securing.

E. Conduit bodies shall be selected and installed to provides the most readily accessible cover access.

2.4 CONDUIT SUPPORTS

A. Conduit supports shall be furnished and installed in accordance with other section of these specifications. Conduits shall be supported so that fittings are accessible. Support systems shall be limited to supporting electrical raceways, conduits, and electrical boxes and apparatus only.

B. Hanger rods shall be 3/8-inch diameter galvanized threaded steel rods, minimum. Stainless steel threaded rods shall be used in areas subject to corrosive atmospheres (chemical storage rooms,

coastal areas, highly alkaline environments, etc.). Conduit racks over 18-inch wide, over one level, or supporting 2-inch RSC or larger, shall be 1/2-inch diameter rod minimum.

C. Conduit Clamps. Conduits in single runs or groups of two shall be supported by steel clamps and clamp backs. They shall be galvanized malleable iron or approved equal cast ferrous metal for steel conduit or tubing.

D. Support Channels. Supports for more than one raceway or conduit shall be constructed of formed steel support channels of minimum 1-5/8 inch depth and width (Unistrut, Kindorf, Superstrut, B-Line, Power Strut or approved equal) with associated bolted-type conduit or tubing straps. Support channels shall be zinc plated steel or hot-dip galvanized after fabrication with galvanized steel clips for steel conduit or tubing.

E. Wall Penetrations. All conduits, raceways, cables and sleeve penetrations through fire rated and hazardous location walls, shafts, floor, ceilings, etc., shall be sealed with a UL-approved fire stopping system, in accordance with specification Section 260526 – Basic Electrical Materials and Methods.

2.5 OUTLET BOXES AND SWITCH BOXES

A. Manufacturers: Firms regularly engaged in the manufacturing of electrical raceways of the types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1 and UL 514A, galvanized flat rolled sheet steel outlet wiring boxes of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.

C. Outlet boxes used in wet outdoor locations, surface mounted shall comply with NEMA FB 1, be cast metal (FS or FD type) with mounting lugs and gasketed covers secured with stainless steel fasteners.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported, per NEC requirements.

F. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, weatherproof cable strain reliefs, and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and meeting requirements of individual wiring situations.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

2.6 PULL BOXES, JUNCTION BOXES, HANDHOLES AND MANHOLES

A. Sheet Metal Boxes shall be NEMA OS 1, NEMA rating as indicated on drawings. Minimum 16 gauge galvanized steel construction with stainless steel hinged cover and neoprene gasket. Cover shall be secured to the body with a continuous, full length, piano type hinge and stainless steel pin on one side and captive stainless steel screw on the other side. Door shall be equipped with padlock hasp with sealing hole provisions.

1. Provide #10-32 tapped collar studs for optional ground lug kit.
2. Provide 3/8-16 tapped collar studs for mounting optional panel.
3. Provide external mounting feet for secure wall mounting.
4. Finish: Wash and phosphate undercoat with ANSI 61 gray polyester power finish.

B. Surface-Mounted Cast Metal Box: NEMA 250, NEMA Type 3R or 4 as indicated, flat-flanged, surface- mounted junction box:

1. Material: Malleable iron.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

C. Stainless Steel Boxes: NEMA 4X. minimum 14 gauge, 316 stainless steel, continuously welded and gasketed. Electro polish surface resistant to impacts of up to 7 Nm. Continuous closed cell neoprene gasket. All hardware shall be 316 Stainless Steel.

D. Concrete pull boxes, vaults and hand holes for power, lighting, controls and telecommunications shall be pre-cast concrete boxes, sized as indicated on the drawing. Pull boxes shall be equipped with a concrete cover for non traffic rated locations OR cast-in frame, galvanized steel, adjustable, high impact traffic cover (H-20 load rated), sump, lifting lugs, and conduit knock-outs as indicated on the drawings. Knockout location and sizes shall be coordinated with the duct bank for each location. Cover shall be engraved with the words - – “POWER”, “LIGHTING”, “CONTROLS”, COMM/DATA”, “TELEPHONE” or similar as applicable.

E. Concrete manholes for buried power (MH-P-xx) and control (MH-C-xx) conduits shall be pre-cast concrete vault. Hand hole or splice box for buried power (MH-P-xx) and control (MH-C-xx) conduits shall be pre-cast concrete Fiberglass-Reinforced-Plastic box.

1. Manufacturer: Utility Vault, Oldcastle, or approved equal.
2. Size shall be indicated on the drawings.
3. Pull boxes, Vaults and Manholes shall be equipped with:
    a. Galvanized steel covers for non-traffic rated locations and cast-in frame, galvanized steel, adjustable, high impact traffic cover (H-20 load rated) for traffic rated locations.
    b. Sump, lifting lugs, conduit knock-outs, pick holes, bolt down holes in cover plate, and pull irons. Knockout location and sizes shall be coordinated with the duct bank for each location. HDG cable racks shall be provided as required to support the cables in the pull box. Cover shall be engraved with the words “POWER”, “LIGHTING”, or “CONTROLS” as applicable.

2.7 CLOSURE FOAM

A. All conduit, raceways, cables and sleeves penetrations through fire rated and hazardous location walls, shafts, floor, ceilings, etc., shall be sealed by closure foam as in Dow Corning #3-6548 silicone RTV, GR RTV 850 silicone foam, or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough in.

3.2 EXISTING WORK

A. Extend existing raceway and box installations using materials and methods compatible with and consistent to existing electrical installations, or as indicated on drawings.

B. Clean and repair existing raceway and boxes that are to remain, or to be reused, or are to repurposed.

3.3 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: RMC. Galvanized Rigid Steel Conduit or IMC by permission of the Construction Manager.
2. Concealed Conduit, Aboveground: RMC or IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or 4X.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: RMC.
2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
3. Boxes and Enclosures: NEMA 250, Type 1.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 1.

2. Stainless steel rigid conduit: Use threaded stainless steel conduit fittings or malleable cast steel fittings unless otherwise directed. Ensure materials will not be electrolytically incompatible.
3. Liquid-tight Flexible Conduit: Use only fittings listed for use with Liquid-tight flexible metal conduit. Comply with NEMA FB 1 and UL 514B.

3.4 INSTALLATION OF RACEWAYS

A. Routing

1. Install raceway and boxes in accordance with NEC 110-12 Mechanical Execution of Work including but not limited to complying with those standards mentioned in the Informational Note. Accepted industry practices are described in ANSI/NECA 1-2006, *Standard Practices for Good Workmanship in Electrical Contracting,* and other applicable ANSI-approved installation standards
2. Conduit routing shown on drawings is diagrammatic only. Contractor shall field route conduit and raceways between equipment and devices as required to obtain a complete wiring system installed in accordance with industry standards.
3. All exposed conduits shall be installed parallel or perpendicular to dominant surfaces with right-angle turns made of symmetrical bends or fittings.
4. Conduit shall not be installed on the outside face of exposed beams, girders, and columns, but shall be routed on the web or on the inside of a flange. When a round, box, or rectangular beam or column is encountered, conduit shall route along the side most protected from damage and least intrusive, with consideration given to minimizing unnecessary bends and fittings.
5. Except where prevented by the location of other work, a single conduit or a group of conduits shall be centered on structural members.
6. Conduit shall be located at least 6 inches from hot water or steam pipes and from other hot surfaces
7. Complete raceway installation before starting conductor installation.
8. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
9. Raceways Embedded in Slabs:
    a. Run conduit larger than 1-inch (25-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
    b. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
    c. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
    d. Do not embed thread less fittings in concrete unless specifically approved by Architect for each specific location.
10. Stub-ups to Above Recessed Ceilings:
    a. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
11. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel

box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

12. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    b. Where an underground service raceway enters a building or structure.
    c. Where otherwise required by NFPA 70.

B. Moisture Pockets

1. Moisture pockets shall be eliminated from conduits. If water cannot drain to the natural opening in the conduit system, a "T-type" conduit body shall be provided at the low point of the conduit run, and a removable plug shall be installed in a downward facing hub.

C. Couplings and Unions

1. Metal conduit shall be joined by threaded conduit couplings, with the conduit ends butted.
2. The use of running threads, Erickson type couplings, split couplings or similar unions are not permitted.

D. Conduit Bodies

1. Conduit bodies shall meet the volume sizing requirements of NEC, and the minimum bend radius of the cable installed or as indicated on the drawings, whichever is greater.

E. Bends and Offsets

1. Changes in direction of conduits shall be made with fittings or bends.
2. Conduit bends shall meet the requirements of NEC, minimum bend radius of the cable installed or as indicated on the drawings, whichever is greater.
3. Field bends shall be made using appropriate tools or mechanical equipment. The use of a pipe tee, pipe vise, or other makeshift methods for bending conduit or tubing will not be permitted.
4. For non-metallic conduit or PVC coated rigid metallic conduit, approved factory bends and offsets shall be used.
5. Conduits or tubing that is cambered, deformed, or crushed in any way including from improper storage or handling shall be removed from the job site and shall not be permitted to be installed.
6. Install no more than the equivalent of three 90 degree bends between conduit bodies, pull boxes, junction boxes, or outlets.
7. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Cutting and Threading

1. The plane of all conduit ends shall be cut square with the centerline. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

2. Where threads are required, they shall be cut and cleaned only after the conduit has been reamed to industry standards.
3. The ends of all conduit and tubing shall be reamed and deburred to remove all rough edges.
4. Cutting oil shall be used in threading operations; the dies shall be kept sharp, and provisions shall be made for chip clearance.
5. Threads on conduits and fittings shall be lubricated and protected with a UL listed thread sealing compound suitable for use on electrical fittings and raceway.
6. All threaded conduit shall be re-galvanized after threading with "Galvanizing Powder M-321" as manufactured by the American Solder and Flux Company of Philadelphia, Pennsylvania; "Zincilate 810" as manufactured by Industrial Metal Protectives, Inc., of Dayton, Ohio; "Zinc Rich" coating as manufactured by ZRC Chemical Products Company, Quincy, Massachusetts; or other cold-galvanized zinc-rich coating. The Contractor shall supply this protective material and shall apply it in the field.

G. Connections to Boxes and Cabinets

1. Install raceways square to the enclosure and terminate at enclosures with locknuts.
2. Conduit shall be securely fastened to all boxes and cabinets.
3. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit.
4. The locknuts, both inside and outside, shall then be tightened sufficiently to bond the conduit securely to the box.
5. Locknuts on connectors shall be tightened securely to bond the connectors.
6. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path

H. All conduits entering enclosures outdoors or in wet areas shall enter through Myer’s hubs, or approved equal, or threaded openings.

I. Cleaning

1. Precautions shall be taken to prevent the accumulation of water, dirt, or concrete in the conduit.
2. Conduit in which water or other foreign materials have been permitted to accumulate shall be thoroughly cleaned and pass inspection by the Owner/Owner’s Representative or, where such accumulation cannot be removed by methods acceptable to the Owner /Owner’s Representative, the conduit shall be replaced.
3. Mandrel all conduits and raceways using mandrels compliant with mandrel table found in NEMA TCB-2, latest edition. After which, draw a stiff bristle brush through the conduit to remove debris, then using a clean swab, clean the conduit until it is clear of particles of foreign materials and a fresh swap drawn through remains clean.

J. Empty Conduit

1. All conduits installed for future use shall have a polypropylene pull line with a minimum tensile strength of 200 lbs., Jet Line, Cat. No. 232, polyolefin, or approved equal. Pull line shall be secured at both ends to ensure future accessibility. Leave at least 12 inches (300

mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

K. Rooftop Conduits

1. Provide manufactured Unistrut supports anchored to concrete roof as indicated for all conduit runs exposed on roofs.

L. Identification

1. All conduits shall be identified in accordance with other section of these specifications.

M. Grounding

1. All conduits shall be grounded in accordance with specification Section 260526 – Basic Electrical Materials and Methods and NFPA 70, Article 250.
2. A solid or stranded bare copper or green insulated copper ground wire shall be provided in all conduits and raceways.

N. Galvanized Rigid Metallic Conduit (RMC)

1. RMC shall be installed in areas exposed to weather, vehicle traffic, in hazardous classified areas, for penetrations through foundations, and 10 feet before transition from below grade to 8 feet above grade, unless otherwise noted on the drawings.
2. RMC in contact with earth shall be protected by UL Listed 10 mil PVC tape applied in double thickness using 50 percent lap turns to 4 inches above grade and 4 inches beyond transition.
3. Expansion joints shall be used where required.

O. Rigid Aluminum Conduit

1. Not acceptable on this project, except where required by the Authority Having Jurisdiction.

P. Stainless steel rigid conduit (SSRC)

1. SSRC shall be installed instead of RMC within vaults and exposed on reservoirs.
2. Compatible expansion joints or LMFC sections shall be used where required.

Q. Liquid-Tight Flexible Metal Conduit (LFMC)

1. LFMC shall be steel. Aluminium flexible conduit shall not be used.
2. LFMC inserts not greater than 30 inches in length, shall be installed in all conduit runs, which are supported by both building steel and by structures subject to vibration, thermal expansion, or otherwise appreciable movement. This shall include locations where conduit supported by building steel enters or becomes supported by isolated structures on separate foundations.
3. LFMC shall be installed in conduit runs, which cross expansion joints. The sections of liquid-tight flexible conduit shall include a threaded coupling and a straight fitting of the same size as the raceway at each end of the section.

4. Special areas, such as plant office control rooms in which external noise is to be minimized, shall have LFMC in conduit runs where the runs cross from the main building framing to the control room or office framing.
5. LFMC shall be installed as the last section of raceway connecting to all equipment and devices, which move in relation to the supply conduit due to vibration, from the normal operation of the mechanism, or as needed to allow for thermal expansion.
6. LFMC shall be used to connect to pressure switches, thermocouples, solenoids, and similar devices. Liquid-tight flexible conduit shall be installed adjacent to the motor terminal housing for motors requiring 4-inch and smaller conduit.
7. LFMC inserts not greater than 6 feet in length may be installed as the last section of raceway connecting to light fixtures.
8. LFMC shall be used for connections to motors and transformers, in areas exposed to weather, moisture or oil, and under raised floors.

R. Non-Metallic Conduit

1. Schedule 40 shall be used for all power, signal feeders and branch circuits, in earth or encased in concrete, unless otherwise noted on the drawings. Conduits must be covered to depth in accordance with NFPA 70, or as indicated on drawings, whichever is greater.

S. Conduit Support

1. Fasten conduit supports to building structures and surfaces in accordance with Section 260526 – Basic Electrical Materials and Methods.
2. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
3. Do not use wire, ceiling support wires or perforated pipe straps to support conduit. Remove any temporary installation support wire.
4. Support conduit within 12 inches of enclosures to which attached.

T. Spacing of Supports

1. All conduit runs shall be rigidly supported, except where buried in concrete,.
2. Each conduit shall be supported within one (1) foot of junction boxes and fittings.
3. Spacers used in duct bank installations shall be placed no more than 6 to 10 feet apart.
4. Support spacing along conduit runs shall be as follows.

Conduit Size	Maximum Distance Between Supports
½ inch through 1-1/4 inch	5 feet
1-1/2 inch and larger	8 feet

U. Ground and bond raceway and boxes in accordance with Section 260526 – Basic Electrical Materials and Methods and NFPA 70, Article 250.

3.5 CABINET AND BOX INSTALLATION

A. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

B. Install electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and in compliance with drawings and regulatory requirements.

C. Locate boxes and conduit bodies so as to ensure ready accessibility of electrical wiring, maintain headroom and to present neat mechanical appearance.

D. Locate boxes so that cover or plate will not span different building finishes.

E. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. In inaccessible ceiling areas, install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire, with cover facing towards direct access.

F. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel. Use flush mounting outlet boxes in finished areas.

1. Do not install flush mounting boxes back-to-back in walls.
2. Provide minimum 6-inch separation between adjacent boxes.
3. Provide minimum 24-inch separation in acoustic rated walls.
4. Use stamped steel bridges to fasten flush mounting outlet box between studs.
5. Secure flush mounting box to interior wall and partition studs.
6. Accurately position boxes and plaster rings to make flush within 1/8 inch of surface finish.
7. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
8. Use adjustable steel channel fasteners for hung ceiling outlet box.
9. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a rain tight connection between box and cover plate or supported equipment and box.

G. Support boxes independently of conduits.

H. Use code sized gang box where more than one device is mounted together. Do not use sectional box. Use code sized gang box with plaster ring for single device outlets.

I. Use cast outlet box in exterior locations where exposed to the weather and wet locations (interior or exterior).

J. Coordinate installation of electrical boxes and fittings with cable and raceway installation work. Provide knockout closures to cap unused knockout holes where blanks have been removed.

K. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections where fastened with a locknut or bushing on rounded surface.

A. Fasten boxes rigidly to substrate or structural surfaces to which they are being mounted, or solidly embed electrical boxes in concrete or masonry as appropriate. Do not support boxes by conduits.

L. Except as prevented by the location of other work, all junction boxes and outlet boxes shall be centered on structures.

M. Conduit openings in boxes shall be made with a knockout punch and not a hole saw. Hole saws may be used only to provide a pilot hold for subsequent use of a knockout punch.

N. Cabinets and boxes shall be rigidly mounted.

1. Mounting on concrete shall be secured by self-drilling anchors, or wedge style anchors such as Hilti Kwik-Bolt or similar. Drop-in anchors that are set with a hammer and tool may be used for equipment mounted on floors only.
2. Mounting on steel shall be by drilled and tapped screw holes, through drilled holes where a nylock nut can be installed and accessed after installation, by special support channels welded to the steel, or by a combination of these methods.
3. Cabinets shall be leveled and fastened to the mounting surface with not less than ¼-inch air space between the enclosure and mounting surface.
4. All mounting holes in the enclosure shall be used.

O. Large Pull Boxes - Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.

1. Interior Dry Locations - Use hinged enclosure.
2. Other Locations - Use surface mounted box of appropriate location classification.
3. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

3.6 ANCHORS

A. Where supports for raceways, boxes, and cabinets are mounted on concrete surfaces, they shall be fastened with self-drilling tubular expansion shell anchors with externally split expansion shells, single-cone expanders, and annular break-off grooved chucking cones. Anchors shall be Phillips "Red Head", Hilti “Kwik-Bolt” or approved equal.

3.7 PULL BOX AND VAULT INSTALLATION

A. Openings or “knockouts” in precast concrete vaults shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or flange.

B. Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with 3,000 psi non-shrink grout.

C. After the structure and all appurtenances are in place and approved, backfill shall be placed to the original ground line or to the limits designated on the plans.

D. All joints between precast concrete vault sections shall be made watertight. The plastic joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure. The outside of the entire structure shall be coated with an approved water proofing material.

E. Access doors shall be built up such that the hatch is flush with the surrounding surface unless otherwise specified on the drawings or by the District. The Contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.

F. Ladders shall be installed using Type 316 stainless steel capsule anchors.

G. Ladders shall be attached a minimum of 3 places to the vault wall.

H. Ladder shall be centered under access door opening.

3.8 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.9 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.10 QUALITY CONTROLS

A. All testing, by Contractor and Owner or their assigned agent shall be in accordance with the NETA ATS. The Owner may impose the requirement the Agent conducting testing be a Member Company of NETA or alternatively that NETA ATS be followed but the Agent may be an separately engaged testing contractor such as one regularly engaged in the business of Acceptance Testing; and that their field personnel must include at least one technician with a current Level-3 Certification from either NETA or NICET.

3.11 ADJUSTING

A. Install knockout closures in unused openings in boxes.

3.12 CLEANING

A. Clean interior of boxes with a wet vac and damp towel to remove dust, debris, and other material.

B. Clean exposed surfaces using a damp towel and when necessary restore manufacturer's finish using manufacturer's OEM finish product.

END OF SECTION 260533

SECTION 310513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil materials.
2. Topsoil materials.

B. Related Sections:

1. Section 310516 - Aggregates for Earthwork.
2. Section 312316.13 - Trenching.
3. Section 312323 - Fill.
4. Section 329119 - Landscape Grading.
5. Section 329219 - Seeding and Soil Supplements.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2216 – Standard Test Methods for Laboratory Determination (Moisture) Content of Soil and Rock by Mass.
5. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
7. ASTM D5084 – Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Test Reports: Submit reports of all tests specified to be performed.

C. Materials Source: Submit name of imported materials source.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil or topsoil material from single source throughout the work.

PART 2 - PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil Type S1:

1. On-site excavated and re-used material.
2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
3. Maximum Plasticity Index of 12 and Liquid Limit of 35.
4. A maximum of 25% fines passing the No. 200 mesh sieve.

2.2 TOPSOIL MATERIALS

A. Topsoil Type S2:

1. Excavated and reused material or imported borrow.
2. Reasonably free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, toxic substances and foreign matter.
3. Imported borrow
    a. Soil conforming to ASTM D2487 Group Symbol OH.
    b. Soluble Salts: 600 ppm maximum
    c. Phosphorus (P): 10-40 ppm
    d. Potassium (K): 121-175 ppm
    e. Acidity range (pH) of 6.0 to 7.0.
    f. Containing minimum of 8 percent and maximum of 25 percent organic matter.

2.3 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing and Inspection Services Testing and analysis of soil material.

B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D4318 and ASTM D6913.

C. Testing and Analysis of Topsoil Material: Analyze to ascertain percentage of phosphorus, potassium, soluble salt content, organic matter content, and pH value. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

D. When tests indicate materials do not meet specified requirements, change or amend material and retest.

E. Furnish materials of each type from same source throughout the work.

F. Testing frequency shall be one test for every 5,000 cubic yards of each type of imported soil.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations designated by Contracting Officer.

B. Stockpile in sufficient quantities to meet project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Stockpile soil to a maximum height of 8 feet and protect from erosion.

E. Prevent intermixing of soil types or contamination.

F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 310513

SECTION 310516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate materials.
2. Fine aggregate materials.

B. Related Sections:

1. Section 310513 - Soils for Earthwork: Fill and grading materials.
2. Section 312316.13 - Trenching.
3. Section 312323 - Fill.
4. Section 312500 – Erosion and Sedimentation Controls: Slope protection and erosion control.
5. Section 331116 - Site Water Utility Distribution Piping.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Copies of test results from qualified testing laboratory and interpretation for compliance of these specifications to be submitted no less than 45 days prior to delivery for each imported material or anticipated use for excavated material.

1. Certified gradation analysis and test results conforming to the specified gradation, properties and characteristics.

2. Classification according to ASTM D2487 of each on-site and imported soil material proposed for fill and backfill.

3. Laboratory compaction curves according to ASTM D1557 for each on-site and imported soil material proposed for fill and backfill.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the work.

PART 2 - PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Type A1 (Structural Backfill): Crushed rock or gravel, and sand with the gradation requirements below.

1. Percent Passing per Sieve Size:
   a. 3/4 inch: 95-100.
   b. No. 4: 30 to 50.
   c. No. 200: 0 to 12.

B. Type A2 (Aggregate Base) Crushed aggregate base material shall consist entirely of crushed rock that can be compacted readily by watering and rolling to form a firm, stable base. The material shall meet the following requirements:

1. Gradation: Percent Passing per Sieve Size:
   a. 2-inch: 100
   b. 1-1/2 inch: -
   c. 1-inch: 80-100
   d. 3/4 inch: 64-94
   e. 3/8 inch: 40-69
   f. No. 4: 31-54
   g. No. 30: -
   h. No. 40: -
   i. No. 200: 4-7

2. California Bearing Value (CBR): ≥ 100
3. Los Angeles Abrasion: ≤ 50
4. Liquid Limit: ≤ 25
5. Plasticity Index: ≤ 6
6. Sand Equivalent Value: ≥ 22

C. Type A3 – Crushed Rock: The material shall conform to the following gradation:

1. Percent Passing per Sieve Size:
   a. 3/4 inch: 100
   b. 1/2 inch: 20-55
   c. 3/8 inch: 0-15
   d. No. 4: 0-5

D. Type A4 (Coarse Drainrock) Crushed granite rock or gravel with the following size gradation for Size Number 4 in accordance with ASTM C33

1. Percent Passing per Sieve Size:
   a. 2-inch: 100
   b. 1-1/2 inch: 90-100
   c. 1-inch: 20-55
   d. 3/4 inch: 0-15
   e. 3/8 inch: 0-5

E. Type A5 (Graded Drainrock) Drainrock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded with the following size gradation for Size Number 57 in accordance to ASTM C33

1. Percent Passing per Sieve Size:
   a. 1-1/2 inch: 100
   b. 1-inch: 95-100
   c. 1/2 inch: 25-60
   d. No. 4: 0-10
   e. No. 8: 0-5

F. Type A6 (Pea Gravel): Clean and graded, washed gravel with the following size gradation for Size Number 8 in accordance with ASTM C33. The loss by abrasion in the Los Angeles abrasion machine, determined as prescribed in ASTM C131, Grading A, shall not exceed 10 percent, by weight, after 100 revolutions nor 40 percent after 500 revolutions.

1. Percent Passing per Sieve Size:
   a. ½-inch: 100
   b. 3/8-inch: 85-100
   c. No. 4: 10-30
   d. No. 8: 0-10
   e. No. 16: 0-5

2.2 FINE AGGREGATE MATERIALS

A. Type A7 (Sand): Non-plastic, clean, natural sand or a combination of natural and manufactured granular material, free from loam, clay, mica, organic material or other substances not suitable for the purpose intended. Manufactured sand shall be the product obtained by crushing stone or gravel specially processed to assure suitable particle shape and gradation. Stone dust will not be permitted.

1. Percent Passing per Sieve Size:

a. 3/8-inch: 100
b. No. 4: 95-100
c. No. 30: 25-60
d. No. 50: 5-30
e. No. 200: 0-6

2. Liquid Limit: ≤ 25
3. Plasticity Index: ≤ 6

2.3 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing and inspection services.

B. Coarse Aggregate Material - Testing and Analysis: Perform according to ASTM D698. ASTM D1557. AASHTO T180. ASTM D4318. ASTM D6913.

C. Fine Aggregate Material - Testing and Analysis: Perform according to ASTM D698. ASTM D1557. AASHTO T180. ASTM D4318. ASTM D6913.

D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate aggregate materials from on-site locations indicated as specified in Section 312316.13.

B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.

C. Remove excess excavated materials not intended for reuse, from site.

D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.2 STOCKPILING

A. Stockpile materials on site at locations designated by Architect/Engineer.

B. Stockpile in sufficient quantities to meet project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 310516

SECTION 312316.13 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:

1. Section 033000 - Cast-In-Place Concrete: Concrete materials.
2. Section 310513 - Soils for Earthwork: Soils for fill.
3. Section 310516 - Aggregates for Earthwork: Aggregates for fill.
4. Section 312323 - Fill: General backfilling.
5. Section 329119 - Landscape Grading: Filling of topsoil over backfilled trenches to finish grade elevation.
6. Section 331116 - Site Water Utility Distribution Piping: Water piping and bedding from building to utility service.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Samples: Submit, in air-tight containers, 10 lb. sample of each type of fill to testing laboratory.

D. Materials Source: Submit name of imported fill materials suppliers.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with OSHA standard and Guam Environmental Protection Agency’s Permit Requirements.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this work and licensed in the Territory of Guam.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Pipe Bedding: Type A6 as specified in Section 310516.

B. Subsoil Fill: Type S1 as specified in Section 310513.

C. Structural Fill: Type A2 as specified in Section 310516.

D. Granular Fill: Type A1 as specified in Section 310516.

E. Concrete: Lean concrete.

PART 3 - EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on drawings.

1. Engineer and Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Maintain grade alignment of pipe using string line parallel with grade line and vertically above centerline of pipe.

1. Establish string line on level batter boards at intervals of not more than 25 feet.
2. Install batter boards spanning trench, rigidly anchored to posts driven into ground on both sides of trench.
3. Set three adjacent batter boards before laying pipe to verify grades and line.
4. Determine elevation and position of string line from elevation and position of offset points or stakes located along pipe route.
5. Do not locate pipe using side lines for line or grade

3.2 PREPARATION

A. Call Local Utility Line companies at GTA 644-4482 and at GWA 647-7831 not less than three working days before performing work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of work. Contractor to secure appropriate permit from Department of Public Works.

3.3 TRENCHING

A. Excavate subsoil required for utilities to utility service.

B. Remove lumped subsoil, boulders, and rock up of 1/6 cubic yard, measured by volume. Remove larger material as specified in Section 312316.26.

C. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.

D. Do not advance open trench more than 200 feet ahead of installed pipe.

E. Cut trenches to width indicated on drawings. Remove water or materials that interfere with work.

F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.

G. Excavate trenches to depth indicated on drawings. Provide uniform and continuous bearing and support for bedding material and pipe utilities.

H. Do not interfere with 45 degree bearing splay of foundations.

I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.

J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered. notify Engineer, and request instructions.

K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type Granular Fill and compact to density equal to or greater than requirements for subsequent backfill material.

L. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

M. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

N. Remove excess subsoil not intended for reuse, from site.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Design sheeting and shoring to be removed at completion of excavation work.

D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

E. Repair damage to new and existing work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Backfill trenches to contours and elevations, or to match existing grade with fill materials. When backfilling within the public right-of-way, follow DPW standards.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, or spongy subgrade surfaces.

C. Place material in continuous layers as follows:

1. Pipe Bedding: Maximum 8 inches compacted depth.
2. Subsoil Fill: Maximum 12 inches compacted depth.
3. Structural Fill: Maximum 8 inches compacted depth.
4. Granular Fill: Maximum 8 inches compacted depth.

D. Employ placement method that does not disturb or damage foundation perimeter drainage, utilities in trench.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Do not leave more than 50 feet of trench open at end of working day.

G. Protect open trench to prevent danger to the public.

3.6 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1/2 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1/2 inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557.

C. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
2. Moisture Tests: ASTM D3017.

D. When tests indicate work does not meet specified requirements, remove work, replace, compact, and retest.

E. Frequency of Tests: Per Section 331116 – Site Water Utility Distribution Piping.

3.8 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution and Closeout Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.9 SCHEDULE

A. Waterline Piping:

1. Cover pipe and bedding with Fill Type Granular Fill: To subgrade elevation.
2. Compact uniformly to minimum 95 percent of maximum density.

B. Duct Bank:

1. Cover duct and bedding with Fill Type Granular Fill: To subgrade elevation.
2. Compact uniformly to minimum 95 percent of maximum density.

END OF SECTION 312316.13

SECTION 312323 - FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Fill under paving.
5. Fill for over-excavation.

B. Related Sections:

1. Section 033000 - Cast-In-Place Concrete: Concrete materials.
2. Section 310513 - Soils for Earthwork: Soils for fill.
3. Section 310516 - Aggregates for Earthwork: Aggregates for fill.
4. Section 312316.13 - Trenching: Backfilling of utility trenches.
5. Section 329119 - Landscape Grading: Filling of topsoil to finish grade elevation.
6. Section 331116 - Site Water Utility Distribution Piping.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with Guam Department of Public Work's standard.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Material: Type S1 as specified in Section 310513.

B. Structure Backfill: Type A1 as specified in Section 310516.

C. Aggregate Base: Type A2 as specified in Section 310516.

D. Crushed Rock: Type A3 as specified in Section 310513.

E. Graded Drainrock: Type A5 as specified in Section 310516.

F. Concrete: Flowable fill concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

C. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Scarify subgrade surface to depth of 8 inches.

B. Compact subgrade to 90 percent relative density at a minimum moisture content of 2 percent over optimum.

C. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular fill and compact to density equal to or greater than requirements for subsequent fill material.

D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

A. Backfill areas to contours and elevations, or match existing grade, as specified.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Place material in continuous layers as follows:

1. Subsoil Fill (Type S1), Structure Backfill (Type A1), or Aggregate Base (Type A2): Maximum 8 inches compacted depth.

D. Compact material as follows

1. Subsoil Fill (Type S1): Compact to 90 percent relative density at a minimum moisture content of 2 percent over optimum. The upper 6 inches of pavement and building areas should be compacted to 95 percent relative density at a minimum moisture content of 2 percent over optimum.
2. Structure Backfill (Type A1) or Aggregate Base (Type A2): Compact to 90 percent relative density at a minimum moisture content of optimum. The upper 6 inches of pavement and building areas should be compacted to 95 percent relative density at a minimum moisture content of optimum.

E. Employ placement method that does not disturb or damage other work.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Backfill against supported foundation and retaining walls. Do not backfill against unsupported foundation and retaining walls.

H. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

I. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

J. Make gradual grade changes. Blend slope into level areas.

K. Remove surplus backfill materials from site.

L. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Within Building or Structure Areas: Plus or minus 1/2 inch from required elevations.

C. Top Surface of Backfilling Under Paved Areas: Plus or minus 1/2 inch from required elevations.

D. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557.

C. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
2. Moisture Tests: ASTM D3017.

D. When tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: One test for each 1,000 square feet of each lift of fill material.

F. Proof roll compacted fill surfaces under slabs-on-grade, and paving.

3.6 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution and Closeout Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

A. Fill Under Shallow Footing or Mat Foundations:

1. Material Types S1, A1 or A2, thickness per drawings, compacted to 95 percent.

B. Fill Under Interior Slab-On-Grade:
1. Material Type A3, thickness per drawings.
2. Material Types S1, A1 or A2, thickness per drawings.

C. Fill Under Grass Areas:

1. Material Type S1 or S2, to 6 inches below finish grade, compact uniformly to 90 percent of maximum density.

D. Fill Under Asphalt and Concrete Paving:

1. Material Type A2, to bottom of pavement layer, compact as discussed in Section 3.3 or per Department of Public Works if within the right-of-way.

E. Fill to Correct Over-excavation:

1. Material Types S1, A1 or A2, flush to required elevation.

END OF SECTION 312323

SECTION 312323.33 - FLOWABLE FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flowable fill for:
   a. Structure backfill.
   b. Utility backfill.

B. Related Requirements:

1. Section 312316.13 - Trenching: Soil and aggregate backfill for utility trenches.
2. Section 312323 - Fill: Soil and aggregate backfill for structures.
3. Section 329119 - Landscape Grading: Filling of topsoil over backfilled trenches to finish grade elevation.
4. Section 331116 - Site Water Utility Distribution Piping: Water piping and bedding from building to utility service.

1.2 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.

B. Excavatable Flowable Fill: Lean cement concrete fill used where future excavation may be required, such as fill for utility trenches, bridge abutments, and culverts.

C. Non-excavatable Flowable Fill: Lean cement concrete fill used where future excavation is not anticipated, such as fill below structure foundations and filling abandoned utilities.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C33 - Standard Specification for Concrete Aggregates.
2. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
5. ASTM C403/C403M - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
6. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
7. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
8. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

9. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
10. ASTM D5971 - Standard Test Method for Practice for Sampling Freshly Mixed Controlled Low Strength Material (CLSM).
11. ASTM D6023 - Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM).
12. ASTM D6103 - Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM).

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Field Quality-Control Submittals:

1. Mix Design:
   a. Furnish flowable fill mix design for each specified strength.
   b. Identify design mix ingredients, proportions, properties, admixtures, and tests.
2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.

D. Delivery Tickets:

1. Furnish duplicate delivery tickets indicating actual materials delivered to project site.

1.5 QUALITY ASSURANCE

A. Perform work according to Guam Department of Public Work’s standards.

B. All testing will be performed by a testing laboratory selected by the Contractor and approved by the Construction Manager, except as otherwise indicated.

1.6 QUALIFICATIONS

A. Supplier:

1. Company specializing in supplying products specified in this section with minimum three years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 015000 - Temporary Facilities and Controls specifies ambient condition control facilities for product storage and installation.

B. Minimum Conditions: Do not install flowable fill during inclement weather.

PART 2 - PRODUCTS

2.1 FLOWABLE FILL

A. Flowable Fill: Excavatable type. Non-excavatable type to follow Section 033000 - Cast-in-Place Concrete.

2.2 MATERIALS

A. Portland Cement: ASTM C150 Type II

B. Pozzolan: ASTM C618, Type F or C. Pozzolan content, by weight, in excavatable type shall not be greater than cement content.

C. Aggregates: ASTM C33.

D. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical Admixture: ASTM C494/C494M.

1. Type A - Water Reducing.

C. Fly Ash: ASTM C618 Class C or F obtained from residue of electric generating plant using ground or powdered coal.

2.4 MIXES

A. Mix and deliver flowable fill according to ASTM C94/C94M, Option A.

B. Flowable Fill Design Mix Requirements:

1. 28-Day Compressive Strength:
   a. Excavatable: Maximum 500 psi.
   b. Minimum 1,000 psi. Follow requirements of Section 033~~3~~000 - Cast-in-Place Concrete.
2. Flow Test:
   a. Excavatable and Non-Excavatable: 8 to 12-inches.

C. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.5 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test and analyze properties of flowable fill design mix and certify results for the following:

1. Design mix proportions by weight of each material.
2. Aggregate: ASTM C33 for material properties and gradation.
3. Properties of plastic flowable fill design mix including:
    a. Temperature.
    b. Air entrainment.
    c. Wet unit mass.
    d. Yield.
    e. Cement factor.
    f. Flow Consistency.
4. Properties of hardened flowable fill design mix including:
    a. Compressive strength at 1 day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.
    b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

C. Prepare delivery tickets containing the following information:

1. Project designation.
2. Date.
3. Time.
4. Class and quantity of flowable fill.
5. Actual batch proportions.
6. Free moisture content of aggregate.
7. Quantity of water withheld.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify excavation specified in and Section 312316.13 Trenching is complete.

C. Verify utility installation is complete and tested before placing flowable fill.

D. Verify excavation is dry and dewatering system is operating.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

C. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

D. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

A. Place flowable fill by chute, pumping or other methods approved by the Engineer.

1. When required, place flowable fill under water using tremie procedure.
2. Do not place flowable fill through flowing water.

B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

C. Place flowable fill evenly on both sides of utilities to maintain alignment.

D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Perform inspection and testing according to ASTM C94/C94M.

1. Take samples for tests for every 150 cu yd of flowable fill, or fraction thereof, installed each day.
2. Sample, prepare and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.
3. Measure temperature at point of delivery when samples are prepared.
4. Sample and flow test according to ASTM D6103

C. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.

1. Test Requirements:
   a. Minimum temperature at point of delivery.
   b. Compressive strength requirements for each type of fill.
   c. Flow test results at point of delivery.
2. Documentation: Duplicate delivery tickets.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Remove spilled and excess flowable fill from project site.

C. Restore facilities and site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION 312323.33

SECTION 312500 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Diversion Channels.
2. Sedimentation Ponds.
3. Erosion Control Blankets.

B. Related Sections:

1. Section 031000 - Concrete Forming and Accessories.
2. Section 032000 - Concrete Reinforcing.
3. Section 033000 - Cast-In-Place Concrete.
4. Section 310513 - Soils for Earthwork.
5. Section 310516 - Aggregates for Earthwork.
6. Section 312323 - Fill.
7. Section 329119 - Landscape Grading.
8. Section 329219 - Seeding.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.

C. ASTM International:

1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. Precast/Prestressed Concrete Institute:

1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Product Data: Submit data on geotextile and erosion control blanket.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with requirements of Section 312323.~~,~~ Section 329119, and Section 329219.

B. Perform work according to Guam EPA standards.

C. Maintain one copy of each document on site.

1.6 PRE-INSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

PART 2 - PRODUCTS

2.1 GEOTEXTILE MATERIALS

A. Geotextile Fabric: Furnish according to Guam EPA standards.

1. Must maintain 125 gpm per sq. ft. flow rate. Note: a 4” washed, rounded limestone aggregate layer may be substituted for geotextiles meant to separate layers.
2. Size: 0.08” thick equivalent opening size of #80 sieve.
3. In accordance with ASTM D751 (puncture strength – 125lb); ASTM D1117 (Mullen Burst Strength – 400 psi); ASTM D1682 (Tensile Strength – 300lb.)

B. Silt Fence Material: Furnish according to the plans.

2.2 EROSION CONTROL BLANKETS (ECB)

A. Manufacturers:

1. Contech Engineered Solutions/Landlok
2. Nilex
3. ACF Environmental
4. Carthage Mills
5. Or approved equal

B. Materials

1. Extended-term ECB with functional longetivity of 2 years.
2. 100% coconut fiber and two polypropylene nets securely sewn together with UV stabilized thread.
3. Light penetration – minimum 16% per ASTM D6567.
4. Tensile strength – minimum 100 lb/ft per ASTM D6818.
5. Unvegetated shear stress – minimum 2 lb/ft^2 per ASTM D6460.

2.3 POSTS FOR SILT FENCE

A. Fence Posts (for fabricated units): The length shall be a minimum of 36 inches long. Wood posts will be of sound quality hardwood with a minimum cross sectional area of 3.0 square inches. Steel posts will be standard T and U section weighing not less than 1.00 pound per linear foot.

2.4 WIRE FENCE FOR SILT FENCE

A. Wire Fence (for fabricated units): Wire fencing shall be a minimum 14 gage with a maximum 6 in. mesh opening, or as approved.

2.5 CONCRETE MATERIALS AND REINFORCEMENT

A. Cement: As specified in Section 033000.

B. Fine and Coarse Aggregates: as specified in Section 033000.

C. Water: Clean and not detrimental to concrete.

D. Admixtures:

1. Air Entrainment: manufactured by.
2. Chemical: As specified in Section 033000.
3. Fly Ash or Calcined Pozzolan: As specified in Section 033000.
4. Plasticizing: As specified in Section 033000.

E. Aggregate, Sand, Water, Admixtures - Precast: Determined by precast fabricator, as appropriate to design requirements and PCI MNL-116S.

F. Reinforcement Steel: As specified in Section 032000.

G. Welded Steel Wire Fabric: As specified in Section 032000.

2.6 AGGREGATE, AND SOIL MATERIALS

A. Crushed Rock: Type A3, as specified in Section 310516.

B. Subsoil Material: Type S1, as specified in Section 310513. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.7 PLANTING MATERIALS

A. Seeding and Soil Supplements: As specified in Section 329219.

B. Mulch: As specified in Section 329219.

2.8 ACCESSORIES

A. Joint Sealers: As specified in Section 033000.

B. Joint Filler: As specified in Section 033000.

2.9 MIXES

A. Concrete: As specified in Section 033000.

2.10 SOURCE QUALITY CONTROL (AND TESTS)

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.

C. Test samples in accordance with ACI 301.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted subgrade, granular base or stabilized soil is acceptable and ready to support devices and imposed loads.

C. Verify gradients and elevations of base or foundation for other work are correct.

3.2 DIVERSION CHANNELS

A. Windrow excavated material on low side of channel.

B. Compact to 95 percent maximum density.

C. On entire channel area, apply soil supplements and sow seed as specified in Section 329219.

D. Mulch seeded areas with hay as specified in Section 329219.

3.3 SEDIMENTATION POND

A. Install work according to the CNMI and Guam Stormwater Management Manual standards

3.4 EROSION CONTROL BLANKETS

A. Install on all slopes 3:1 or steeper and 6 feet or greater in length along the slope.

B. Install per manufacturer's instructions.

C. Grade and compact area prior to installation. Remove large rocks, soil clods, vegetation and other sharp objects.

D. Amend soil, add fertilizer, and seed per Section 329219.

E. Dig anchor trench at top of slope. Extend end of blanket 6-12 inches beyond trench toward slope. Use staples or stakes to fasten blanket into trench at 12 inches on center. Backfill with soil and compact. Cover backfill with blanket roll and fasten on downhill side of trench at 12 inches on center.

F. Continue to unroll blanket down slope, ensuring direct contact with ground. Overlap edges a minimum of 3 to 6 inches.

G. Fasten with stakes or staples per manufacturer's specifications. Do not stretch the blanket.

3.5 SITE STABILIZATION

A. Incorporate erosion control devices indicated on the Drawings into the project at the earliest practicable time.

B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.

C. Stockpile and waste pile heights shall not exceed 35 feet. Slope stockpile sides at 2: 1 or flatter.

D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.

1. During non-germinating periods, apply mulch at recommended rates.
2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 329219 at 50 percent of permanent application rate with no topsoil.
3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 329219 permanent seeding specifications.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.6 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements and 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

C. Field test concrete in accordance with Section 033000.

D. Compaction Testing: As specified in Section 312323.

E. When tests indicate work does not meet specified requirements, remove work, replace and retest.

3.7 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.

C. Do not damage structure or device during cleaning operations.

D. Do not permit sediment to erode into construction or site areas or natural waterways.

E. Clean channels when depth of sediment reaches approximately one half channel depth.

3.8 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished work.

B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.

C. Do not permit construction traffic over paving for 7 days minimum after finishing until 75 percent design strength of concrete has been achieved.

D. Protect paving from elements, flowing water, or other disturbance until curing is completed.

END OF SECTION 312500

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.
6. Surface slurry.

B. Related Requirement:

1. Section 310516 – Aggregates for Earthwork: Base course
2. Section 312323 - Fill: Compacted subbase for paving.
3. Section 321723 - Pavement Markings: Painted pavement markings, lines, and legends.

C. The work under this section shall consist of furnishing all materials, mixing at the plant, hauling, placing and compacting a mixture of aggregate materials, mineral admixture, additives, and an asphalt binder to form a pavement course, or other specified purposes, in accordance with the details shown on the project plans and the requirements of these specifications.

D. It is the intent of this specification that the Contractor acquire and make all arrangements for a source, or sources, of material; that it furnish Certificates of Compliance as hereinafter specified; that it furnish a mix design using Marshall mix design methodology that will meet the design criteria specified hereinafter; and that it provide all the equipment, materials, and labor necessary to furnish and place the asphalt concrete in accordance with the requirements specified herein.

E. The mix design shall follow the methods as described in the most current edition of Design Methods for Asphalt Concrete and Other Hot-Mix Types MS-2 published by the Asphalt Institute.

1.2 REFERENCE STANDARDS

A. Federal Highway Administration

1. FP-03 – The Standard Specifications of the Construction of Roads and Bridges on Federal Highway Projects.

B. American Association of State Highway and Transportation Officials:

1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.

2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

C. Asphalt Institute:

1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

D. ASTM International:

1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.
4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.
7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit product information for asphalt and aggregate materials.
2. Submit mix design with laboratory test results supporting design.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Conform to Public Work's standard**.**

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum 5 years experience.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Aggregate: the more stringent of FP-03 Subsection 703.07 or Tables 321216-1 & 2

B. Asphalt binder: Tables 321216-1 & 2

C. Additives: As accepted by the Engineer

D. High-tensile strength synthetic fibers*: As accepted by the Engineer

E. Anti-strip additive use Type 3 (lime). Anti-strip additive shall be used on all bridge decks and where HMA is placed over concrete.

F. Polymer additive shall be used in all HMA Friction Course.

G. High-tensile strength synthetic reinforcing (micro) fiber shall be used for all HMA Friction Course placed over portland cement concrete pavement.

2.2 ASPHALT CONCRETE MIX DESIGN CRITERIA

A. The Contractor shall do all things necessary to furnish, develop, and supply asphalt concrete pavements to comply with the design and acceptance requirements for the HMA design as specified herein. Variation to the requirements shall not be considered except as may be hereinafter specified in Subsection 3.14, Alternate Mix Design Criteria.

Table 321216-1
HMA Base Course Requirements:

Criteria (AASHTO T 245)	Requirements
Voids in Mineral Aggregate (VMA)	13% minimum
Air Voids	3.0% to 5.0%
Air Voids Design Target Value	4%
Stability, pounds minimum	2700
Flow, 0.01 inches	8-14
Compaction, number of blows each end of test specimen	75
Dust –asphalt ratio	0.8-1.2
Asphalt Cement Binder	AR16000 or PG 70-10. AR8000 with additive may be used with approval of the Engineer
Immersion Compression (AASHTO T165 and T167) (1) Compressive strength, psi (dry) (2) Retained strength, minimum	 300 70%
Gradation (AASHTO T 27 & T 11)	FP-03 Table 703-4, Gradation Designation B or C
Los Angeles abrasion, AASHTO T 96	35% maximum
Sodium sulfate soundness loss of course and fine aggregate (5 cycles), AASHTO T 104	12% maximum
Fractured faces, ASTM D 5821	95% minimum, one face 90% minimum, two faces
Fine aggregate angularity, AASHTO T 304, method A	42 minimum
Flat and elongated particles, 3 to 1 ratio, ASTM D 4791	10% maximum 3:1 Ratio
Sand equivalent value, AASHTO T 176, alternate method No. 2, reference method	45 minimum

(a) For base course (binder) mixes, the VMA shall be calculated and reported to the nearest tenth of a percent. This value will be rounded to the nearest whole number for Job Mix Formula (JMF) acceptance and JMF verification testing. VMA calculated to xx.5% shall be rounded up to the nearest whole percent.

(b) Up to 15 percent recycled asphalt pavement material by mass may only be used in the HMA Base Course Mix.

(c) Furnish hard, durable particles or fragments of crushed stone, crushed slag, or crushed gravel.

Table 321216-2
HMA Friction Course Requirements:

Criteria (AASHTO T 245)	Requirements
Voids in Mineral Aggregate (VMA)	15% minimum
Air Voids	3.0% to 5.0%
Air Voids Design Target Value	4%
Stability, pounds minimum	2,000
Flow, 0.01 inches	8-14
Compaction, number of blows each end of test specimen	75
Dust-asphalt ratio	0.8-1.2
Asphalt Cement Binder	AR16000, or PG 70-10. AR8000 with additive – use will be limited and only with the approval of the Engineer
Immersion Compression (AASHTO T165 and T167) (1) Compressive Strength, psi (dry) (2) Retained strength, minimum	 300 70%
Gradation (AASHTO T 27 & T11)	FP-03 Table 703-4, Gradation Designation D
Fine Aggregate Angularity (AASHTO T 304)	43 minimum
Los Angeles abrasion, AASHTO T 96	30% maximum

(a) Voids in Mineral Aggregate (VMA) shall be calculated to the nearest tenth of a percent. VMA calculated to xx.5% shall be rounded up to the nearest whole percent for Job Mix Formula (JMF) acceptance and JMF verification. VMA shall be determined in accordance with Asphalt Institute Manual Series No. 2 (MS-2).

(b) The percent asphalt shall target a value of 4% air voids, to the nearest whole percent, for the preparation of the Job Mix Formula (JMF).

(c) The percent of air voids shall be based on AASHTO T166, T209, and T269. Maximum specific gravity (density) shall be based on AASHTO T 209.

(d) Dust-asphalt ratio is defined as the percent of material including non-liquid anti-strip and mineral filler passing the No. 200 sieve divided by the percent of the effective asphalt (calculated by mass of mix).

(e) The aggregate for the asphalt concrete wearing surface (friction course) shall be basalt or approved equivalent. Limestone, relatively pure carbonate aggregates or any aggregates known to polish shall not be used in the mix. The Los Angeles abrasion value for these aggregates shall not exceed 30%.

(f) An anti-strip additive is required for asphalt concrete wearing surface (friction course) when placed on bridge decks and concrete pavement.

(g) AR8000 asphalt cement binder may be used, with an additive, upon approval of the Engineer. The additive may be a Warm Mix or Polymer that shall modify the properties of AR8000 to meet or exceed AASHTO M 320, Standard Specifications for Performance-Graded Asphalt Binder for PG 70-10. The equivalent PG Grade and True Performance Grade of the AR8000 with the additive shall be submitted with the LJMF (Laboratory Job Mix Formula).

(h) No recycled asphalt pavement material is allowed in the friction course hot mix asphalt.

2.3 COMPOSITION OF LABORATORY JOB MIX FORMULA (LJMF)

A. The Contractor shall furnish mixes of aggregate, asphalt cement binder and additives that meet the applicable material requirements, appropriate design requirements specified in Tables 321216-1 and 321216-2, and are capable of being placed and compacted as specified.

1. Submission of LJMF. Utilizing mineral aggregate which has been crushed, processed, separated, and stockpiled for this project, a LJMF shall be formulated and submitted by the Contractor on Form FHWA 1622 (Marshall) and FHWA 0.45 power gradation charts for review at least 28 days before production begins. The LJMF shall include the location of all commercial mixing plants to be used. A separate LJMF for each plant is required. The LJMF shall be prepared under the direct supervision of, and shall bear the seal of, a registered professional engineer authorized to practice on Guam. The LJMF shall also include a signed statement prepared by the testing laboratory that certifies the proposed job-mix formula meets the requirements of the contract and can be compacted in the field during production to meet contract requirements.

   Testing laboratories used by the Contractor for Quality Control testing shall be properly accredited.

   Acceptable laboratory accreditations are:

   - American Association of State Highway and Transportation officials (AASHTO)
   - American Association for Laboratory Accreditation (A2LA)
   - International Accreditation Services, Inc. (IAS)
   - National Voluntary Laboratory Accreditation Program (NVLAP)
   - U.S. Army Corps of Engineer Materials testing Center (MTC)

   The Contractor shall supply split samples of aggregate, admixture and binder with the LJMF in the event the Engineer decides to perform verification testing. These samples shall be taken by the Contractor's personnel as split samples from the same material used for development of the LJMF. The samples shall be collected and split under the observation of the Engineer or the Engineer's representative.

   For each LJMF the Contractor shall submit the following:

   a. Aggregate and mineral filler.
      1) Target values;
         a) Target value for percent passing each sieve size for the aggregate blend; and
         b) Target values for the percent passing each sieve size for each stockpile.
      2) Stockpile blend ratios;
      3) Target values for individual hot bins of batch plants;
      4) Hot bin blend ratios;
      5) Target asphalt content;
      6) Maximum density value according to AASHTO T 209;
      7) Source and percentage of each aggregate stockpile to be used;
      8) Average gradation of each aggregate stockpile;

9) Representative samples from each aggregate stockpile. Use split samples of material taken in accordance with 2.3(A.1) above;
10) 200 pounds of aggregates proportioned by stockpile according to the stockpile's proportion in the mix;
11) 20 pounds of bag house fines if proposed for the mix;
12) 20 pounds of mineral filler if proposed for mix; and
13) Results of aggregate quality tests for Contractor selected sources. Include the sand equivalent, fractured faces, Los Angeles abrasion, sodium sulfate soundness, coarse durability, and fine durability results from tests performed within 1 month of aggregate use.

b. Asphalt binder.
1) Target asphalt binder content;
2) Three 1-gallon samples of the asphalt binder to be used in the mix. Do not include anti-strip additives in these samples;
3) Recent test results from the manufacturer for the asphalt binder including a temperature-viscosity curve;
4) Material safety data sheets; and
5) Mixing temperature range and minimum compaction temperature for the grade of asphalt to be used in the mix.

c. Anti-strip additives. If part of the job-mix formula:
1) 1 pint of liquid anti-strip additive or 10 pounds of cement, fly ash, or lime anti-strip additive;
2) Name of product;
3) Manufacturer;
4) Material safety data sheet; and
5) Dosage rate.

d. High tensile strength reinforcing (micro) fibers.
The fiber reinforcement shall conform to the following
1) Approximate fiber length: ¾" (19mm);
2) Synthetic aramid fiber blend.
3) A high fiber tensile strength > 390,000 p.s.i.
4) Synthetic aramid fiber blend shall be tested using the Indirect Tensile (IDT) strength test protocol from AASHTO T322 or ASTM D6931 from a minimum of three (3) separate laboratory trials. Test results shall be conducted at a temperature between 50 degrees F and 70 degrees F and compared with a control that does not contain the aramid fiber blend. The aramid fiber blend shall be identical to control mix except for the inclusion of fibers added at the same dosage as proposed on the project. Indirect tensile test results from fiber specimens shall show an average tensile strength increase of 20 percent over control specimen.
5) Synthetic aramid fiber blend shall be tested using the Aramid Dispersion State Ratio (ADSR) Tests from a minimum of two (2) separate laboratory trials. Perform ADSR test based on ASTM D2172. The average extracted aramid fiber quantity must be greater than or equal to 0.007 percent by total sample weight with no individual result less than 0.005 percent of the total sample weight. All tested fiber mixes must achieve a minimum ADSR of 85%.
6) Fiber dosage rate and tolerance per manufacturer's requirements.
7) Fiber addition during asphalt production that ensure efficient and thorough distribution, mixing and melting of fibers through asphalt mix.
8) No change to the HMA mix design other than the addition of fibers.

e. Recycled asphalt pavement material. If part of the job-mix formula:
   1) Source and percentage of recycled asphalt pavement material;
   2) Average gradation of the recycled asphalt pavement material;
   3) Percent asphalt binder in the recycled asphalt pavement;
   4) Target value for the asphalt binder content (that considers the percent asphalt binder in the recycled asphalt pavement) and the percent new (virgin) asphalt binder to be added to the mix;
   5) 200-pound representative sample of recycled asphalt pavement material. For existing pavements, mill where designated by the Project Engineer to the pavement removal depth. Sample the removed material and replace it with an approved asphalt concrete mix. Do not use the replacement material in the recycled mix; and
   6) One gallon of recycling agent, if part of the job-mix formula.

2. Verification. The Engineer will review and may perform design verification testing for the Contractor's proposed mix design. If verification testing is performed by the Engineer the information supplied in the Contractor's LJMF must agree with the verification test results within the following tolerances:
   a. Aggregate gradations. Representative aggregate samples from each stockpile, when combined according to the Contractor's recommendation for stockpile percentages, shall be within the gradation tolerances depicted in FP-03 Table 703-4, with the base point for each sieve defined by the target values of the LJMF.
   b. Voids in Mineral Aggregate (VMA). See Table 321216-1 HMA Base Course Requirements.
   c. Immersion Compression. The Contractor's dry strength result is verified if the Engineer's result is above the minimum contract requirement, or the average of the Contractor's and the Engineer's result is above the minimum contract requirement and the two values differ by no more than 50 pounds per square inch. The Contractor's percent of retained strength is verified if the Engineer's result is above the minimum contract specification.
   d. Marshall Air Voids, stability, and flow. The Contractor's results are considered verified if they meet the contract requirements shown in Table 321216-1 for HMA Base Course Requirements or Table 321216-2 for HMA Friction Course Requirements.
3. Changes and Resubmissions. If a job-mix formula is rejected, material source is changed, or if the recycled asphalt pavement source, use or percentage used is changed, a new job-mix formula shall be submitted for acceptance. Up to 21 days may be required to evaluate a change. Approved changes in target values will not be applied retroactively for payment.

   The Engineer will, at their discretion, deduct all job-mix formula evaluation costs from amounts due to the Contractor resulting from any of the following:
   a. Contractor-requested changes to the approved job-mix formula;
   b. Contractor requests for additional job-mix formula evaluations; and
   c. Additional testing necessary due to the failure of a submitted job-mix formula.
4. Acceptance. Do not begin mix production until the job-mix formula is accepted by the Engineer.

2.4 MIXING PLANT

A. Use mixing plants conforming to AASHTO M 156 supplemented as follows:

1. All plants.
   a. Automated controls. Control the proportioning, mixing, and discharging of the mix automatically.
   b. Dust collector. AASHTO M 156, Requirements for All Plants, Emission Controls is amended as follows:
      1) Equip the plant with a dust collector. Dispose of the collected material. In the case of baghouse dust collectors, dispose of the collected material or return the collected material to the mix uniformly. Use of baghouse fines in asphalt concrete mixes requires approval from the Engineer, unless included as part of the approved job-mix formula.
   c. Recycled asphalt pavement. When recycled asphalt pavement material is incorporated into the mixture, modify plants according to the plant manufacturer's recommendations to process reclaimed material.
   d. High tensile strength reinforcing (micro) fibers. Deliver fiber-reinforcement in sealed, undamaged containers with labels intact and legible, indicating material name and lot number. Deliver fiber-reinforcement to location where it will be added to each batch or loaded into the mixer. Store materials covered and off the ground. Keep sand and dust out of boxes and do not allow boxes to become wet. Add aramid and polyolefin reinforcing fiber blends at a dosage rate proposed by the manufacturer that achieves the IDT and ADSR results required. Have a fiber manufacturer's representative on site during mixing and production. This requirement can be waived if fiber manufacturer and asphalt producer can supply evidence of manufacturer's brand of fiber being successfully produced a minimum of two times at the asphalt plant to be used for the project. Add fiber through specialized equipment that can accurately proportion and/or meter, by weight (mass), the proper amount per batch for batch plants, or continuously and in a steady uniform manner for drum plants.
2. Drum dryer-mixer plants.
   a. Bins. Provide a separate bin in the cold aggregate feeder for each individual aggregate stockpile in the mix. Use bins of sufficient size to keep the plant in continuous operation and of proper design to prevent overflow of material from one bin to another.

      Ensure that each bin compartment has the capacity and design to permit a uniform flow of aggregates. Mount the bin compartment over a feeder of uniform speed, which will deliver the specified proportions of the separate aggregates to the dryer at all times. If necessary, equip the bins with vibrators to ensure a uniform flow of the aggregates at all times.

      Provide each bin compartment with a gate that is adjustable in a vertical direction. Provide gates that can be held securely at any specified vertical opening. Equip the gates with a measuring device for measuring the vertical opening of the gates from a horizontal plane level with the bottom of the feeder.

      Each bin will have a 'no-flow' switch which will alert the plant operator that no material is flowing from the bin, if this bin is active for the mix being produced.

   b. Stockpiling procedures. Place each aggregate component in an individual stockpile, and separate each from the adjacent stockpiles, either by space or by a system of bulkheads. Prevent the intermingling of different materials in stockpiles at all times. Identify each stockpile, including RAP, as shown on the mix design.

      Form and maintain stockpiles in a manner that will prevent segregation. If a

stockpile is determined to have excessive segregation, the Engineer will disapprove the material for use on the project until the appropriate actions have been taken to correct the problem.

c. Oversize Aggregate. Remove any oversized pieces of aggregate by use of a scalping screen. Do not return this oversized material to the stockpile for reuse unless it has been crushed and reprocessed into sizes that will pass the scalping screen.

d. Mineral Filler. If mineral filler is used in the mix, feed or weigh it in separately from the other aggregates.

e. High tensile strength reinforcing (micro) fibers. Inject fibers through the RAP collar by placing fibers on the RAP belt for by feeding them with a blower tube system. Rate the feeding of fibers with the rate the plant is producing asphalt mix. If there is any evidence of fiber balls at the discharge chute, increase the mixing time and/or temperature or change the angle of the fiber feeder line to increase dry mixing time. For manual feeding, place fibers on the RAP belt at intervals based on the plant production rate. If approved by the Engineer, fiber can be added manually by pre-weighed dissolvable bags for HMA mixes only. Have a manufacturer's representative approve all fiber addition systems. When using a blower tube system, add fibers continuously and in a steady uniform manner. Provide automated proportioning devices and control delivery within ±10% of the mass of the fibers required. Perform an equipment calibration to the satisfaction of the fiber manufacturer's representative to show that the fiber is being accurately metered and uniformly distributed into the mix.

3. Batch and continuous mix plants.

a. Hot aggregate bin. Provide a bin with 3 or more separate compartments for storage of the screened aggregate fractions to be combined for the mix. Make the partitions between the compartments tight and of sufficient height to prevent spillage of aggregate from one compartment into another. Heat and dry the aggregates before screening. Control the temperature of the aggregates so that the temperature of the completed mixture at the plant is within the range allowed.

b. Load cells. Calibrated load cells may be used in batch plants instead of scales.

c. Recycled asphalt pavement. Modify batch plants so the recycled asphalt pavement is introduced into the mix after bypassing the dryer. Design the cold feed bin, conveyor system, and special bin adjacent to the weigh hopper, if used, to avoid segregation and sticking of the recycled asphalt pavement material. Heat aggregate to a temperature that will transfer sufficient heat to the recycled asphalt pavement material to produce a mix of uniform temperature within the range specified in the approved job-mix formula.

d. High tensile strength reinforcing (micro) fibers. When a batch plant is used, add the fiber to the aggregate in the weigh hopper and increase both dry and wet mixing times. Ensure that the fiber is uniformly distributed before the injection of asphalt cement into the mixture.

2.5 PAVERS

A. Use pavers that are:

1. Self-contained, power-propelled units with adjustable vibratory screeds with full-width screw augers;
2. Heated for the full width of the screed;
3. Capable of spreading and finishing courses of asphalt mix in widths at least 12 inches more than the width of one lane;
4. Equipped with a receiving hopper having sufficient capacity to ensure a uniform spreading operation;
5. Equipped with automatic feed controls, which are properly adjusted to maintain a uniform depth of material ahead of the screed;
6. Operable at forward speeds consistent with satisfactory mix lay down;
7. Capable of producing a finished surface of the required smoothness and texture without segregating, tearing, shoving, or gouging the mix; and
8. Equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line, sensing the transverse slope of the screed, and providing the automatic signals that operate the screed to maintain grade and transverse slope.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

C. Verify compacted granular subbase is dry and ready to support paving and imposed loads.

1. Proof roll subbase with minimum two perpendicular passes to identify soft spots.
2. Remove soft subbase and replace with compacted fill as specified in Section 312323.

D. Verify gradients and elevations of base are correct.

E. Verify manhole frames and valve covers are installed in correct position and elevation.

3.2 SURFACE PREPARATION

A. Clean the existing surface of all loose material, dirt, or other deleterious substances by approved methods. Apply an asphalt tack coat to contact surfaces of pavements, curbs, gutters, manholes, and other structures according to FP-03 Section 412.

3.3 WEATHER LIMITATIONS

A. Place hot mix asphalt pavement on a dry surface when the temperature of the road surface in the shade conforms to table below.

Table 321216-3
Asphalt Concrete Mix Placement Temperature

Compacted Lift Thickness	**< 2 Inches**	**2 – 3 Inches**	**> 3 Inches**
Road Surface Temperature °F	**Minimum Lay-Down Temperature[1] °F**		
50 – 59.9	295	280	270
60 – 69.9	285	275	265
70 – 79.9	280	270	265
80 – 89.9	270	265	260
≥ 90	265	260	255

B. Do not transport asphalt mix from the plant to the roadway unless all of the following weather conditions are suitable for the laying operations.

1. Temperature: Spread the HMA only when the air temperature in the shade and away from artificial heat is at least 60ºF for layers greater than 1 inch (100 lb/yd2) in thickness and at least 65ºF for layers 1 inch (100 lb/yd2) or less in thickness (this includes leveling courses). The minimum temperature requirement for leveling courses with a spread rate of 50 lb/yd2 or less is 70 ºF.

2. Wind: Do not spread the HMA when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc., are being deposited on the surface being paved to the extent that the bond between layers will be diminished.

3. Night Paving: Use Engineer approved night paving operations and traffic control plan.

4. Rain: Do not produce HMA when rain is falling at the plant or on site.

   Stop paving when rain starts and the ground or pavement becomes wet. Restart paving when the rain stops and the ground or pavement becomes dry.

3.4 ASPHALT PREPARATION

A. Uniformly heat the asphalt binder to provide a continuous supply of the heated asphalt binder from storage to the mixer. Do not heat asphalt binder above 350ºF unless the manufacture recommends a higher temperature due the modification of the asphalt binder.

B. If a liquid heat stable anti-strip additive is used, meter it into the asphalt binder transfer lines at a bulk terminal or mixing plant. Inject the additive for at least 80 percent of the transfer or mixing time to obtain uniformity.

3.5 AGGREGATE PREPARATION

A. If non-liquid anti-strip is used, adjust the aggregate moisture to at least 4 percent by mass of aggregate. Mix the anti-strip uniformly with the aggregate before introducing the aggregate into the dryer or dryer drum. Mix with the aggregate particles to produce a uniform mixture. Use calibrated weighing or metering devices to measure the amount of anti-strip and moisture added to the aggregate.

B. Treated aggregate may be held in stockpiles before mixing with asphalt, but the treated aggregate must be used during the same construction season in which it was produced.

C. For batch plants, heat, dry, and deliver aggregate for pugmill mixing at a temperature sufficient to produce a mix temperature within the approved range. Adjust flames used for drying and heating to prevent aggregate damage and contamination.

3.6 MIXING

A. Measure or meter the aggregate and asphalt into the mixer according to the approved job-mix formula. Mix until all the particles are completely and uniformly coated with asphalt according to AASHTO M 156. Maintain the discharge temperature within the approved range.

B. Control plant operations so the moisture content of the HMA at the plant is 0.5 percent or less according to AASHTO T 110.

C. The Contractor is responsible to produce a homogeneous mixture, with no segregated materials, that meets all specification requirements. Also apply these requirements to all mixes produced by the drum mixer process and all mixes processed through a hot storage or surge bin, both before and after storage.

D. Batch Mixing:

1. Aggregates: Once the dried aggregates and mineral filler (if required) are prepared in the manner previously described and combined in batches to meet the verified mix design by weighing each separate bin size, convey them to the empty mixer.
2. Asphalt Binder: Introduce the accurately measured hot asphalt binder into the mixer simultaneously with, or after, the hot aggregates. Continue mixing until the mixture is thoroughly uniform with all particles fully coated.
3. Mixing Time: The mixing time begins when the measuring devices for both the asphalt and the aggregates indicate that all the material is in the mixer, and continues until the material begins to leave the mixing unit. Since the mixing time varies in relation to the nature of the aggregates and the capacity of the mixer, mix sufficiently to produce a thoroughly and uniformly coated mixture according to AASHTO M 156.

E. Continuous Mixing: Introduce the dried aggregates and mineral filler (if required), prepared as specified and proportioned to meet the verified mix design, into the mixer in synchronization with the accurate feeding of the hot asphalt cement. Mix sufficiently to produce a thoroughly and uniformly coated mixture.

F. Mix Temperature:

1. Heat and combine the ingredients of the mix in such a manner as to produce a mixture with a temperature, when discharged from the pugmill or surge bin, which is within the master range as defined below.
2. Determine the temperature of the completed mixture using a quick-reading thermometer through a hole in the side of the loaded truck immediately after loading. Locate 1/4 inch hole on both sides of the truck body within the middle third of the length of the body, and at a distance from 6 to 10 inches above the surface supporting the mixture. If a truck body already has a hole located in the general vicinity of the specified location, use this hole. At the Engineer's discretion, the Contractor may take the temperature of the load over the top of the truck in lieu of using the hole in the side of the truck.
3. The normal frequency for taking asphalt mix temperatures will be for each day, for each design mix and every truck load. Take the temperature of the asphalt mix at the plant and at the destination, on arrival, and right before the mix is placed. Record the temperature on the front of the respective delivery ticket. The Engineer shall review the plant and destination temperature readings and may take additional temperature measurements at any time.
4. The master range for all mix designs will be the target mix temperature from the mix design ±30ºF. There are two master ranges, one at the asphalt plant (mixing temperature from the mix design ±30ºF) and one at the roadway (compaction temperature from the mix design ±30ºF). Reject any load or portion of a load of asphalt mix at the plant or at the placement location with a temperature outside of the master ranges. The Engineer will be immediately notified of the rejection.

3.7 HAULING

A. Use vehicles with tight, clean, and smooth metal beds for hauling asphalt concrete mixes.

B. Thinly coat the beds with an approved material to prevent the mix from adhering to the beds. Do not use petroleum derivatives or other coating material that contaminates or alters the characteristics of the mix. Drain the bed before loading.

C. Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mix from the weather. When necessary to maintain temperature, use insulated truck beds and securely fastened covers. Provide access ports or holes for checking temperature of asphalt mix in the truck.

D. Deliver HMA using HMA trucks in sufficient quantities and at such intervals to allow continuous placement of the material. Do not allow trucks to leave the plant within 1 hour of sunset unless nighttime paving is approved by the Engineer. The Engineer can suspend construction operations if the Contractor fails to maintain a continuous paving operation. Before the truck leaves the plant, obtain a weigh ticket from a computerized truck scale. Before unloading, submit for each truckload a legible weigh ticket that includes the following:

1. Name and location of the HMA plant;
2. Project title and number;
3. Load time and date;
4. Truck number;
5. Mix designation and number;
6. Plant lot number;
7. Tare, gross, and net weight; and

8. Daily Sub-Total.

E. The weight tickets shall have locations on the tickets to write the mix temperatures at the plant and at the destination, arrival time of the truck at destination, the unloading time of the truck, the locations of where the HMA was placed, signature of the scale operator, truck driver and inspector at site.

F. Each weight ticket will have at least 2 copies of which at least one copy will be kept by the inspector.

G. The weigh master and truck driver shall sign the weigh tickets.

H. In the event of breakdown of the weight ticket printer system, the Engineer can accept weigh tickets showing the information listed above written by hand for each truck, for a period not exceeding the necessary repair time but not to exceed a 24 hour period unless approved by the Engineer.

I. When using an automated batching plant, obtain weigh tickets from the printer used in conjunction with an automated batching and mixing system. The printed ticket shall show the individual weights of the various components of the HMA in a batch, the total weight of each batch, and the sum of all batch weights in the truckload. At the completion of each day's work, the HMA supplier's representative shall certify that the total net weight supplied to each contract was correct.

3.8 PRODUCTION START-UP PROCEDURES

A. Pre-paving Conference. At least 14 days before the start of paving operations, the Contractor shall arrange a pre-paving conference. Coordinate attendance with the Engineer and all applicable subcontractors. Submit and prepare to discuss the following:

1. Proposed schedule of paving operations;
2. List of all equipment (excavation, compaction, lay down, haul, pugmill, etc.), and personnel used in the production and construction of the work;
3. Proposed traffic control plan for paving operations including provisions for pavement drop-offs and moving operations;
4. Contractor quality control plan for paving and sampling and testing according to FP-03 Sections 153 and 154;
5. Procedures for constructing the control strip including placing, finishing, compacting, and smoothness procedures; and
6. Acceptance procedures according to FP-03 Subsections 106.05 and Subsection 3.13 below.

B. Control Strip

1. Provide 14 calendar days notice before beginning production of asphalt concrete mix.
2. On the first day of production, produce sufficient mix to construct a 1000-foot long control strip, a minimum of one-travel lane in width, and at the designated minimum lift thickness. Construct the control strip at an approved location.
3. Construct the control strip using mix production, lay-down, and compaction procedures intended for the entire mix. Cease production after construction of the control strip until

the asphalt concrete mix and the control strip are evaluated and accepted. The Engineer shall provide an evaluation of the control strip to the Contractor within 5 business days after the control strip is completed.

4. Mixture
   a. During the production of HMA for the control strip the Contractor shall provide the Engineer with samples of asphalt cement and aggregates for the evaluation of the Production Job-mix Formula (PJMF). Aggregate samples shall be collected and split by the Contractor from the hot bins and cold feed bins as directed by the Engineer.
   b. The Engineer shall sample the HMA in at least five locations from the pavement of the control strip HMA samples for evaluation of the PJMF. The location of the samples shall be selected by the Engineer based on random numbers.
   c. It is recommended that the Contractor also obtain aggregate samples and samples from the control strip at the locations determined by the Engineer and prepare a companion Job Mix Formula with the HMA placed on the roadway from the control strip. This companion Job Mix Formula may be utilized by the Contractor to provide another LJMF, if necessary.
   d. The Engineer shall prepare a PJMF from the samples taken. The PJMF shall be evaluated against the LJMF. The PJMF and the HMA placed for the control strip will be acceptable if:
      1) The optimum binder content in the PJMF at 4% air voids is plus or minus 0.2% of the optimum binder content in the LJMF;
      2) The VMA in the PJMF is equal to or above the minimum VMA requirements;
      3) The gradation of the material placed for the control strip is within the LJMF tolerances;
      4) The AC content of the material placed for the control strip is within the specification limits;
      5) The air voids of the material placed is within the specification limits;
      6) Marshall Plug stability is above the specification limits; and
      7) Marshall Plug flow is within specification limits.
5. Compaction
   a. The Contractor shall take nuclear density readings behind each roller pass to determine the roller pattern necessary to achieve required density.
   b. At a minimum of five locations within the control strip, the Contractor shall take nuclear gauge readings in observance of the Engineer, and cut and test core samples according to Subsection 3.13. The test locations shall be selected by the Engineer based on random numbers. Density of the control strip is acceptable if all tests are within the specification range in Subsection 3.10.
6. Acceptance
   a. The LJMF and the control strip will be acceptable if the PJMF and densities meet the requirements of (1) and (2) above. If these requirements are not met the material placed for the control strip will be evaluated according to FP-03 Subsection 106.05. The control strip may remain in place at reduced payment in accordance with FP-03 Subsection 106.05 if the pay factor for asphalt content, gradation, and densities is 0.90 or greater. The pay factor shall be applied to the Contractor's schedule of values for the pavement being evaluated. If the pay factor is less than 0.90 all material for the control strip shall be removed from the project at the Contractor's expense. Repeat the LJMF and control strip process until an acceptable control strip is produced and a pay factor of 1.0 is achieved. If an acceptable control strip is not achieved by the third attempt all of the material for

all of the control strips shall be removed at the Contractor's expense and the control strip process repeated.

b. Once a control strip is acceptable the remaining HMA pavement will be evaluated in accordance with Subsection 3.13.

c. Previously performed PJMF for the same HMA material from the same source may be substituted for the PJMF listed above as approved by the Engineer.

3.9 PLACING AND FINISHING

A. The Engineer may direct the Contractor to prepare the surface of the existing HMA pavement by lightly milling or other approved methods so that the bond between the existing HMA surface and the Friction Course layer is improved.

B. Do not use HMA produced from different plants unless the HMA are produced according to the same job-mix formula, use material from the same sources, and are approved.

C. Place HMA at a temperature conforming to Table 321216-3. Measure temperature of the mix in the hauling vehicle just before dumping into spreader or measure it in the windrow immediately before pickup.

D. Place the HMA with a paver conforming to Subsection 2.5. Control horizontal alignment using a reference line. Automatically control the grade and slope from reference lines using a ski and slope control device, or dual skis. Use skis having a minimum length of 20 feet.

E. In areas where mechanical spreading and finishing is impractical, place and finish the HMA with Engineer approved alternate equipment. This alternate equipment shall produce a uniform surface closely matching the surface obtained when using a mechanical paver.

F. The Engineer will designate the job-mix formula to be used for wedge and leveling courses at each location. Place wedge and leveling courses in maximum 3-inch lifts. Complete the wedge and leveling before starting normal paving operations.

G. The Friction Course Mix shall have a thickness of 1-2 inches within a tolerance of (-0, +1/2"). The base course will be applied to the thickness of design within a tolerance of (-1/2", +1/2") and no one layer can be paved at more than a maximum thickness of 3-inches. When a base course thicker than 3-inches is required, multiple layers of approximate equal thicknesses will be applied.

H. If a core is found to be out of specification on thickness a new core will be taken 5 feet from the location of the out of specification core and if the thickness is found to be within specification the pavement is acceptable.

I. Apply an asphalt tack coat according to FP-03 Section 412 to the contact surface areas of asphalt pavement layers, leveling layers, and on any milled surfaces prior to placing the next layer of asphalt pavement.

J. Safety Edge Specification

1. Attach an approved device to the screed of the paver that confines the material at the end gate and extrudes the asphalt material in such a way that results in a compacted wedge shape pavement edge of approximately 30 degrees (not steeper than 35 degrees) relative

to the pavement structure. Maintain contact between the device and the road shoulder surface, and allow for automatic transition to level for areas such as cross roads, driveways and obstructions. Use the device to constrain the asphalt head reducing the area by 10% to 15% increasing the density of the extruded profile. Do not use conventional single plate strike off.

2. Use the TransTech Shoulder Wedge Maker, or the Advant-Edge, or a similar approved-equal device that produces the same wedge consolidation results. Contact information for these wedge shape compaction devices is the following:
   a. TransTech Systems, Inc.
      1594 State Street
      Schenectady, NY 12304
      Ph. 1-800-724-6306
      Website:www.transtechsys.com
   b. Advant-Edge Paving Equipment LLC
      P.O. Box 9163
      Niskayuna, NY 12309-0163
      Ph. 518-280-6090
      Website: www.advantedgepaving.com

K. If electing to use a similar device, provide proof that the device has been used on previous projects with acceptable results or construct a test section prior to the beginning of work and demonstrate wedge compaction to the satisfaction of the Engineer. Short sections of handwork will be allowed when necessary for transitions and turnouts or otherwise authorized by the Engineer.

3.10 COMPACTING

A. Thoroughly and uniformly compact the asphalt surface by rolling. Do not cause cracking, shoving or undue displacement. Continue rolling until all roller marks are eliminated, all cracks are sealed, and the required density is obtained. Do not roll the mix after the surface cools below 175 °F.

B. Monitor the compaction process with nuclear density gauges. Calibrate the gauge according to the ASTM D 2950 calibration section within 6 months before use and check the standard and reference on each day of use according to the ASTM D 2950 standardization and reference check sections. Compact to a pavement specific gravity (density) that is no less than 92.0 percent and no more than 97.0 percent of the maximum specific gravity (density) determined according to AASHTO T 209 of the PJMF.

C. Along forms, curbs, headers, walls, and other places not accessible to the rollers, compact the mix with alternate equipment to obtain the required compaction.

D. Do not allow the rollers to deposit gasoline, oil, or grease onto the pavement. Remove and replace any areas damaged by such deposits as directed by the Engineer. While rolling is in progress, check the surface continuously, and correct all discrepancies to comply with the surface requirements. Remove and replace all drippings, fat or lean areas, and defective construction of any description. Remedy depressions that develop before completing the rolling by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depression remain after obtaining the final compaction, remove the full depth of the mixture, and replace it with sufficient new mixture to form a true and even surface. Correct all

high spots, high joints, and honeycombing as directed by the Engineer. Remove and replace any mixture remaining unbounded after rolling. Correct all defects prior to laying the subsequent course.

E. Keep sections of newly compacted asphalt concrete, which are to be covered by additional courses, clean until the successive course is laid. Do not dump embankment or base material directly on the pavement. Dress shoulders before placing the friction course on adjacent pavement.

F. Equip blade graders operating adjacent to the pavement during shoulder construction with a 2 inch by 8 inch or larger board, or other attachment providing essentially the same results, attached to their blades in such manner that it extends below the blade edge to protect the pavement surface from damage by the grader blade.

G. To prevent rutting or other distortion, protect sections of newly placed HMA base course and HMA friction course from traffic until the surface temperature has cooled below 160ºF for HMA base course and below 120ºF for HMA friction course.

H. The Contractor may use artificial methods to cool the pavement to expedite paving operations. In addition, the Engineer may direct the Contractor to use artificial cooling methods when maintenance of traffic requires opening the pavement to traffic at the earliest possible time.

3.11 JOINTS, TRIMMING EDGES AND CLEANUP

A. Complete pavement construction of adjacent traffic lanes to the same elevation within 24 hours. If drop-offs are left overnight, sign the drop-offs in excess of 1 inch with "Uneven Lanes" warning signs and provide a 1V:3H fillet for drop-offs in excess of 2 inches.

B. To both transverse and longitudinal joints, apply asphalt tack coat to the joint edge according to Section 412.

C. For all layers of pavement except leveling course, offset the longitudinal joint of one layer 6 to 12 inches laterally from the joint in the layer immediately below. The longitudinal joint in the top layer shall be at the centerline of two-lane roadways or at the lane lines of roadways with more than two lanes.

D. Plan offsets in advance so that longitudinal joints of the friction course are not in wheel path areas. The longitudinal joints for friction course layers shall be within 6 inches of the lane line, at the center of the lane or as approved by the Engineer. The Engineer may also waive this requirement where offsetting is not feasible due to the sequence of construction.

E. Place the asphalt concrete mix as continuously as possible. Do not pass rollers over the unprotected end of a freshly laid mix.

F. Dispose of material trimmed from the edges and any other discarded asphalt mix according to Subsection 211.02 (a) (2).

G. Butt joints shall be constructed according to the details shown on the plans. The surface removal shall be done according to Section 413. Construction of butt joints shall not begin prior to general operations on the project.

H. When butt joints are to be constructed under traffic, temporary ramps shall be constructed and maintained at both upstream and downstream ends of the surface removal areas immediately upon completion of the surface removal operation. The temporary ramps shall be constructed by providing hot asphalt concrete with a minimum taper rate of 1:40 (V: H). The HMA for the ramp shall meet the approval of the Engineer. Cold milled pavement tailings will not be acceptable. The temporary ramps shall be removed just prior to placing the HMA.

3.12 PAVEMENT SMOOTHNESS/ROUGHNESS

A. Use a 10-foot metal straight edge at right angles and parallel to the centerline to check for surface deviations. Defective areas are surface deviations in excess of 1/4 inch in 10 feet between any two contacts of the straightedge with surface. Measurements shall be made to the nearest 1/16 inch.

B. Correct defective areas. Obtain approval for the proposed method of correction. Re-check corrected areas according to the specified type of pavement smoothness/roughness. The smoothness/roughness value obtained will replace the original measured results.

3.13 ACCEPTANCE

A. See Table 321216-5 for sampling, testing and acceptance requirements.

B. Mineral filler and anti-strip additive will be evaluated under FP-03 Subsections 106.03 and 106.04. Chemical agents will be evaluated as required by the Engineer.

C. Asphalt binder will be evaluated under FP-03 Subsection 106.03(a), 106.04 and 702.09.

D. Construction of the HMA pavement courses not evaluated under FP-03 Subsection 106.05 shall be evaluated under FP-03 Subsections 106.02 and 106.04.

E. Testing for VMA, Air Voids, VFA, Marshall Stability and Flow will be completed and reported for each HMA sample taken. Gradation of cold feed bins, hot bins and mineral filler materials will be reported along with the percentages of each bin/material used.

F. When one days production is 100 tons or less one sample shall be taken each day and grouped with subsequent days production for evaluation.

G. Testing data used for acceptance shall be from an accredited laboratory conforming to FP-03 Section 154.

H. Asphalt content. The upper and lower specification limits are the accepted JMF target value for asphalt content +/- 0.4 percent.

I. Aggregate gradation. The upper and lower specification limits are the accepted JMF target values +/- the allowable deviations shown in FP-03 Table 703-4.

J. Density. The lower specification limit is 92.0 percent and the upper limit is 97.0 percent of the accepted JMF maximum specific gravity (density) determined according to AASHTO T 209. If a core is found to be out of specification, a new core will be taken 5 feet from the location of the

out of specification core. If the density of the new core is found to be within specification, the new test result will replace the previous failed density test, and the pavement will be acceptable.

K. Pavement smoothness/roughness. The evaluation of pavement smoothness and roughness shall be made in accordance with Subsection 3.12 and FP-03 Subsection 106.04 after all defective areas are corrected.

L. Thickness.
   1. For friction course pavement the thickness of the cores cannot be less than the design thickness of the friction layer and should be no more than 25% higher than design thickness. If a core is found to be out of specification a new core will be taken 5 feet from the location of the out of specification core and if the thickness is found to be within specification the pavement is acceptable. If the cores show that the pavement is thin, then pavement must be cored every 50 feet longitudinal from the original cores to establish the length of the thin pavement.
   2. For binder pavement, no one core can be less than 15% of design thickness nor more than 25% higher of design thickness. If a core is found to be out of specification a new core will be taken 5 feet from the location of the out of specification core and if the thickness is found to be within specification the pavement is acceptable. If the cores show that the pavement is thin, then pavement must be cored every 50 feet longitudinal from the original cores to establish the length of the thin pavement.
   3. Calculations will be completed of the actual tonnage placed and the theoretical tonnage which should have been placed.
   4. Based on this information the Engineer will determine if:
      a. The pavement can be accepted at the contract units and/or unit rates;
      b. An additional thickness layer must be paved;
      c. The next lift of hot mix asphalt must be thickened; or
      d. The section determined to be outside the allowable thickness tolerance must be removed and replaced.

M. If the production tonnage meets the requirements of (a), (b) (c), and (e) above, it is accepted. If these requirements are not met, the material placed will be evaluated according to FP-03 Subsection 106.05.

N. If the evaluation, according to FP-03 Subsection 106.05, the pay factor for asphalt content, gradation, and densities is 0.80 or greater, the mix may remain in place at reduced payment in accordance with FP-03 Subsection 106.05. The pay factor shall be applied to the Contractor's schedule of values for the pavement being evaluated. If the pay factor is less than 0.80 all material in this evaluation shall be removed from the project and replaced at the Contractor's expense with HMA which meets these specifications.

3.14 ALTERNATIVE MIX DESIGN CRITERIA

A. The Contractor may propose an alternate mix design criteria such as Hveem or Superpave for the Engineer's consideration. This proposed JMF must meet or exceed the JMF requirements specified in Table 321216-1 and Table 321216-2. Changes to the pavement structural section will not be considered.

3.15 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Immediately after placement, protect paving from mechanical injury for twelve hours or until surface temperature is less than 140 degrees F.

Table 321216-4
Materials Quality Sampling and Testing Requirements
(Prior to Production)

Material or Product	Type of Acceptance (FP-03 Subsection)	Characteristic	Category	Test Method Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Aggregate source quality	Measured and tested for conformance (106.04)	LA abrasion (coarse)	—	AASHTO T 96	1 per type & source of material	Source of Material or Stockpile	Yes	Before producing
		Sodium sulfate soundness loss (coarse & fine)	—	AASHTO T 104	"	"	"	"
		Sand equivalent	—	AASHTO T 176 Alternate method no. 2, reference method	"	"	"	"
Asphalt concrete (mix design)	Measured and tested for conformance (106.04)	Gradation	—	AASHTO T 27 & T 11	1 per submitted mix design	Stockpiles	Yes	28 days before producing
		Voids	—	AASHTO T 209	"	"	"	"
		Moisture Susceptibility	—	AASHTO T 165 & T 167	"	"	"	"
Aggregates (during aggregate production)	Measured and tested for conformance (106.04)	Gradation	—	AASHTO T 27 & T 11	1 per every hot mix sample	From each cold feed bin, hot bin and mineral filler	Yes	End of shift
		Sand equivalent	—	AASHTO T 176 alternate method no. 2 reference method	1 per type & source of material	"	"	"
		Fractured faces	—	ASTM 5821	"	"	"	"
		Sample for job-mix formula verification	—	Subsection 2.2	1 per aggregate sample Stockpile	"	"	28 days before approval of job-mix formula
Asphalt binder	Measured and tested for conformance (106.04)	Quality	—	FP-03 Subsection 702.01	1 per mix design and 1 per grade of asphalt binder	In line between tank & mixing plant	2 – 1 quart samples provided to the Government	Tested by the Government

Table 321216-5
Acceptance Sampling and Testing Requirements
(During Production)

Material or Product	Type of Acceptance (FP-03 Subsection)	Characteristic	Category	Test Method Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Hot asphalt concrete pavement (control strip)	Statistical (106.05)	Gradation 1 inch 3/4 inch 1/2 inch 3/8 inch No .4 No. 8 No. 16 No. 30 No. 50 No. 100 No. 200 Asphalt Content	 I II II II I I II II II II I I	AASHTO T308, T 30 & T 110	3 minimum	Behind paver before compacting or from truck as determined by the Engineer. (2)	Yes	5 days
Hot asphalt concrete pavement (production paving)	Statistical (106.05)	Gradation	See control strip	AASHTO T30	3 minimum (3)	”	”	24 hours
		Asphalt content		AASHTO T308	“	“	“	“
		Compaction	I	AASHTO T166	“	Completed roadway after rolling	“	“
	PJMF	Gradation	—	AASHTO T 27 & T 11	1 per every hot mix sample	From each cold feed bin and hot bin -	—	“
Asphalt binder	Not Evaluated for Acceptance	Quality	—	FP-03 Subsection 702.01	1 per 130 tons of liquid	Line between storage tank and asphalt plant	2 – 1 quart samples	Tested by Government

(1) Cut core sample from the compacted pavement according to AASHTO T 230, method B. Fill and compact the sample holes with asphalt concrete mixture. Cores shall be 6 inches in diameter. Perform specific gravity and thickness test on cores and deliver to CO after testing is completed. Label cores and protect from damage due to handling or alteration due to temperature during storage or transfer.

(2) For HMA friction course, the point of sampling shall be from the hauling vehicle prior to discharge into the paver.

(3) For days where the production is less than 100 tons the sampling frequency shall be a minimum of 1 per day.

END OF SECTION 321216

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Traffic lines and markings.
2. Thermoplastic markings.

B. Related Requirements:

1. Section 32 12 16 - Asphalt Paving.

1.2 REFERENCE STANDARDS

A. Federal Specifications:

1. FP-03

B. American Association of State Highway and Transportation Officials:

1. AASHTO M247 - Standard Specification for Glass Beads Used in Traffic Paint.
2. AASHTO M249 - Standard Specification for White and Yellow Reflective Thermoplastic Striping.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer’s printed Product Data Sheet for each type of marking.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Test and Evaluation Reports: Submit source and acceptance test results in accordance with AASHTO M247.

E. Manufacturer's Instructions: Submit instructions for application temperatures, eradication requirements, application rate, line thickness, type of glass beads, bead embedment and bead application rate, and any other data on proper installation.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing work of this section with minimum five years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Invert containers several days prior to use when paint has been stored more than 2 months. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.

1.6 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by markings product manufacturer.

C. Do not apply exterior coatings during rain or when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by marking product manufacturer.

PART 2 PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

A. Furnish materials in accordance with FP-03 for Type H thermoplastic pavement marking and AASHTO M249.

2.2 EQUIPMENT

A. Continuous Longitudinal Line Application Machine: Use application equipment with following capabilities.

1. Spray gun or extruder to apply lines of indicated width in solid or broken patterns or various combinations of those patterns.

B. Apply parking striping by approved mechanical equipment.

C. Machine Calibration:
1. Spray Guns: Calibrate to simultaneously apply thermoplastic at uniform rates as specified with an allowable tolerance of plus or minus 1 mil.

D. Other Equipment:

1. For application of stop lines, arrows and other miscellaneous items by walk behind stripers, hand spray or stencil trucks, apply with equipment meeting requirements of this section.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements: Requirements for installation examination.

B. Do not apply markings to concrete surfaces until concrete has cured for 28 days.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Surface Preparation.

1. Clean and dry paved surface prior to painting.
2. Blow or sweep surface free of dirt, debris, oil, grease or gasoline.
3. Spot location of final pavement markings as specified and as indicated on Drawings by applying pavement spots 25 feet on center. The Contractor shall establish control points for marking and provide templates to control paint application by type and color at necessary intervals.
4. Notify Engineer after placing pavement spots and minimum 3 days prior to applying traffic lines.

3.3 APPLICATION

A. On areas to be marked on rigid pavements and old asphalt pavements, apply an epoxy resin primer/sealer according to the thermoplastic manufacturer's recommendations. Allow the primer/sealer to dry.

B. Apply thermoplastic when the pavement and air temperatures are above 50 ºF. Spray or extrude the thermoplastic at 430±5 ºF. For centerlines and lane lines, spray or extrude 90 mil minimum dry film thickness or at a rate of 17.8 square feet per gallon. For edge lines, spray or extrude 60 mil minimum dry film thickness or at a rate of 26.7 square feet per gallon.

C. The minimum bond strength of the thermoplastic shall be 175 pounds per square inch on rigid pavements.

D. Apply markings to indicated dimensions at indicated locations. Stripes shall be four (4) inches wide unless otherwise shown on the drawings. Broken line segments (dashed or skip traffic type) shall be as shown on the drawings or as directed by the Engineer.

E. Arrows, letters, stop lines and other pre-cut symbols shall be as shown on the drawings or as directed by the Engineer.

F. Prevent splattering and over spray when applying markings.

G. Unless material is track free at end of paint application convoy, use traffic cones to protect markings from traffic until track free. When vehicle crosses a marking and tracks it or when splattering or over spray occurs, eradicate affected marking and resultant tracking and apply new markings.

H. Collect and legally dispose of residues from painting operations.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Dry Film Thickness: 5 mil.

C. Maintain cycle length for skip lines at tolerance of plus or minus 6 inches per 40 feet and line length of plus or minus 3 inches per 10 feet.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

B. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.

C. Repair lines and markings, which after application and curing do not meet following criteria:

1. Incorrect Location: Remove and replace incorrectly placed patterns.
2. Insufficient Thickness, Line Width, or Paint Coverage: Prepare defective material by acceptably grinding or blast cleaning to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot beyond affected area. Apply new markings on cleaned surface in accordance with this Section.

D. Replace pavement marking material under warranty using original or better type material. Continue warranty to end of original 1 year period even when replacement materials have been installed as specified.

E. When eradication of existing paint lines is necessary, eradicate by shot blast or water blast method. Do not gouge or groove pavement more than 1/16 inch during removal. Limit area of removal to area of marking plus 1 inch on all sides. Prevent damage to transverse and longitudinal joint sealers, and repair any damage according to requirements in Section 32 12 16.

F. Maintain daily log showing work completed, results of above inspections or tests, pavement and air temperatures, relative humidity, presence of any moisture on pavement, and any

material or equipment problems. Make legible entries in log in ink, sign and submit by end of each work day. Enter environmental data into log prior to starting work each day and at two additional times during day.

3.6 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect painted pavement markings from vehicular and pedestrian traffic until markings are fully bonded. Follow manufacturer's recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes cure time.

3.7 MAINTENANCE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.

3.8 ATTACHMENTS

A. Pavement Markings:

Items	Location
12 inch White Thermoplastic	Stop Line
4 inch Yellow Thermoplastic, Type H	Parking Stalls

END OF SECTION

SECTION 329119 - LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of subsoil.
2. Final grade topsoil for finish landscaping.

B. Related Sections:

1. Section 312316.13 - Trenching: Backfilling trenches.
2. Section 312323 - Fill: Backfilling at building areas.
3. Section 310513 - Soils for Earthwork.
4. Section 329219 - Seeding: Finish ground cover.

1.2 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures

B. Samples: Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

C. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Furnish topsoil material from single source throughout the Work.

B. Perform Work in accordance with Guam EPA standard.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Topsoil: Fill Type S2 as specified in Section 310513.

B. Compost Material: For amending topsoil not meeting the requirements. Well decomposed organic material/green waste. Stable, weed free, dark brown in color, and parent material no

longer visible. It shall be derived from agriculture, food, yard trimmings, source-separated or mixed solid waste. Structure is mixture of fine and medium size particles and humus crumbs. 30-40% moisture. Free of non-organic debris (<1% by dry weight) and substances toxic to plants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify building and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.

B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.3 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 4 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.4 PLACING TOPSOIL

A. Place topsoil in areas where seeding or planting is required to minimum thickness of 6 inches. Place topsoil during dry weather. Rake until smooth.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.5 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top of Topsoil: Plus or minus 1 inch.

3.6 PROTECTION OF INSTALLED WORK

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Prohibit construction traffic over topsoil.

END OF SECTION 329119

SECTION 329219 - SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fertilizing.
2. Seeding.
3. Hydroseeding.
4. Mulching.
5. Maintenance.

B. Related Sections:

1. Section 312316.13 - Trenching: Rough grading over cut.
2. Section 310513 - Soils for Earthwork: Topsoil material.
3. Section 312500 Erosion and Sedimentation Controls: Erosion Control Blanket
4. Section 329119 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the Work of this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. Guam Landscaping Guidelines – August 2010

1.3 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Perform Work according to Guam EPA standards.

1.7 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 MAINTENANCE SERVICE

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Maintain seeded areas immediately after placement until grass is well established, 90% coverage, and exhibits vigorous growing condition for six months. Cut, fertilize, and water as required to meet coverage requirement.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

A. Furnish materials according to Guam Landscaping Guidelines.

B. Seed Mixture:

Cynodon Dactylon, Common Bermuda Grass	
Minimum percent pure seed	95 percent
Minimum percent germination and hard seed	85 percent
Maximum percent week seed	0.5 percent

2.2 ACCESSORIES

A. Mulching Material: Wood cellulose fiber, shall be dyed green, free of growth or germination inhibiting ingredients and shall be manufactured so that when thoroughly mixed with seed, fertilizer and water, in the proportions specified, it will form homogeneous slurry that is capable of being sprayed.

B. Mulch Binder: Shall be applied to all slopes greater than 3:1 in steepness, or longer than 100 linear feet.

C. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, conforming to territorial and federal laws and suitable for application with equipment designed for that purpose. Fertilizer mix shall have the following proportions: Nitrogen 16 percent, phosphoric acid 20 percent, soluble potash 0 percent.

D. Lime: ASTM C602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

E. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

F. Erosion Fabric: Erosion Control Blanket per Section 312500 Erosion and Sedimentation Controls.

G. Herbicide: Approved by the Guam EPA.

H. Stakes: Softwood lumber, chisel pointed.

I. String: Inorganic fiber.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.2 FERTILIZING

A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.

B. Apply fertilizer at application rate recommended by soil analysis.

C. Apply after smooth raking of topsoil and prior to roller compaction.

D. Do not apply fertilizer at same time or with same machine used to apply seed.

E. Mix fertilizer thoroughly into upper 2 inches of topsoil.

F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

A. Apply seed at rate recommended by manufacturerevenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

D. Immediately following seeding, apply mulch to thickness of 1/8 inches. Maintain clear of shrubs and trees.

E. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.4 HYDROSEEDING

A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at rate of 2,000 lbs per acre evenly in one pass.

B. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.5 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery.

B. Cover seeded slopes where grade is 3:1 or greater with erosion fabric per Section 312500 Erosion and Sedimentation Controls.

C. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

D. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.6 MAINTENANCE

A. Maintain planted areas in a satisfactory condition until meeting coverage requirements and final acceptance of the project.

B. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

C. Neatly trim edges and hand clip where necessary.

D. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

E. Water to prevent grass and soil from drying out.

F. Roll surface to remove minor depressions or irregularities.

G. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

H. Immediately reseed areas showing bare spots.

I. Repair washouts or gullies.

J. Protect seeded areas with warning signs during maintenance period.

END OF SECTION 329219

SECTION 330507.13 - UTILITY DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation for approach trenches and pits.
2. Horizontal directional drilling.
3. Pipe.
4. Drilling fluid system.

B. Related Requirements:

1. Section 310513 - Soils for Earthwork: Subsoil fill as required by this section.
2. Section 310516 - Aggregates for Earthwork: Aggregates for fill.
3. Section 312323.33 - Flowable Fill: Alternative fill materials.
4. Section 313216.13 - Trenching: Excavation of subsoil, trenching, and installation and compaction requirements as required by this section.
5. Section 331116 - Site Water Utility Distribution Piping: Potable-water pipe testing.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop.

B. American Water Works Association:

1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
2. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In.
3. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.
4. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In. , for Water Distribution and Transmission.

C. American Welding Society

1. AWS D1.1 - Material And Design, Fabrication, Inspection, And Qualification

D. ASTM International:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3).

2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3).
3. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
4. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
5. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
6. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
7. ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
8. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
9. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
10. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
11. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
12. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
13. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
14. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
15. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
16. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
17. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
18. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
19. ASTM F1056 - Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.
20. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.

E. North American Society for Trenchless Technology:

1. NASTT - Horizontal Directional Drilling Good Practices Guidelines.

F. Plastics Pipe Institute:

1. PPI TR-46 - Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe.

1.3 COORDINATION

A. Coordinate work of this section with Guam Waterworks Authority and utilities within construction area.

1.4 PREINSTALLATION MEETINGS

A. Convene meeting with Construction Manager a minimum of one week prior to commencing work of this section.

1.5 SUBMITTALS

A. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.

B. Manufacturer's installation instructions shall be provided along with product data.

C. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).

D. Product Data:

1. Identify source of water used for drilling.
2. Submit copy of approvals and permits for use of water source.

E. Shop Drawings:

1. Submit technical data for equipment, method of installation, and proposed sequence of construction.
2. Include information pertaining to pits, dewatering, method of spoils removal, and equipment size, capacity, and capabilities, including installing pipe on radius, type of drill bit, drilling fluid, method of monitoring line and grade, detection of surface movement, name plate data for drilling equipment, and mobile spoils removal unit.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statement:

1. Submit qualifications for driller.

a. Provide two (2) project references using 12" plastic pipe of length 800 ft or greater.
b. Provide two (2) project references drilling in coral stone/limestone.

I. Written Drilling Procedure: Describes in detail proposed method and entire operation but not limited to the following:

1. Size, capacity and arrangement of equipment, drawn to scale.

2. Location and size of drilling and receiving pits.
3. Calculate the maximum anticipated construction loads acting on the conductor casing and demonstrate that the anticipated loads are implemented in the manufacturer's design of the conductor casing, subject to the Engineer's review. Provide a minimum factor of safety of 2.0.
4. Calculate the maximum anticipated construction loads acting on the carrier pipe and show that the anticipated loads are implemented in the manufacturer's design of the carrier pipe, subject to the Engineer's review. Provide a minimum factor of safety of 2.0.
5. Prepare HDD calculations using industry accepted methods such as ASTM or API, or other standard acceptable to the Engineer. Use conservative assumptions.
6. Dewatering and methods of removing spoils material.
7. Method of installing detection wire and pipe.
8. Type, location and method of installing locator station.
9. Method of fusion pipe segment and type of equipment.
10. Type of cutting head.
11. Method of monitoring and controlling line and grade.
12. Detection of surface movement.
13. Bentonite drilling mud for information only.
14. Products information, material specifications, and handling procedures.
15. Material safety data sheet and special precautions required.
16. Method of mixing and application.

J. Welder Certificates: Certify welders and welding procedures employed on work, verifying AWS qualification within previous 12 months.

K. Quality Control Submittals:

1. Contractor's Qualifications Data:

   a. Firm name, address, and phone number.
   b. Period of time that the firm has been in the business of performing horizontal directional drilling.
   c. Names and addresses of 5 similar projects completed by the firm. Include the name and phone number of contact person.

2. Field Supervisor Qualifications Data:

   a. Name of the person supervising the horizontal directional drilling.
   b. Period of time that the person has performed/supervised horizontal directional drilling.
   c. Names and addresses of three similar projects that the person has worked on during the past three years.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of pipe and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

C. Reproducible as-built drawings showing dimensions, accurate locations, and depth of burial at 100 ft intervals. Marked-up contract drawings will not be acceptable.

D. Issue a written report at the conclusion of the installation phase, stating whether or not specifications and approved manufacturer's installation recommendations.

E. Furnish a certified report to the Construction Manager.

F. Record actual horizontal location of installed pipe.

G. Show depth and location of abandoned bores.

H. Record depth and location of drill bits and drill stems not removed from bore.

I. The submittal will not relieve the Contractor of complete responsibility to the successful performance of the intended installation procedure.

1.7 QUALITY ASSURANCE

A. Perform work according to the following:

1. NASST - Horizontal Directional Drilling Good Practices Guidelines.
2. ASTM F1962.
3. PPI TR-46.

B. Pre-Installation Conference: Before the work is scheduled to commence, a conference will be called by the Construction Manager at the site for the purpose of reviewing the Contract Documents and discussing requirements for the work. The conference shall be attended by related trade Contractors (if any), their qualified installers and Field Supervision.

1.8 QUALIFICATIONS

A. Contractor: The firm performing the work of this section shall have been regularly engaged in performing horizontal directional drilling for a minimum of 10 years, and shall have completed 5 similar projects of size and complexity over the last 5 years.

B. Field Supervisor: The person supervising the work of this section shall have been regularly engaged in performing horizontal directional drilling for a minimum of 5 years and shall have supervised 3 similar projects of size and complexity over the last 3 years.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on site in manufacturer's original packaging and inspect for damage.

B. Handling:

1. Use shipping braces between layers of stacked pipe.
2. Support pipes with nylon slings during handling.

C. Storage:

1. According to manufacturer instructions.
2. Stack piping lengths no more than three layers high.
3. Store field joint materials in original shipping containers in dry area indoors.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect pipe from entry of foreign materials and water by installing temporary covers, completing sections of work, and isolating parts of completed system.
3. Provide additional protection according to manufacturer instructions.

1.10 PROJECT CONDITIONS

A. Complete horizontal directional drilling so as not to interfere with, interrupt, or endanger surface and activity thereon.

B. Do not use horizontal directional drilling in rock stratum or subsoil consisting of boulders and underground obstructions that impede the process.

C. Follow applicable ordinances, codes, statutes, rules, and regulations of Federal Government, OSHA 29CFR 1926, and applicable criteria of ANSI A10.16-1995 (R2001), “Safety Requirements for Tunnels, Shafts, and Caissons.”

D. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 HORIZONTAL DIRECTIONAL DRILLING

A. Performance and Design Criteria:

1. Drilling Steering System: Remote with continuous electronic monitoring of boring depth and location.
2. Directional Change Capability: 90 degrees with 35-foot radius curve.
3. Minimum distance for single bores and between boring pits:

   a. Pipe Size 3 to 6 Inches: 300 feet.
   b. Pipe Size 8 t0 12 Inches: 500 feet.

4. Ratio of Reaming Diameter to Pipe OD:

   a. Nominal Pipe Diameter of 6 Inches and Smaller: Maximum of 1.5.

b. Nominal Pipe Diameter Larger Than 6 Inches: Submit recommended ratio and reaming procedures for review by Engineer.

B. Water Source:

1. Potable.
2. Obtained from GWA.

C. Underground Pipe Markers: As specified in Section 331116 – Site Water Utility Distribution Piping.

D. Materials:

1. Drilling Fluid: Liquid bentonite clay slurry; totally inert with no environmental risk.

E. PVC Piping:

1. Casing: Comply with AWWA C900, DR 21 (Class 200)
2. Pipe: Comply with AWWA C900, DR 14 (Class 305).
3. Per Section 33 11 16 – Site Water Distribution Piping
4. Conduit: Comply with AWWA C900, DR 25 (Class 165).

F. Casing End Seal:

1. Type ASTM for multi-pipe sealing
2. Soft PVC or EDM material
3. Stainless steel tightening straps
4. Water tight

G. Subsoil Fill: excavated and reused soil with no rocks more than 6 inches in diameter, or foreign matter.

H. Drilling Fluid:

1. Bentonite drilling mud compatible with environment.
2. Waste oil or environmentally non-compatible polymers cannot be part of composition.

I. Detection Wire: TW, THW, THWN, or HMWPE insulated copper, 10 gage or thicker wire.

J. Locator Station.

1. Underground, Flush Mounted:

a. Tube minimum 15 inches long with minimum inside diameter of 2-1/2-inches made of non-corrosive material, schedule 40 PVC, HDPE, or equal.
b. Factory attached cast iron or high-impact plastic collar with ribs to prevent rotation when removing locking lid after locator station is set in concrete.
c. Light blue cast iron or high-impact plastic locking lid that will withstand AASHTO H-20 traffic loads and ultra-violet rays.
d. Mark locking lid to identify pipeline with permanent identification such as P.S. Locator.

e. Terminal block made of high dielectric material which is made of phenolic resin, plastic, micarta, Lexan or Bakelite for each locator station. Terminal block furnished with two 3/16-inch threaded studs, nuts, and washers made of nickel-plated brass.
f. Manufacturers: C.P. Test Services, Inc., Model Mini – Test Station; Handly, Industries, Model T2IS2, or equal.

2. Manhole Mounted:

a. Waterproof enclosure made from cast aluminum, galvanized steel, high-impact plastic, Lexan, Gyrlyn, or equal.
b. Light blue schedule 40 PVC pipe or schedule 40 galvanized steel with outside diameter of at least 3/4-inch to mount enclosure.
c. Use similar materials for pipe and enclosure to fasten enclosure onto pipe following manufacturer's instructions.
d. Manufacturers:

1) Cott Manufacturing Company, Model Finklet or Finkplate, 2 leads.
2) Gerome Manufacturing Company, Inc., Model Testox Series 300, 2 leads.
3) Approved equivalent.

2.2 MIXES

A. Flowable Fill: As specified in Section 312323.33 - Flowable Fill.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that connections to piping system, locations, and invert elevations are according to Drawings. Report any discrepancies to the Construction Manager.

3.2 PREPARATION

A. Underground Utilities:

1. Coordinate with utility agencies for the locate and marking of existing, underground utilities along directional drill path.
2. Determine vertical orientation and depths of utility lines along directional drill path.

B. Maintain access to existing services and indicated to remain.

C. Locate and identify utilities indicated to remain and protect from damage.

D. Identify required lines, levels, contours, and data locations.

E. Protect plant life, lawns, and other features remaining as portion of final landscaping.

F. Protect benchmarks, existing structures, fences, sidewalks, paving, curbs and survey control points from excavating equipment and vehicular traffic.

G. Establish pipe elevations with not less than **5** feet of cover.

H. Pit Preparation:

1. Excavate pits following contract documents are as specified by the Engineer.
2. Dewater pits as required and as directed.

3.3 INSTALLATION

A. General.

1. Determine drilling length and equipment pull strength for type of soil encountered.
2. Provide method to control line and grade.

a. Provide and maintain instrumentation that accurately locates pilot hole.
b. Drill pilot hole along path following Drawings to these tolerances:

1) Vertical alignment plus or minus 0.5 foot. Vertical path of pilot hole must not establish new high points not shown on Drawings.
2) Horizontal alignment plus or minus 1.0 foot.

c. Include electronic monitoring of horizontal and vertical drilling head location. Obtain accuracy range within 1 inch of actual position of pipeline. Record position readings at maximum of 10-foot intervals.
d. At completion of pilot hole drilling, furnish tabulations of horizontal and vertical alignment to Construction Manager.

3. When water is encountered.:

a. Provide and maintain dewatering system of sufficient capacity to remove water.
b. Keep excavation free of water until backfill operation is in progress.
c. Perform dewatering in manner that removal of soils particles are held to minimum.
d. Dewater into sediment trap per Contractor dewatering plan.

4. Maintain close observation to detect settlement or displacement of surface and adjacent facilities.

a. Notify Engineer immediately if settlement or displacement is detected.
b. Maintain safe conditions and prevent damage.

B. Drilling Operation.

1. Drilling Fluids.

a. Maintain drilling fluid in bore hole to increase stability of surrounding soil and reduce drag on pulled pipe.

b. Dispose of drilling fluid and other spoils at location following laws, ordinances, rules, and regulations of local jurisdiction.
c. Transport excess fluids and other spoils to disposal site, at no additional cost to the contract.
d. Minimize drilling fluid at locations other than entry and exit points. Immediately clean up any drilling fluids that inadvertently surface.
e. Provide clean water for drilling, at no cost to the contract, and as directed by the Engineer.

2. Pilot Hole Drilling.

a. Angle entry hole so that the curvature of pilot hole does not exceed allowable radius of PVC pipe.
b. Be able to make turn of up to 90 degrees and maintain curvature not to exceed allowable bending radius of PVC pipe.
c. Alignment adjustment and restarts:

1) Follow pipeline alignment on Drawings within tolerances specified herein. Before adjustments, notify Engineer for approval.
2) Notify Engineer when forward motion of operation is stopped by an obstruction.

a) Abandon in place with drilling fluid, unless Engineer directs otherwise.
b) Upon the Engineer's approval, attempt second installation at approved location or excavate at point of difficulty and install PVC pipe by trench methods specified in Section 310000.

3. Withdrawals, abandonments, and restarts are at no additional costs to the Contract when horizontal directional drilling is provided as an option of installation of pipe.
4. Exercise caution including, but not limited to, locating utilities, drilling downholes (test pits) to observe drill stems or reamer assembly to clear other existing utilities at locations following drawings.
5. Keep the number of boring pits to a minimum.
6. Verification of Accuracy:

a. Calibrate and verify electronic monitor accuracy during first 50 feet of bore in presence of Construction Manager before proceeding with other drilling.
b. Excavate minimum of four test pits spaced along first 50 feet of bore to verify required accuracy.
c. If required accuracy is not met, adjust equipment or provide new equipment capable of meeting required accuracy.

7. After completing pilot bore, remove drill bit.

C. Drilling Obstructions:

1. Perform subsurface utility location as required prior to commencing drilling operations.
2. If obstructions are encountered during drilling, notify Engineer immediately.
3. Do not proceed around obstruction without approval of Engineer.

4. For conditions requiring more than 3 feet of deviation in horizontal alignment, submit revised Shop Drawings to Engineer for approval before resuming work.
5. Maintain adjusted bore alignment within easement or right-of-way.

D. Installing PVC Pipe

1. Provide a swivel to reaming assembly and pull section of pipe to minimize torsional stress on pull section after drilling pilot hole.
2. Hold reaming diameter to 1.5 times outside diameter of PVC pipe being installed.
3. Protect pull section as it proceeds during pull back so it moves freely and is not damaged.
4. Pull detection wire along with PVC pipe. Extend wire into locator station at each end of the PVC pipe.
5. When connecting to adjacent pulled or non-pulled section of PVC pipe, allow pull section of pipe to extend past termination point. Make tie-ins the next day after pull back of PVC pipe.
6. Test pit pipe installation to verify horizontal and vertical alignment at Engineer's direction.

    a. One test pit every 500 feet along length of pipeline, if not within environmentally sensitive and/or protected area.
    b. Construction Manager may order additional test pits for each test pit that reveals pipeline installation is not in compliance with the Contract Documents at no additional cost to the Contract.

7. Replace portions of pipeline not in compliance with the Contract Documents at Engineer's direction and at no cost to the Contract.

E. Installing Locator Station

1. Location Stations:

    a. When PVC pipe is connected to another type of pipe material, continue detector wire over connecting pipe, so locator station is installed out of paved area.
    b. In areas scheduled to be improved identify and protect station locations immediately after installation.

        1) Space 3 stakes equally around the station.
        2) Extend at least 4 feet above existing grade.

2. Detection Wire.

    a. Install detection wire without splices unless specified on the plans.
    b. Terminate detection wire inside locator box using proper sized crimp type connection on wire ends.
    c. Neatly coil slack wire in test station below terminal board.
    d. Locate wires on top and along PVC pipe.
    e. Allow adequate slack and support to protect wires from damage during backfilling operations.
    f. Test each detection wire for continuity after backfill is completed.

        1) If test for continuity is negative, repair or replace at Construction Manager's direction.

2) After continuity is verified, connect each detection wire to terminal block in locator station.

F. Slurry Removal and Disposal:

1. Contain excess drilling fluids at entry and exit points until recycled or removed from site; provide recovery system to remove drilling spoils from access pits.
2. Drilling Spoils:

a. Remove, transport, and legally dispose of drilling spoils.
b. Do not discharge drilling spoils in sanitary sewers, storm sewers, or other drainage systems.
c. When drilling in suspected contaminated soil, test drilling fluid for contamination before disposal.

3. If drilling fluid leaks to surface, immediately contain leak and barricade area from vehicular and pedestrian travel before resuming drilling operations.
4. Complete cleanup of drilling fluid at end of each working day.

G. Backfilling:

1. Install backfill as specified in Section 312316.13 - Trenching.
2. Backfill approach trenches and pits with subsoil fill to contours and elevations of surrounding existing grade
3. Compact subsoil fill as specified in Section 312316.13 – Trenching.

3.4 TOLERANCES

A. Maximum Variation from Horizontal Position: 12 inches.

B. Maximum Variation from Vertical Elevation: 2 inches.

C. Minimum Horizontal and Vertical Clearance from Other Utilities: 12 inches.

D. Deviation:

1. If pipe installation deviates beyond specified tolerances, abandon bore, remove installed pipe, rebore, and reinstall pipe in correct alignment.
2. Fill abandoned bores greater than 3 inches in diameter with grout or flowable fill material.

3.5 FIELD QUALITY CONTROL

A. Upon completion of pipe installation, test pipe according to the following:
1. Water Distribution Pipe Testing: As specified in Section 331116–- Site Water Utility Distribution Piping.
2. If tests indicate work does not meet specified requirements, remove work, replace, and retest. Coordinate with the Construction Manager.

B. Compaction Testing:

1. Comply with ASTM D1557.
2. If tests indicate work does not meet specified requirements, remove work, replace, and retest.
3. Frequency of Compaction Testing: One for each lift.

C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this section for not less than 4 days on site for installation, inspection, startup, field testing, and instructing Construction Manager’s personnel in maintenance of equipment.

D. Certify that equipment for drilling has been properly set up and is ready for drilling.

3.6 MAINTENANCE AND RESTORATION

A. Restore grades to original levels where settlement or damage due to performance of the work has occurred. Correct conditions contributing to settlement. Remove and replace improperly placed or poorly compacted fill materials.

B. Restore pavements, walks, curbs, lawns, and other surface features damaged during performance of the work to match the appearance and performance of existing corresponding features as closely as practicable.

C. Topsoil and seed or sod damaged lawn areas in accordance with 329200 – Turf and Grasses.

3.7 CLEANING

A. Upon completion of drilling and pipe installation, remove drilling spoils, debris, and unacceptable material from approach trenches and pits.

B. Clean up excess slurry from ground.

C. Restore approach trenches and pits to original condition.

D. Remove temporary facilities for drilling operations.

END OF SECTION 330507.13

SECTION 330507.33 - CLOSE TOLERANCE PIPE SLURRIFICATION WITH FUSIBLE POLYVINYL CHLORIDE (FPVC) PIPE

PART 1 – GENERAL

1.01 SCOPE

A. The work to be performed herein shall consist of replacing Asbestos Cement (AC) pipe by the Close Tolerance Pipe Slurrification (CTPS) method in accordance with Azuria guidelines.

B. CTPS method shall remove the existing pipe by pulling a series of rotating pipe cutters/grinders (aka Slurrifier tools) through the existing pipe while simultaneously injecting a bentonite-based encapsulating agent (aka Slurrifier Solution).

C. The Slurrifier Tools shall cut and grind the existing pipe and surrounding bedding material while injecting Slurrifier Solution on the cuttings to form a slurry with the asbestos containing materials (ACM).

D. The ACM slurry shall be forced through the remaining AC pipe by a new tight fit pipe (Fusible PVC) that is being pulled in behind the Slurrifier Tools. The ACM slurry existing pipe fragments, backfill, and soil shall be vacuumed from Atmospheric Control Stations before being properly marked and prepared for final disposal at an approved asbestos waste material landfill.

E. All work shall comply with EPA Alternative Work Practice EPA EPA-HQ-OAR-2017-0427; FRL-9994-29-OAR; RIN 2060-AT73 for asbestos pipe removal using the CTPS method.

F. All work shall be performed in accordance with federal, state, and local air quality requirements

1.02 REFERENCES

A. Reference standards include:

1. American Society for Testing and Materials (ASTM) and American Water Works Association (AWWA):

    a. ASTM F3632 – 23, Standard Practice for Close Tolerance Pipe Slurrification (CTPS) Method to Replace, Rehabilitate, and Repair Existing Buried Asbestos Cement (AC) Pipe Systems.
    b. ASTM D638, Standard Test Method for Tensile Properties of Plastics.
    c. ASTM D1784, Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and
    d. Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds. AWWA C900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 60 in. (100mm Through 1,500mm).
    e. AWWA C605, Standard for Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

f. AWWA M23, AWWA Manual of Supply Practices for PVC Pipe – Design and Installation.
g. AWWA/ANSI C153/A21.53, Standard for Ductile-Iron Compact Fittings.

2. Environmental Protection Agency

a. National Emission Standards for Hazardous Air Pollutants

1) Notice of Final Approval for an Alternative Work Practice Standard for Asbestos Cement Pipe Replacement

A. EPA-HQ-OAR-2017-0427: FRL-9994-29-OAR
B. RIN 2060-AT73

1.03 SUBMITTALS

A. Pre-Construction Submittals:

1. Material Submittals

a. Pipe Materials

1) Pipe Joining Materials

b. Fitting Materials

c. Service Materials

B. Contractor's experience:

1. Certification from Azuria Water Solutions to install pipe by the CTPS method.
1. Asbestos Supervisor Certification for supervising work relating to removal and disposal of asbestos containing material (ACM).
2. OSHA Competent Person Training relating to Asbestos Work & Excavation.
3. Asbestos Worker Certification.
4. Fusion Equipment Operator: Certifications of training by the pipe manufacturer that the operators have been fully licensed to fuse specified product by an authorized representative of the pipe manufacturer.

C. Installation Plan and Sequencing Submittals:

2. Detailed Construction Methods & Procedures demonstrating compliance with NESHAP and OSHA Standards when working with and disposing of Asbestos Cement (AC) pipe.
3. Copy of completed asbestos abatement permit or other EPA notification to be filed 14 days prior to start of construction.
4. Plan to monitor project site for visible emissions (where required).
5. Describe mud vacuum and bagging system.

D. Disposal Plan: Submit information for waste disposal site operated in accordance with the provisions of NESHAP regulation. Upon completion of the project, submit Waste Shipment Records (WSR) maintained for a period of two years by the Contractor. The WSR shall include the following information:

1. Name, address, and telephone number of the waste generator.
2. Name and address of the local, state, or EPA regional agency responsible for administering the asbestos NESHAP program.
3. The quantity of asbestos containing waste material in cubic yards or cubic meters.
4. The name and telephone of the disposal site operator.
5. Name and physical site location of the disposal site.
6. Date transported.
7. Name, address, and telephone number of transporter(s).
8. Certification that the waste was properly classified, packed, marked, labeled, and transported.

1.04 QUALITY ASSURANCE

A. The Contractor shall be licensed by Azuria Water Solutions to install pipe by the CTPS method. The Contractor shall provide certificates of experience/training for an employee directly involved in the supervision or operation of the CTPS system from Azuria Water Solutions.

B. Fusible polyvinyl chloride (FPVC) pipe joining shall be performed by personnel licensed by the FPVC manufacturer.

C. Installation of other materials shall be performed by personnel qualified by the specific product manufacturer.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Fusible Polyvinyl Chloride (FPVC) pipe for potable water, reclaimed water, and wastewater

1. The pipe manufacturers shall be fully experienced, reputable, and qualified in the manufacture of fusible polyvinyl chloride (FPVC). Fusible polyvinyl chloride (FPVC) pipe marking shall include either Fusible PVC®, Fusible C-900®, or FPVC®.
2. FPVC pipe shall conform to AWWA C900, ASTM D2241 or ASTM D1785, as applicable. Testing shall be in accordance with the test methods provided or referenced in the applicable pipe standard.
3. FPVC pipe shall be extruded with plain ends. The ends shall be square to the pipe and without any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe unless specified for connections with appurtenances or for connections at the fusible pipeline termination locations.
4. FPVC pipe shall be manufactured in a standard 40’ or 45’ nominal length, or custom lengths as specified.
5. FPVC pipe for potable water use shall be blue in color.
6. Marking on the pipe shall include:
    a. Pipe size (nominal diameter)
    b. PVC
    c. Pipe Dimension Ratio (DR), Standard Dimension Ratio (SDR), or Schedule (SCH)
    d. AWWA pressure class or ASTM pressure rating, as applicable
    e. Designation of the applicable AWWA or ASTM standard (e.g., “AWWA C900”)
    f. NSF-61-G mark, designation of suitability for potable water service (when applicable)

g. Extrusion production-record code
h. Trademark or trade name
i. Cell Classification 12454 and/or PVC material designation code 1120

7. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

B. Fusion Joints

1. The pipe fusion joining process shall be approved by the Engineer & Azuria Water Solutions.
2. Unless otherwise specified, fusible polyvinyl chloride (FPVC) pipe lengths shall be assembled in the field with butt-fused joints. The licensed fusion personnel shall follow the pipe supplier's written guidelines for this procedure.

C. Tracer Wire shall be No. 8 stranded copper wire wrapped in color blue (water).

PART 3 – EXECUTION

3.01 EQUIPMENT

A. CTPS: Provide the necessary equipment to execute close tolerance pipe slurrification in accordance with federal, state, and local law and in conformance with the manufacturer's method.

1. Contractor shall provide rotational and drive equipment of sufficient size and power to accomplish the specified pipe replacement in lengths as determined to be as long as possible under anticipated conditions.
2. Contractor shall provide the Slurrifier tool with cutting head sized to be no more than ½" greater than the outside diameter of the new pipe to be installed.
3. Provide bentonite drilling fluid mixing equipment to properly mix the Slurrifier Solution with potable water.
4. Mixing equipment shall be sized for day usage of slurrifier solution.

B. Vacuum Excavation Equipment (VAC): Provide vacuum excavation equipment for the removal of spent Slurrifier Solution from Atmospheric Control points.

3.02 PREPARATION

A. General
1. Submit local air board notice of asbestos abatement work permit and all preconstruction plans and procedures.
2. Work shall be supervised by personnel experienced in installation of CTPS using similar size and type of pipe.
3. Locate insertion or access pits so that the total number is minimized and footage of pipe installed in a single run is maximized.
4. Use excavations at point repair locations and service connections for atmospheric control stations.

a. Install vertical risers from the top of the pipe to above the ground surface. Risers shall be sized for easy insertion and extraction of vacuum extraction tube.
b. Once slurrifier tools pass atmospheric control points, monitor vacuum extraction points until new pipe is observed in the bottom of the draft tube.
c. Prevent overflow of spent slurrifier solution from each vacuum excavation point.

B. Pre-pipeline Inspections

1. The contractor shall perform a pre-installation inspection prior to CTPS activities using any one or combination of the following:

a. CCTV
b. Ground Penetrating Radar
c. Potholing
d. Record Drawing Inspections
e. Or other approved pipeline inspection technology

3.03 PIPE INSTALLATION

A. General

1

1. Provide temporary 8-inch bypass line, test and disinfect, and locate and connect all services before beginning CTPS, if necessary. Install the bypass line underground for driveway or road crossings.
2. Isolate and depressurize the existing waterline segment.
3. Disconnect all service saddles and repair clamps from AC pipe prior to CTPS process. Use excavations for removal of service saddles and repair clamps for stand pipe for slurry removal. Excavate entry and exit pits to access the existing pipe. Hand excavate, break and bag collars, and remove whole AC pipe sections between collars without creating visible emissions of asbestos fibers. No dry cutting or grinding allowed.

a. Remove first sections of AC pipe whole using manual labor taking care not to break, crush, or cut the AC pipe removed from the trench. Wrap and tape whole sections of AC and place in lined slurry bins.
b. Pipe insertion pits shall be graded as needed to provide proper support and geometry for safe pipe installation and shall conform to pipe manufacturer guidelines based on depth of pipe and bending radius limits for fusible polyvinyl chloride (FPVC) pipe.
c. Bag and remove ACM in compliance with federal, state, and local laws and in accordance with Title 40 of the Code of Federal Regulations (CFR) 61.145 and Title 40 CFR 61.150 of the Asbestos NESHAP.
d. Locations of pits shall minimize quantity of pits and disruption to the public.

4. Push drill stem through existing AC pipe from one pit to another where the Slurrifier tools and pipe are staged for insertion.
5. Connect Slurrifier tools to drill string and pull first tool into AC pipe before beginning to rotate.
6. Pump Slurrifier Solution through drill stem to release points in Slurrifier tools. Pump Slurrifier Solution while rotating and cutting to lubricate tool, saturate pipe debris, suppress dust, and encapsulate AC fibers. No visible emissions allowed.
7. Slurrifier cutting head shall be sized no more than ½” greater than new FPVC pipe size specified or as shown on the plans.

8. During pipe installation, the recommended maximum allowable pulling force of the FPVC pipe, established by the manufacturer, shall not be exceeded.
9. The spent Slurrified Solution containing asbestos and cement material, soil, and pipe gaskets shall be vacuumed from Atmospheric Control Excavations at service excavations and similar planned excavation pits as described in Section 3.03.B: Atmospheric Control Excavations. Slurrifier spoils shall be pumped to secondary containment for disposal pursuant to federal, state, and local requirements.
10. Asbestos containing material (ACM) shall be disposed of at an approved asbestos landfill in accordance with local, state, and federal requirements.
11. Make service reconnections to new pipe as specified in the project specifications.

    a. Prior to connecting to new pipe, thoroughly wet the pipe and wipe dry with disposal rags.
    b. Treat wipe down towels as contaminated with asbestos containing material. prior to connecting and tapping the pipe.

12. Flush, test, disinfect and approve new waterline and services before reinstating services and or completing connections as shown on the plans.

B. Atmospheric Control Excavations

1. Excavate atmospheric control points, to access the existing pipe at services, valves, fittings, or repair band locations.

    a. Hand excavate and remove fittings, services, or repair bands from AC pipe sections without creating visible emissions of asbestos fibers. No dry cutting or grinding of AC pipe ALLOWED.
    b. Where necessary to remove appurtenances, cut bolts with wet saw taking care not to contact AC pipe.
    c. Place vertical riser well on top of AC pipe and backfill riser pipe to secure it in place.
    d. Bag and remove any dislodged asbestos material in compliance with NESHAP requirements.

2. Vacuum ACM Slurry pushed into excavation pits. Slurry shall be vacuum excavated, pumped to lined haul tank, and hauled to landfill in a manner consistent with NESHAP and DOT requirements.

    a. Follow all federal, state, and local secondary containment, labeling, and record keeping requirements.
    b. Provide Owner with receipt for each load of ACM material disposed of.

3.04 RESTORATION

A. The CONTRACTOR shall restore all service pits, launching pits and disturbed surface areas to their original condition as specified in the project specifications.

END OF SECTION

SECTION 331116 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for site water line, including domestic water line.
2. Valves: Gate, butterfly, ball, and air release combination.
3. Couplings.
4. Dismantling Joints.
5. Valve Operators.
6. Underground pipe markers.
7. Valve boxes.
8. Bedding and cover materials.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints.
2. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
3. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
4. Section 312316 - Excavation: Product and execution requirements for excavation and backfill.
5. Section 312316.13 - Trenching: Execution requirements for trenching.
6. Section 312323 - Fill: Requirements for backfill to be placed by this section.
7. Section 331300 - Disinfecting of Water Utility Distribution: Disinfection of site service utility water piping.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
3. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A182 – Forged or rolled alloy steel pipe flanges, forged fittings and valves and parts for high temperature service.
3. ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
4. ASTM A403 – Wrought austenitic stainless steel piping fittings.
5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
6. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
7. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).
8. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
9. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
11. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
13. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
14. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
5. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
6. AWWA C153 – Ductile-Iron Compact Fittings, 3 In. through 24 In. and 54 In. through 64 In., for Water Service
7. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
8. AWWA C502 - Dry-Barrel Fire Hydrants.
9. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).
10. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
11. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
12. AWWA C550 – Protective Interior Coatings for Valves and Hydrants
13. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
14. AWWA C606 - Grooved and Shouldered Joints.
15. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
16. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
17. AWWA C702 - Cold-Water Meters - Compound Type.

18. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
19. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1524 mm), for Water Transmission and Distribution.
20. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
21. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

F. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

H. UL:

1. UL 246 - Hydrants for Fire-Protection Service.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories including all options, appurtenances and cavitation data.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform work according to Guam Waterworks Authority standards.

B. For piping and fitting surfaces in contact with potable water, the coating material shall be listed by the NSF International as in compliance with NSF 372 and NSF 600 according to the requirements of NSF 61.

PART 2 - PRODUCTS

2.1 WATER PIPING

A. Ductile Iron Pipe:

1. Comply with AWWA C151, C104 and C105.
2. Pressure Class 250 minimum.
3. Fittings:
   a. Material: Ductile iron.
   b. Thickness: Standard.
   c. Comply with AWWA C110 and C104 for buried.
   d. Comply with AWWA C110 and C116 for in vaults or interior.
4. Joints:
   a. Comply with AWWA C111.
   b. Provide rubber gasket with rods.
   c. Flanged Joints: Comply with AWWA C115
5. Jackets: AWWA C105, polyethylene jacket.

B. Copper Tubing:

1. Comply with ASTM B88.
2. Type K, annealed.
3. Fittings: ASME B16.18, cast copper or ASME B16.22, wrought copper.
4. Joints: Compression connection.

C. PE Pipe

1. Comply with AWWA C901
2. Fittings:
   a. Type: Molded or fabricated.
   b. Comply with AWWA C901,
3. Joints: Compression.

D. Stainless Steel Pipe:

1. Comply with ASTM A312.
2. Type: Seamless, 316, Schedule 40.
3. Fittings and Special Sections:
   a. Comply with ASTM A403 or A182.
   b. Type: Threaded or flanged.

E. Stainless Steel Tubing:

1. Comply with ASTM A213.
2. Type: Seamless, 316, annealed.
3. Fittings: ASME A479, stainless steel.
4. Joints: Compression connection.

F. PVC Pipe:

1. Comply with AWWA D1785, Schedule 80.
2. Fittings:
   a. Material: PVC
   b. Comply with ASTM D2466
3. Joints:
   a. Material: PVC
   b. Comply with ASTM D2855, solvent weld.

G. PVC Pipe:

1. Comply with AWWA C900, Class 305 (DR 14).
2. Fittings:
   a. Material: Ductile iron.
   b. Thickness: Standard.
   c. Comply with AWWA C110 and C104 for buried.
   d. Comply with AWWA C110 and C116 for within vaults or interior.
3. Joints:
   a. Butt heat fused complying with ASTM F2620
   b. Or comply with ASTM D3139.
   c. Provide compression gasket ring.

2.2 GATE VALVES 3 INCH AND LARGER

A. Manufacturers:

1. Clow Valve
2. Kennedy Valve
3. American AVK
4. Or approved equal
5. Substitutions: As specified in Section 016000 - Product Requirements.

B. Furnish materials in accordance with GWA's standards.

C. Description:

1. Comply with AWWA C509, NSF 61, NSF 372 and NSF 600.
2. Materials:
   a. Body: Ductile iron.
3. Seats: Resilient.
4. Stem:
   a. Type: Non-rising.
   b. Material: Bronze.
5. Operation:
   a. Square operating nut or hand wheel as shown on the plans and depending on access.
   b. Open counterclockwise unless otherwise indicated.
6. End Connections: Flanged, mechanical joint, or bell as indicated.
7. Coatings:
   a. Comply with AWWA C550.
   b. Interior and exterior.

8. Pressure Rating:
    a. 12-inch Diameter and Smaller: 200 psig.
    b. 16-inch Diameter and Larger: 150 psig.

D. Mark manufacturer's name and pressure rating on valve body.

2.3 BUTTERFLY VALVES

A. Manufacturers:

1. Clow Valve
2. Kennedy Valve
3. Val-Matic
4. Henry Pratt
5. Or approved equal
6. Substitutions: As specified in Section 016000 - Product Requirements.

B. Furnish material in accordance with GWA's standards.

C. Description:

1. Comply with AWWA C504, MSS SP-67 and API 609, NSF 61, NSF 372 and NSF 600.
2. Materials:
    a. Body: Ductile iron.
    b. Disc: Ductile iron
    c. Extended neck
3. Seats: Resilient, EPDM or Buna N stem seals. Mate with 316 stainless steel body ring. Seal retaining hardware 316 stainless steel.
4. Stem:
    a. Type: Non-rising.
    b. Material: Stainless steel.
5. Operation:
    a. Square operating nut or hand wheel as shown on the plans.
    b. Open counterclockwise unless otherwise indicated.
    c. Operator for Sizes 2 inches to 6 inches: Standard lever handle with memory stop.
    d. Position indicator for valves inside vaults or above ground
6. End Connections: Flanged or mechanical joint as indicated.
7. Coatings:
    a. Comply with AWWA C550.
    b. Interior and exterior.
    c. molded-in or bonded-in EPDM or Buna N seat.
8. Pressure Rating:
    a. 12-inch Diameter and Smaller: 200 psig CWP.
    b. 16-inch Diameter and Larger: 150 psig CWP.
    c. 150 psi maximum pressure differential.
    d. Suitable for dead-end service in either direction at the full working pressure of the valve with the downstream flange removed for up to 96 hours.

D. Mark manufacturer's name and pressure rating on valve body.

2.4 BALL VALVES

A. Furnish materials in accordance with GWA's standards.

B. 2 Inch and Smaller: MSS SP-110, NSF 61, NSF 372 and NSF 600 (Lead Free). 316 stainless steel body complying to ASTM A351 Grade CF8M, 316 stainless steel ball, full port, reinforced seats, blow-out proof stem, tee stem pre-drilled for control rod, AWWA standard corporation stop thread or iron pipe thread (IPT) inlet and outlet end, with control rod, valve box, and valve key.

C. Mark manufacturer's name and pressure rating on valve body.

2.5 AIR RELEASE COMBINATION VALVES

A. Manufacturers:

1. Cla-Val
2. Val-Matic
3. APCO
4. Or approved equal
5. Substitutions: As specified in Section 016000 - Product Requirements.

B. General: Multipurpose valve able to vent air upon pipeline fill and break vacuum upon drain to prevent pipeline collapse.

1. 1 inch to 2 inches:
   a. Comply with AWWA C512
   b. ASTM A126 Cast Iron body or ASTM A536 Ductile Iron body.
   c. 316 SS Float, plug, and all other internal metal parts
   d. Type 316 SS spring
   e. Buna-N rubber seal.
   f. Body interior and exterior coated in accordance with AWWA C550, NSF 61, NSF 372 and NSF 600 certified fusion bonded epoxy.

2.6 COUPLINGS

A. Manufacturers:

1. Romac Industries
2. Smith-Blair
3. EBAA Iron
4. Or approved equal
5. Substitutions: As specified in Section 016000 - Product Requirements.

B. General: Furnish couplings and coupling adapters where indicated to connect plain end pipe sections or join plane end pipe to flanged valves and fittings.

1. Body: Ductile iron ASTM A536, bolt circle, bolt size and spacing conform to ANSI Class 125 and 150 flange drilling.

2. Gasket: SBR per ASTM D2000 MBA 710, compounded for water service or Nitrile Buna N certified to NSF/ANSI 61 and 372. Flange o-ring gasket is NBR rubber.
3. Bolts and Nuts: Type 316 stainless steel.
4. Finish: Fusion bonded epoxy finish certified to NSF 61, NSF 372 and NSF 600

C. All couplings for PVC and ductile iron pipe and all fittings at tees and bends shall be restrained.

2.7 DISMANTLING JOINTS

A. Manufacturers:

1. Romac Industries DJ405
2. Or approved equal
3. Substitutions: As specified in Section 016000 - Product Requirements.

B. General: Furnish dismantling joints where indicated to connect flanged pipe spools or flanged valves and fittings to other flanged valves and fittings.

1. Body: Ductile iron ASTM A536, bolt circle, bolt size and spacing conform to ANSI Class 125 and 150 flange drilling.
2. Gasket: SBR per ASTM D2000 MBA 710, compounded for water service or Nitrile Buna N certified to NSF 61, NSF 372 and NSF 600. Flange o-ring gasket is NBR rubber.
3. Bolts and Nuts: Type 316 stainless steel.
4. Finish: Fusion bonded epoxy finish

2.8 FIRE HYDRANTS

A. Manufacturers:

1. Clow Valve
2. Mueller
3. Or approved equal
4. Substitutions: As specified in Section 016000 - Product Requirements.

B. Furnish materials in accordance with GWA's standards.

C. Fire Hydrants:

1. Comply with AWWA C503 and UL listed, certified to NSF 61, NSF 372 and NSF 600.
2. Type: Wet barrel.
3. Body: Ductile iron
4. Working pressure: 200 psi
5. Minimum Inside Diameter: 7 inches.
6. Inlet: 6-inch bell or mechanical joint connection with accessories, gland bolts, and gaskets.

D. Fire Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.

E. Hose and Streamer Connection:

1. Match sizes and type of thread with requirements of GWA.
2. Provide two hose nozzles and one pumper nozzle.
3. Independently valved ports.
4. Standard nut size of valve stem and protector cap shall be pentagonal shape of 1-1/8" measured form point to flat of the pentagon.
5. Protector caps of grey cast iron, securely chained to hydrant barrel.

F. Finish:

1. Primer and two coats of enamel.
2. Color according to GWA requirements.

2.9 VALVE OPERATORS

A. General

1. Valve operator types describe only general characteristics of operators.
2. Provide operators compatible with valve with which it will be used and of same manufacturer, or product that is recommended by valve manufacturer.
3. Size operator to operate valve for full range of pressures and velocities specified.
4. Valve operators shall open by turning counterclockwise.

B. Manual Operators

1. General
   a. Provide 2 inch AWWA operating nut where located below valve cover in vault, otherwise provide manual handwheel operators within vaults, unless otherwise shown or specified.
   b. Galvanize and paint ferrous handwheels same color as valve and associated pipeline.
   c. When maximum force required to operate valve under full operating head exceeds 40 pounds, provide gear reduction operators.
   d. Gear operators totally enclosed and lubricated.
   e. Quarter-turn valve operators: self-locking type to prevent disc or plug from creeping and provide with position indicators to show position of valve disc or plug.
   f. Worm and gear type operators: self-locking worm-gears, one-piece design, of gear bronze material, accurately machine cut. Worm hardened alloy steel, with thread ground and polished.
   g. Geared traveling nut type operators: threaded steel reach rods with internally threaded bronze or ductile iron nut.
   h. Provide safety isolation valves and lockout valves with handles, handwheels, or chain wheels painted "safety yellow." Equip handles to take padlock and wheels, chain and padlock. Isolation valves are valves that shut off source of stored energy (such as compressed air or water pressure) and that, if opened, could endanger safety or life.
2. Exposed Operators
   a. Furnish with geared operators, extension stems, floor stands, and other elements to permit operation from normal operating level.

b. Lever type operators: means of being fixed in any given position to prevent accidental movement; rugged, noncorrosive construction; fully compatible with valve.

3. Buried Operators
   a. Provide buried service operators on valves larger than 2½ inches with 2 inch AWWA operating nut.
   b. Provide buried operators on valves two inches and smaller with cross handle for operation.
   c. All moving parts of valve and operators enclosed in housing to prevent contact with soil.
   d. Design buried service operators for quarter-turn valves to withstand 450 foot-pounds of input torque at FULLY OPEN or FULLY CLOSED positions without damage to valve or operator and grease pack and gasket to withstand submersion in water to 10 psi.
   e. Install valves with extension stems, as required, and valve boxes.

2.10 UNDERGROUND PIPE MARKERS

A. Detectable Ribbon Tape:

1. Bright colored, color coded, continuously printed.
2. Metallic foil laminated between two layers of impervious plastic film.
3. Minimum 6 inches wide by 5 mil thick.
4. Manufactured for direct burial service.

B. Trace Wire:

1. Bare Copper, 10 gage, solid conductor.

2.11 VALVE BOXES

A. Furnish materials in accordance with GWA's standards.

B. Description:

1. Valve boxes and covers, including position indicators and valve extensions.
2. Material: Cast iron.
3. Type: Extension, with slide adjustment.
4. Covers marked with a "W" or "Water".

2.12 MATERIALS

A. Bedding and Cover:

1. Bedding: Coarse aggregate type A5, pea gravel, as specified in section 310516 Aggregates for Earthwork.
2. Cover: Coarse aggregate base material type A2 as specified in section 310516 Aggregates for Earthwork.

2.13 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type as specified in Section 033000 - Cast-in-Place Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

B. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

D. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

E. Examine threads on valve and mating pipe for form and cleanliness.

F. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

G. Do not attempt to repair defective valves; replace with new valves

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

D. Protect and support existing distribution piping and appurtenances as work progresses.

3.3 INSTALLATION - PIPE

A. Refer to Section 312316.13 for trenching.

B. Wrap all steel pipe, coat all iron, and heat shrink wrap pipe joints after assembly where buried or concrete encased.

C. Perform work according to Guam Waterworks Authority standards.

D. Maintain separation of water main from sewer piping according to GWA standards.

E. Route pipe in straight line; re-lay pipe that is out of alignment or grade.

F. High Points:

1. Install pipe with no high points unless directed on drawings.
2. If unforeseen field conditions arise that necessitate high points, install air release valves as directed by Engineer.

G. Bearing:

1. Install pipe to have bearing along entire length of pipe.
2. Excavate bell holes to permit proper joint installation.
3. Do not lay pipe in wet trench.

H. Prevent foreign material from entering pipe during placement.

I. Install pipe to allow for expansion and contraction without stressing pipe or joints.

J. Close pipe openings with watertight plugs during work stoppages.

K. Install access fittings to permit disinfection of water system performed under Section 331300 - Disinfecting of Water Utility Distribution.

L. Cover:

1. Establish elevations of buried piping with not less than 3 feet of cover.
2. Measure depth of cover from final surface grade to top of pipe barrel.

M. Pipe Markers:

1. Install detectable ribbon tape and trace wire continuous buried 18 inches below finish grade, and over top of pipe, respectively. Attach to pipe for horizontal directional drilling and close tolerance pipe slurrification.

3.4 INSTALLATION - VALVES

A. Install valves as indicated, according to manufacturer’s written instructions.

B. Piping installation requirements are specified in other Division 33 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.

3.5 PIPE BEDDING, PIPE ZONE AND BACKFILL

A. Excavate pipe trench as specified in Section 31 23 16.13 - Trenching.

B. Place bedding material at trench bottom.

C. Level fill materials in continuous layers not exceeding 6 inches compacted depth.

D. Compact to 95 ASTM D1557 percent of maximum density.

E. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to 95 ASTM D1557 percent of maximum density.

3.6 PVC PIPE

A. All rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations. Plastic pipe shall be laid by snaking the pipe from one side of the trench to the other. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of solvent welding and during operation.

B. Schedule 40 pipe shall not be threaded. Use Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.

C. Only strap wrenches shall be used for tightening threaded plastic joints, and care shall be taken not to overtighten these fittings. Pipe shall not be laid when the temperature is above 90 degrees F when exposed to direct sunlight. Ends to be joined shall be shielded from direct sunlight prior to and during the laying operation.

D. Provide adequate ventilation when working with pipe joint solvent cement.

3.7 DUCTILE IRON PIPE

A. Cutting Pipe: Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.

B. Dressing Cut Ends

1. Dress cut ends of pipe in accordance with the type of joint to be made.
2. Dress cut ends of buried pipe joints to remove sharp edges or projections which may damage the rubber gasket.
3. Dress cut ends of push-on joint pipe by beveling, as recommended by the pipe manufacturer.

4. Dress cut ends of pipe for flexible couplings, flanged coupling adapters, and grooved end pipe couplings as recommended by the coupling or adapter manufacturer.

C. Fabrication of Flanged Pipe

1. Fabricate flanged pipe in the shop, not in the field, and deliver to the jobsite with flanges in place and properly faced.
2. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by the manufacturer.
3. Face flanges after fabrication in accordance with ANSI A21.15/AWWA C115.
4. Hydrostatically shop test a sufficient number of selected flange-to-pipe threaded joints to ensure joint integrity.

D. Jointing Pipe

1. Grooved End: Install in accordance with the manufacturer's printed instructions.
2. Flanged
   a. Prior to connecting flanged pipe, thoroughly clean the faces of the flanges of all oil, grease, and foreign material.
   b. Check the rubber gaskets for proper fit and thoroughly clean.
   c. Take care to assure proper seating of the flange gasket.
   d. Tighten bolts so that the pressure on the gasket is uniform. Use torque-limiting wrenches to ensure uniform bearing insofar as possible.
   e. If joints leak when the hydrostatic test is applied, remove and reset gaskets and retighten bolts.
3. Mechanical, Proprietary Restrained, and Push-On Joint
   a. Join pipe with mechanical, proprietary restrained, and push-on type joints in accordance with the manufacturer's recommendations.
   b. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation.
   c. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstances.

E. Encapsulate all buried ductile iron pipe and/or fittings in polyethylene jacket in accordance with AWWA C105.

3.8 THRUST RESTRAINT

A. Anchor all pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist.

B. Determine dimensions of thrust blocks based upon the pipeline maximum design pressure.

C. Pipe anchorage and expansion provisions are not completely detailed. The absence of these details on any contract document shall not relieve the Contractor of the responsibility for providing them where required, and at his sole expense.

D. Place thrust blocking between undisturbed ground and the fitting to be anchored. Place blocking so that pipe and fitting joints will be accessible for repairs. Place concrete in accordance with Section 033000.

E. As an alternative to thrust blocks, the contractor may use thrust restrained joint couplers such as MegaLug or equal.

3.9 ELECTROMAGNETIC FLOW METERS

A. Install flow meter in accordance with the manufactures recommendations.

B. Meter specified in Section 409001 Instrumentation and Control Components

3.10 DISINFECTION

A. Flush and disinfect system as specified in Section 331300 - Disinfecting of Water Utility Distribution.

3.11 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Install pipe within tolerance of 5/8 inch.

3.12 FIELD QUALITY CONTROL

A. Pressure test system according to AWWA C600 for ductile iron pipe and AWWA C605 for PVC and following:

1. Test Pressure: Not less than 150 psig or 50 psi in excess of maximum static pressure, whichever is greater.
2. Conduct hydrostatic test for at least two hours.
3. Slowly fill with water section to be tested and expel air from piping by installing corporation cocks at high points.
4. Close air vents and corporation cocks after air is expelled and raise pressure to specified test pressure.
5. Observe joints, fittings, and valves under test. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage and retest.
6. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
7. Maintain pressure within plus or minus 5 psi of test pressure.
8. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
9. Compute maximum allowable leakage using following formula:
    a. $L = SD \times \sqrt{P}/C$.
        1) L = testing allowance, gph.
        2) S = length of pipe tested, feet.
        3) D = nominal diameter of pipe, inches.
        4) P = average test pressure during hydrostatic test, psig.
        5) C = 148,000.

b. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

10. If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
11. Correct visible leaks regardless of quantity of leakage.

B. Compaction Testing for Bedding: Comply with ASTM D1557.

C. When tests indicate work does not meet specified requirements, remove work, replace, and retest.

D. A direct factory representative shall be made available by the equipment supplier for start-up service, inspection and necessary adjustments of altitude and pressure reducing valves.

E. Frequency of Compaction Tests: One set of two (2) tests per 100 L.F. of trench per lift when under roadways pavement or structures and one set of one (1) tests per 100 L.F. of trench per lift in other areas, for each trench type.

END OF SECTION 331116

SECTION 331300 – DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Disinfection of potable water distribution and transmission system.
2. Testing and reporting of results.

B. Related Requirements:

1. Section 331116 - Site Water Utility Distribution Piping: Product and execution requirements for installation and testing of site domestic water distribution piping.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA B300 - Hypochlorites.
2. AWWA B302 - Ammonium Sulfate.
3. AWWA B303 - Sodium Chlorite.
4. AWWA C651 - Disinfecting Water Mains.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Certify that cleanliness of water distribution system meets or exceeds specified requirements.

E. Certify that water conforms or fails to conform to bacterial standards of GWA and Guam EPA.

F. Certify that water conforms to quality standards of GWA and Guam EPA.

G. Test and Evaluation Reports: Indicate testing results comparative to specified requirements.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

I. Qualifications Statements:

1. Submit qualifications for water treatment firm and testing firm.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Disinfection Report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological Report:

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Submit bacteriologist's signature and authority associated with testing.

1.5 QUALITY ASSURANCE

A. Perform work according to AWWA C651.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section with minimum three years' documented experience.

B. Testing Firm: Company specializing in testing potable water systems, certified on Guam.

C. Submit bacteriologist’s signature and authority associated with testing.

PART 2 - PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals:

1. Hypochlorite: Comply with AWWA B300.
2. Ammonium Sulfate: Comply with AWWA B302.
3. Sodium Chlorite: Comply with AWWA B303.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that piping system has been cleaned, inspected, and pressure tested.

C. Perform scheduling and disinfecting activity with startup, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Provide and attach required equipment to perform work of this section.

B. Perform disinfection of water distribution system and installation of system and pressure testing as specified in Section 331116 - Site Water Utility Distribution Piping.

C. Inject treatment disinfectant into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved using domestic water.

F. Replace permanent system devices that were removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Disinfection, Flushing, and Sampling:

1. Disinfect pipeline installation according to AWWA C651.
2. Use of liquid chlorine is not permitted.
3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
4. Disposal:
    a. Legally dispose of chlorinated water.
    b. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
5. After final flushing and before pipeline is connected to existing system or placed in service, employ an approved independent testing laboratory to sample, test, and certify that water quality meets quality standards of GWA and suitable for human consumption.

END OF SECTION 331300